

PROJECT MANUAL FOR  
**KATE FURBISH ELEMENTARY**  
**DISCOVERY CLASSROOM**

Brunswick, Maine

**Issued for Bid**

**April 1, 2020**

**ARCHITECT**

CHA Architecture

49 Dartmouth Street

Portland, ME 04101

**SECTION 00 01 10**

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SECTION 1  
SHORT FORM  
INSTRUCTIONS TO BIDDERS

PUBLIC SCHOOL PROJECTS

1. At the time of the opening of proposals, each bidder will be presumed to have read and to be thoroughly familiar with the plans and contract documents, including all addenda. The failure or omission of any bidder to receive or examine any form, instrument, or document shall in no way relieve any bidder from any obligation in respect to his proposal. The owner reserves the right to accept or reject any or all proposals as may best serve the interest of the owner.
2. Subject to the owner's right, reserved herein, to accept or reject any or all proposals, the general contractor will be selected on the basis of the sum of the lowest acceptable proposal plus such of the alternates as the owner desires to use.
3. The owner is exempt from the payment of federal excise taxes on articles not for resale and the federal transportation tax on all shipments. The contractor shall quote less these taxes. Upon application, exemption certificates will be furnished when required.
4. Maine State Sales and Use Taxes should not be included in your quotation as the owner is exempt from the payment of such taxes.
5. No proposal may be withdrawn during a period of thirty (30) calendar days immediately following the opening thereof.
6. No contract may be assigned or transferred without the written consent of the owner.
7.
  - (a) All foreign corporations intending to do business in the State of Maine must comply with the provisions of 13-A M.R.S.A., Chapter 12. Any foreign corporation receiving notice of award of contract shall contact the Secretary of State for the purpose of complying with this statute.
  - (b) All individuals not residents of this state must comply with the provisions of Title 14 M.R.S.A., Section 704.
  - (c) It may be necessary for the contractor to submit to the owner documentary evidence that the above provisions have been complied with.
8. The selected general contractor will be required to furnish a 100% contract performance bond and a 100% contract payment bond to cover the execution of his contract. Form of bonds are shown in section 00 61 13.13 (formerly 2-C2) and section 00 61 13.16 (formerly 2-C3).
9. Contractors may be required to furnish a statement of their business experience, record of accomplishments, and financial responsibility at the discretion of the owner.
10. The owner shall retain five percent (5%) of each payment due the contractor as part security for the fulfillment of the contract by the contractor. The owner may, if he deems it expedient to do so, cause

the contractor to be paid temporarily or permanently from time to time during the progress of the work, such portion of the amount retained as he deems prudent or desirable. In case such payments are made, the owner may at any time withhold further payments until the full amount of the five percent (5%) is re-established, all in accordance with the provisions of Title 5, M.R.S.A., Section 1746.

11. (a) The date of completion is stated in the proposal form section 2-B and in the contract form section 2-E. If the contractor finds it impossible to complete the work on or before the said date of completion, he may make a written request to the owner for an extension of time setting forth therein the reasons for the request. If the owner finds that the work was delayed because of conditions beyond the control and without the fault of the contractor he may extend the date of completion in such amount as, in his judgment, the conditions warrant. The said new date of completion shall then be in full force and effect the same as though it were the original date of completion.

(b) Time is an essential element of the contract and it is important that the work be pressed vigorously to completion. The cost to the owner of administration of the contract, inspection and supervision will be increased as the time occupied in the work is lengthened.

12. The proposal shall be based on the materials, methods, equipment and products as specified.

Any materials, methods, equipment or products not herein specified, but deemed worthy of consideration by any general contractor, may be introduced by a separate letter attached to his proposal. He shall state the cost comparison with the specified materials, methods, equipment or products and the reason for the suggested substitution.

It shall be understood by the general contractor or subcontractor that the attached letter describing the proposed change will not be used in determining the low general or subcontract proposal submitted unless the general or subcontractor shall have submitted their list to the architect/engineer 10 days prior to the date set for the receipt of their respective proposals and shall have received written approval by the architect/engineer.

13. If, in the performance of this contract, a dispute arises between the owner and the contractor which cannot be settled, then this dispute shall be submitted to arbitration and both the owner and the contractor shall be bound by the decision of the arbitrator.

The membership of the American Arbitration Association shall be used as arbitrators and the procedures used for arbitration shall be in conformity with construction industry arbitration rules as administered by the American Arbitration Association.

14. Projects which require compliance with the Davis-Bacon Act are subject to the regulations contained in Title 29, Subtitle A, Part 5 of the Code of Federal Regulations, and the federal wage determination attached to and made a part of these Instructions to Bidders.

15. (a) Listing of Job Vacancies; Executive Order No. 5, dated December 6, 1971, requires "that the contractor, to the maximum feasible, list all of its suitable employment openings with the Maine Employment Security Commission."

"This provision shall not apply to employment openings which the contractor proposes to fill from within its own organization."

Two copies of a "Quarterly Report of New Hires" shall be prepared by the 7th of January, April, July and October for the calendar quarter to which data pertains and sent to the local office of the Maine Employment Security Commission.

A copy of the report form is attached to these Instructions to Bidders. These may be obtained from the nearest office of the M.E.S.C. serving the area.

(b) Code of Fair Practices: Executive Order No. 11, dated July 1, 1972, requires that every state contract for public works contain the following provisions: "During the performance of this contract, the contractor agrees as follows:

1. The contractor will not discriminate against any employee or applicant for employment because of race, color, religious creed, sex, national origin, ancestry or age. Such action shall include, but not be limited to the following: Employment, upgrading demotions, transfers, recruitment or recruitment advertising; layoffs or terminations; rates of pay or other forms of compensation; and selection for training including apprenticeship.

2. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religious creed, sex, national origin, ancestry or age.

3. The contractor will send to each labor union or representative of the workers with which he has a collective or bargaining agreement, or other contract or understanding, whereby he is furnished with labor for the performances of his contract, a notice, to be provided by the contracting department or agency, advising the said labor union or workers' representative of the contractors commitment under this section and shall post copies of the notice in conspicuous places available to employees and to applicants for employment."

4. The contractor will cause the foregoing provisions to be inserted in all contracts for any work covered by this agreement so that such provisions will be binding upon each subcontractor.

16. OSHA - Safety Regulations. This project is subject to compliance with all requirements of the Occupational Safety and Health Administration, Volume 36, No. 105 of the Federal Register, U.S. Department of Labor published Saturday May 29, 1971, as amended.

17. Any proposal that contains an escalation clause will be invalid.

SECTION 2-A

NOTICE TO CONTRACTORS  
SHORT FORM  
PUBLIC SCHOOL PROJECT  
(Advertisement)

Sealed bid proposals in envelopes plainly marked for: Kate Furbish Elementary - Discovery Classroom.

Addressed to: Kelly Wentworth, Business Manager  
Brunswick School Department  
46 Federal Street  
Brunswick, Maine 04011

Brief Job Description: The Work involves the construction of a new elementary public-school classroom building at location indicated on Drawings. Work includes but is not limited, to earthwork, site utilities and site improvements, paving and landscaping. Work also includes concrete foundations and slab-on-grade, metal decking, low-slope roof, sheet metal flashing, aluminum storefront framing and sliding doors, fiber-cement siding, metal stud partitions, insulation, gypsum board walls and ceilings, resilient floor tile, acoustical ceilings, custom cabinets and fixtures, carpentry, painting, steel and wood doors and frames, door hardware, toilet accessories, signage, security systems, electrical, and heating, ventilating, and air conditioning complete and ready for use. The site will be shared with another general contractor, as it is currently under construction of the main elementary school building.

Bid proposals will be opened and read aloud at 2:00 p.m. at Brunswick School Department Building, 46 Federal Street, Brunswick, Maine, on April 23, 2020. Bid proposals received after 2:00 p.m. will not be considered and will be returned unopened.

Bid proposals must be accompanied by certified or cashiers check for 5% of the proposal, or a satisfactory bid bond in a similar amount. The Owner reserves the right to waive all formalities, and reject any and all proposals, or to accept any proposal. Bids shall be submitted upon the letterhead of the bidder.

The successful bidder will be required to furnish a 100% contract performance bond and a 100% contract payment bond to cover the execution of the work which shall be in conformity with the form of bonds contained in section 2-C of the specifications and for the contract amount.

Bid proposals that contain an escalation clause will be invalid.

Printed Procurement and Contracting Documents: General Bidders and Subcontractors may obtain sets of Drawings and Specification, including Instruction to Bidders and Bid Forms from Xpress Copy, 17 Westfield Street, Portland, ME (Tel: 207-775-2444) after 9:00 a.m. on April 2, 2020, at cost, on a non-refundable basis. Cost is \$75 per set plus shipping.

Electronic mail (e-mail) correspondence in connection with this Project will be addressed to the office of the Architect, Attention: Benjamin Winschel, CHA Architecture, e-mail: [bwinschel@chacompanies.com](mailto:bwinschel@chacompanies.com).

Verbal, telephone, and facsimile queries will not be accepted.



## **SECTION 00 30 00**

### **AVAILABLE INFORMATION**

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

##### **1.1 DEFINITIONS**

- A. Available Information means information of any type and in any form, related to the Project and identified in this Section as such and do not include the Contract Documents.
- B. Contractor is synonymous with Proponent.

##### **1.2 STATUS OF AVAILABLE INFORMATION**

- A. Available Information, or any part thereof, are not part of the Contract unless specifically incorporated into Contract Documents by means of copying, transcribing or referencing.

##### **1.3 USE OF AND RELIANCE UPON AVAILABLE INFORMATION**

- A. Available Information are made available to Proponent by Owner for the purpose of providing Proponent with access to information available to Owner.
- B. Available Information shall not be considered a representation or warranty that information contained therein is accurate, complete or appropriate, and do not form a part of the Contract Documents.
- C. Proponent shall interpret and draw its own conclusions about Available Information and is encouraged to obtain specialist advice with respect thereto. Architect assumes no responsibility for such interpretations and conclusions.
- D. Information contained in Available Information may be time sensitive and dates shall be considered when interpreting Available Information.
- E. Proponent may rely upon the data contained in Available Information, or parts thereof, which are specifically incorporated into Contract Documents by means of copying, transcribing or referencing, but shall draw his own conclusions from such data and shall not rely on opinions or interpretations contained therein.

##### **1.4 AVAILABLE INFORMATION**

- A. Available Information, in whole or in part, consist of the following:
  - 1. A copy of a detailed geotechnical site investigation report with respect to the building site is included with the Contract documents, titled as follows:
    - a. Titled: Explorations and Geotechnical Engineering Services
    - b. Sub-Titled: Proposed Elementary School Jordan Acre School Site
    - c. File No.: 13-1270.1 S
    - d. Dated: February 5, 2018

- e. Prepared By: S.W. Cole Engineering, Inc.
- f. Prepared For: Brunswick School Department

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**3.1 ATTACHMENTS**

- A. Geotechnical Site Investigation report

**END OF SECTION**

# R E P O R T (rev 1)

13-1270.1 S

February 5, 2018

## Explorations and Geotechnical Engineering Services

Proposed Elementary School  
Jordan Acre School Site  
Brunswick, Maine

**Prepared For:**

Brunswick School Department  
Attn: Paul Perzanoski, Superintendent  
46 Federal Street  
Brunswick, ME 04011

**Prepared By:**

S. W. Cole Engineering, Inc.  
286 Portland Road  
Gray, Maine 04039  
T: 207-657-2866



- *Geotechnical Engineering*
- *Construction Materials Testing and Special Inspections*
- *GeoEnvironmental Services*
- *Test Boring Explorations*

[www.swcole.com](http://www.swcole.com)

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13-1270.1 S

February 5, 2018

Brunswick School Department  
Attn: Paul Perzanoski, Superintendent  
46 Federal Street  
Brunswick, ME 04011

Subject: Explorations and Geotechnical Engineering Services (rev 1)  
Proposed Elementary School  
Jordan Acre School Site  
Brunswick, Maine

Dear Superintendent:

In accordance with our Agreement, dated September 21, 2017, we have performed subsurface explorations for the subject project. This report summarizes our findings and geotechnical recommendations, and its contents are subject to the limitations set forth in Appendix A.

## **1.0 INTRODUCTION**

### **1.1 Scope and Purpose**

The purpose of our services was to obtain subsurface information at the site in order to develop geotechnical recommendations relative to foundations, earthwork and pavement associated with the proposed construction. Our scope of services included a review of prior explorations, test boring explorations, soils laboratory testing, a geotechnical analysis of the subsurface findings and preparation of this report.

### **1.2 Site and Proposed Construction**

Based on the concept plans provided by PDT Architects (project architect), we understand redevelopment plans for the site include demolition of the existing facilities for construction of a new elementary school with associated paved, playground and stormwater management areas. We understand the new school will be a one and two-story, steel framed building with on-grade floor slabs and spread footing foundations.

Paved areas are generally proposed on the south side of the building with playground areas east and west of the building.

The site is relatively flat and level with existing grades varying from about elevation 40 to 42 feet (project datum) across the proposed building pad. Existing grades rise to a high elevation of 46 feet in the southwest corner of the site and grade to a low of about 28 feet along the northwest site boundary. We understand the new elementary school building is proposed at a finished floor elevation of 43.5 feet requiring several feet of fill to establish proposed grades.

Proposed and existing site features are shown on the "Exploration Location Plan" attached in Appendix B.

## **2.0 EXPLORATION AND TESTING**

### **2.1 Explorations**

#### **2.1.1 Current Explorations**

Ten test borings (B-101 through B-110) were made at the site between October 12 through 16, 2017 by S. W. Cole Explorations, LLC. The exploration locations were selected and established in the field by S. W. Cole Engineering, Inc. (S.W.COLE) using measurements from existing site features. The approximate exploration locations are shown on the "Exploration Location Plan" attached in Appendix B. Logs of the explorations and a key to the notes and symbols used on the logs are attached in Appendix C.

#### **2.1.2 Prior Explorations**

Six test pit explorations (TP-101 through TP-106) were made at the site by Brunswick Public Works Department on December 4, 2013 for a prior hydrologic soils classification and infiltration testing scope of services by S.W.COLE. The approximate locations of these test pits are shown on the "Exploration Location Plan" attached in Appendix B. The logs of these explorations are attached in Appendix D.

### **2.2 Field Testing**

The test borings were drilled using a combination of solid stem auger and cased wash-boring techniques. The soils were sampled at 2 to 5 foot intervals using a split spoon

sampler and Standard Penetration Testing (SPT) techniques. Pocket penetrometer readings were taken on samples of stiff silty clay obtained at the borings. PPT readings and SPT blow counts are shown on the logs.

Infiltration testing was performed in prior test pits TP-102 and TP-105. The results of these tests are attached in Appendix D.

### **2.3 Laboratory Testing**

Soil samples obtained from the explorations were returned to our laboratory for further classification and testing. The results of three gradation tests on native sand are attached in Appendix D.

## **3.0 SUBSURFACE CONDITIONS**

### **3.1 Soil and Bedrock**

Beneath a surficial layer of topsoil or pavement, the explorations encountered a soils profile generally consisting of 0 to 6 feet of granular fill overlying native sand. Test boring B-101 was advanced to assess the deep soils profile and encountered layered sand and clay at a depth of 46 feet which transitioned to a deposit of relatively soft clay at a depth of 54 feet that continued to a depth of 83 feet. Boring B-101 was terminated in a granular deposit at a depth of about 84 feet. Not all the strata were encountered at each exploration; refer to the attached logs for more detailed subsurface information.

### **3.2 Groundwater**

At the time of drilling, groundwater was encountered in certain test borings at depths ranging from 10 to 23 feet below the ground surface. At the time of digging, groundwater was encountered in certain test pits at a depth of about 9 feet below the ground surface. Groundwater tended to be shallowest in the western portion of the site, becoming deeper toward a drainage feature existing on the eastern site boundary. Groundwater likely becomes perched on the relatively impervious silty clay encountered beneath the native sands. Long term groundwater information is not available. It should be anticipated that groundwater levels will fluctuate, particularly in response to periods of snowmelt and precipitation, as well as changes in site use.

## **4.0 EVALUATION AND RECOMMENDATIONS**

### **4.1 General Findings**

Based on the subsurface findings, the proposed construction appears feasible from a geotechnical standpoint. The principle geotechnical considerations include:

- Spread footing foundations and slab-on-grade floors bearing on properly prepared subgrades appear suitable for the proposed building. Footings should bear on at least 3-inches of compacted Crushed Stone overlying undisturbed native non-organic soils. On-grade floor slabs should bear on at least 12-inches of properly compacted Structural Fill overlying properly prepared subgrades.
- All organics, topsoil, remnant structures, foundations and debris must be completely removed from beneath the proposed building and backfilled with properly compacted Granular Borrow.
- Earthwork and grading activities should occur during non-freezing weather of Spring, Summer and Fall. Excavation of bearing surfaces should be completed with a smooth-edged bucket to lessen subgrade disturbance.

### **4.2 Site and Subgrade Preparation**

We recommend that site preparation begin with the construction of an erosion control system to protect adjacent drainage ways and areas outside the construction limits. Surficial organics, roots and topsoil should be completely removed from areas of proposed fill and construction. As much vegetation as possible should remain outside the construction areas to lessen the potential for erosion and site disturbance.

**Building Pad and Footings:** As discussed, the site was previously developed. All existing foundations, floor slabs and buried utilities should be completely removed beneath the proposed building and backfilled with compacted Granular Borrow. The building pad should be proofrolled and densified with at least 3 passes of a 10 ton smooth drum roller compactor prior to excavating for footings. Areas that become soft or yielding after proofrolling should be removed and replaced with compacted Granular Borrow.



We recommend that footings be excavated using a smooth-edged bucket and that footings be underlain by at least 3 inches of compacted Crushed Stone.

Pavement and Utilities: Pavement subgrades should be proofrolled and densified with at least 3 passes of a 10 ton smooth drum roller compactor prior to installing pavement gravels. Areas that become soft or continue to yield after densification should be removed and replaced with compacted Granular Borrow.

Based on the subsurface findings, we do not anticipate soft trench bottoms; as such, customary bedding materials for pipes and structure appear adequate.

#### **4.3 Excavation and Dewatering**

Excavation work will generally encounter granular fills and native sands and silty sands. Care must be exercised during construction to limit disturbance of the bearing soils. Earthwork and grading activities should occur during non-freezing weather of Spring, Summer and Fall. Final cuts to subgrade should be performed with a smooth-edged bucket to help reduce strength loss from soil disturbance.

Sumping and pumping dewatering techniques should be adequate to control groundwater in excavations to within 1 foot of groundwater. Excavations below groundwater will likely require sheetpile shoring and dewatering systems. Controlling the water levels to at least one foot below planned excavation depths will help stabilize subgrades during construction. Excavations must be properly shored or sloped in accordance with OSHA Regulations to prevent sloughing and caving of the sidewalls during construction. Care must be taken to preclude undermining adjacent structures, utilities and roadways. The design and planning of excavations, excavation support systems, and dewatering is the responsibility of the contractor.

#### **4.4 Foundations**

We recommend the proposed buildings be supported on spread footings founded on at least 3-inches of compacted Crushed Stone overlying properly prepared subgrades. For foundations bearing on properly prepared subgrades, we recommend the following geotechnical parameters for design consideration:

<b>Geotechnical Parameters for Spread Footings and Foundation Walls</b>	
Design Frost Depth (100 year AFI)	4.5 feet
Net Allowable Soil Bearing Pressure	3.0 ksf
Base Friction Factor	0.35
Total Unit Weight of Backfill	125 pcf
At-Rest Lateral Earth Pressure Coefficient	0.5
Internal Friction Angle of Backfill	30°
Seismic Soil Site Class	D (IBC 2009/2015)
Estimated Total Settlement	1-inch
Differential Settlement	½-inch

#### **4.5 Foundation Drainage**

We recommend an underdrain system be installed on the outside edge of perimeter footings. The underdrain pipe should consist of 4-inch diameter, slotted HDPE foundation drain pipe bedded in Underdrain Sand. The underdrain pipe must have a positive gravity outlet protected from freezing, clogging and backflow. Surface grades should be sloped away from the building for positive surface water drainage.

#### **4.6 Slab-On-Grade**

On-grade floor slabs in heated areas may be designed using a subgrade reaction modulus of 100 pci (pounds per cubic inch) provided the slab is underlain by at least 12-inches of compacted Structural Fill placed over properly prepared subgrades. The structural engineer or concrete consultant must design steel reinforcing and joint spacing appropriate to slab thickness and function.

We recommend a sub-slab vapor retarder particularly in areas of the building where the concrete slab will be covered with an impermeable surface treatment or floor covering that may be sensitive to moisture vapors. The vapor retarder must have a permeance that is less than the floor cover or surface treatment that is applied to the slab. The vapor retarder must have sufficient durability to withstand direct contact with the sub-slab base material and construction activity. The vapor retarder material should be placed according to the manufacturer's recommended method, including the taping and lapping of all joints and wall connections. The architect and/or flooring consultant should select the vapor retarder products compatible with flooring and adhesive materials.

The floor slab should be appropriately cured using moisture retention methods after casting. Typical floor slab curing methods should be used for at least 7 days. The

architect or flooring consultant should assign curing methods consistent with current applicable American Concrete Institute (ACI) procedures with consideration of curing method compatibility to proposed surface treatments, flooring and adhesive materials.

#### **4.7 Entrance Slabs and Sidewalks**

Entrance slabs and sidewalks adjacent to the building must be designed to reduce the effects of differential frost action between adjacent pavement, doorways, and entrances. We recommend that non-frost susceptible Structural Fill be provided to a depth of at least 4.5 feet below the top of entrance slabs. This thickness of Structural Fill should extend the full width of the entrance slab and outward at least 4.5 feet, thereafter transitioning up to the bottom of the adjacent sidewalk or pavement gravels at a 3H:1V or flatter slope.

For plaza slabs extending beyond immediate building entrances, we recommend extending the thickness of Structural Fill beneath the entire plaza slab thereafter transitioning up to the bottom of the adjacent sidewalk or pavement gravels at a 3H:1V or flatter slope. Alternatively, the entrance slab and plaza slab may be insulated for frost protection.

#### **4.8 Segmental Retaining Wall**

For the proposed site retaining walls, we recommend wet-cast segmental retaining walls (SRW), such as Redi-Rock. We recommend the facing blocks be founded on a minimum 6-inch thick leveling course of compacted Crushed Stone underlain by non-woven geotextile fabric overlying properly prepared subgrades. For design of Segmental Retaining Walls (SRW), such as Redi-Rock, we recommend the following geotechnical parameters for design:

<b>Geotechnical Parameters for Segmental Retaining Wall</b>		
<b>Wall Zone</b>	<b>Unit Weight (pcf)</b>	<b>Friction Angle</b>
Reinforced Soil	130	34
Retained Soil	125	30
Foundation Soil	125	30

Design of the retaining wall and evaluation of base sliding, overturning and internal stability of the wall are the responsibility of the wall design engineer. The wall designer must account for construction surcharge loads and future live load conditions.

S.W.COLE should be retained to perform a global stability analysis of the SRW and to review the SRW submittal if designed by others.

We recommend SRW walls should meet the requirements of 2014 MaineDOT Standard Specification 672 or 673.

#### **4.9 Fill, Backfill and Compaction**

We recommend the following fill and backfill materials: recycled products, if used, must also be tested in accordance with applicable environmental regulations and approved by a qualified environmental consultant.

Common Borrow: Fill to raise grades in landscape areas should be non-organic compactable earth meeting the requirements of 2014 MaineDOT Standard Specification 703.18 Common Borrow.

Granular Borrow: Fill to raise grades in building and paved areas, as well as to repair soft areas, should be sand or silty sand meeting the requirements of 2014 MaineDOT Standard Specification 703.19 Granular Borrow.

Structural Fill: Backfill for foundations, slab base material and material below exterior entrances slabs should be clean, non-frost susceptible sand and gravel meeting the gradation requirements for Structural Fill as given below:

<b>Structural Fill</b>	
<b>Sieve Size</b>	<b>Percent Finer by Weight</b>
4 inch	100
3 inch	90 to 100
1/4 inch	25 to 90
#40	0 to 30
#200	0 to 6

Underdrain Sand: Sand used for underdrains and beneath bedding materials in soft trench bottoms should be clean, free-draining sand meeting the requirements of 2014 MaineDOT Standard Specification 703.22 Underdrain Backfill Material Type B.

Crushed Stone: Crushed Stone, used beneath foundations should be washed ¾-inch crushed stone meeting the requirements of 2014 MaineDOT Standard Specification 703.22 Underdrain Backfill Material Type C.

Reuse of Site Soils: The native sands and granular fills without organics appear suitable for reuse as Granular Borrow.

Placement and Compaction: Fill should be placed in horizontal lifts and compacted such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Loose lift thicknesses for grading, fill and backfill activities should not exceed 12 inches. We recommend that fill and backfill in building and paved areas be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557. Crushed Stone should be compacted with 3 to 5 passes of a vibratory plate compactor having a static weight of at least 500 pounds.

#### **4.10 Weather Considerations**

Construction activity should be limited during freezing weather and the site soils may require thawing before construction activities may continue. The contractor should anticipate the need for water to temper fills in order to facilitate compaction. If construction takes place during cold weather, subgrades, foundations and floor slabs must be protected during freezing conditions. Concrete and fill must not be placed on frozen soil; and once placed, the concrete and soil beneath the structure must be protected from freezing.

#### **4.11 Paved Areas**

We anticipate paved areas will be subjected primarily to passenger vehicle and light delivery truck traffic with occasional heavy delivery truck traffic. Considering the site soils, and proposed usage, we offer the following pavement section for consideration.

<b>FLEXIBLE (HMA) PAVEMENT SECTION – 2014 MaineDOT Standard Specs</b>		
<b>Pavement Layer</b>	<b>Standard Duty</b>	<b>Heavy Duty</b>
MaineDOT 9.5 mm Hot Mix Asphalt	1 ½ inches	1 ½ inches
MaineDOT 9.5 mm Hot Mix Asphalt	1 ½ inches	--
MaineDOT 19.0 mm Hot Mix Asphalt	--	2 ½ inches
MaineDOT 703.06 Aggregate Base Type A	6 inches	6 inches
MaineDOT 703.06 Aggregate Subbase Type D	9 inches	12 inches

The base and subbase materials should be compacted to at least 95 percent of their maximum dry density as determined by ASTM D-1557. Hot mix asphalt pavement should be compacted to 92 to 97 percent of its theoretical maximum density as determined by ASTM D-2041. A tack coat should be used between successive lifts of bituminous pavement.

It should be understood that frost penetration can be on the order of 4.5 feet in this area. In the absence of full depth excavation of frost susceptible soils below paved areas and subsequent replacement with non-frost susceptible compacted fill, frost penetration into the subgrade will occur and some heaving and distress of pavement must be anticipated.

#### **4.12 Design Review and Construction Testing**

S.W.COLE should be retained to review the construction documents prior to bidding to determine that our earthwork, foundation and pavement recommendations have been properly interpreted and implemented.

A soils and concrete testing program should be implemented during construction to observe compliance with the design concepts, plans, and specifications. S.W.COLE is available to observe earthwork activities, the preparation of foundation bearing surfaces and pavement subgrades, as well as to provide IBC Special Inspections and construction materials testing services for soils, concrete, steel, spray-applied fireproofing, structural masonry and asphalt construction materials.

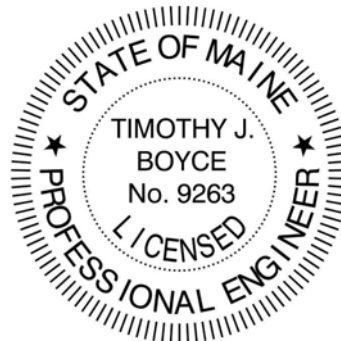
#### **5.0 CLOSURE**

It has been a pleasure to be of assistance to you with this phase of your project. We look forward to working with you during the construction phase of the project.

**S. W. Cole Engineering, Inc.**

Timothy J. Boyce, P.E.  
Senior Geotechnical Engineer

TJB:emw



This report has been prepared for the exclusive use of Brunswick School Department for specific application to the proposed Elementary School on Jordan Acre School Site in Brunswick, Maine. S. W. Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct our services in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

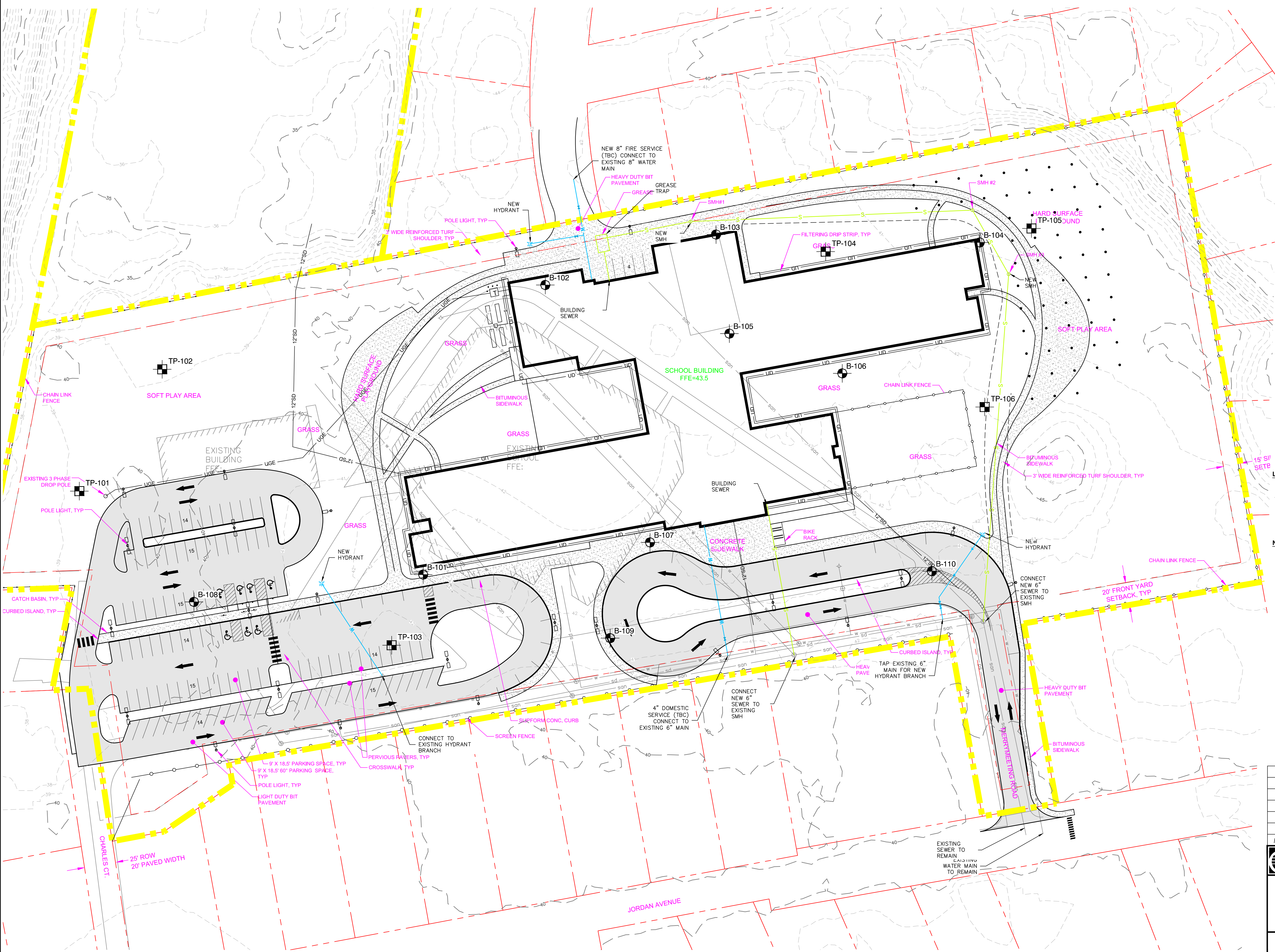
S.W.COLE's scope of services has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S.W.COLE should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S.W.COLE.

## **APPENDIX B**

### **Figures**





- LEGEND:**
- APPROXIMATE BORING LOCATION
  - APPROXIMATE TEST PIT LOCATION
- NOTES:**
- EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=40' SCALE PLAN OF THE SITE ENTITLED "EXISTING CONDITIONS & REMOVALS PLAN," PREPARED BY ATLANTIC RESOURCE CONSULTANTS, DATED NOVEMBER 2017.
  - THE BORINGS WERE LOCATED IN THE FIELD BY GPS SURVEY BY S. W. COLE ENGINEERING, INC. USING A MAPPING GRADE TRIMBLE GPS RECEIVER.
  - TEST PITS TP-101 THROUGH TP-106 WERE PERFORMED UNDER THE DIRECTION OF S. W. COLE ENGINEERING, INC. IN 2013.
  - THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S. W. COLE ENGINEERING, INC. GEOTECHNICAL REPORT.
  - THE PURPOSE OF THIS PLAN IS ONLY TO DEPICT THE LOCATION OF THE EXPLORATIONS IN RELATION TO THE EXISTING CONDITIONS AND PROPOSED CONSTRUCTION AND IS NOT TO BE USED FOR CONSTRUCTION.

04080Feet

0	10/27/2017	PRELIMINARY FINDINGS SUBMISSION	CEM
NO.	DATE	DESCRIPTION	BY

S.W. COLE  
ENGINEERING, INC.

BRUNSWICK SCHOOL DEPARTMENT  
**EXPLORATION LOCATION PLAN**  
PROPOSED ELEMENTARY SCHOOL  
JORDAN ACRES SCHOOL SITE  
BRUNSWICK, MAINE

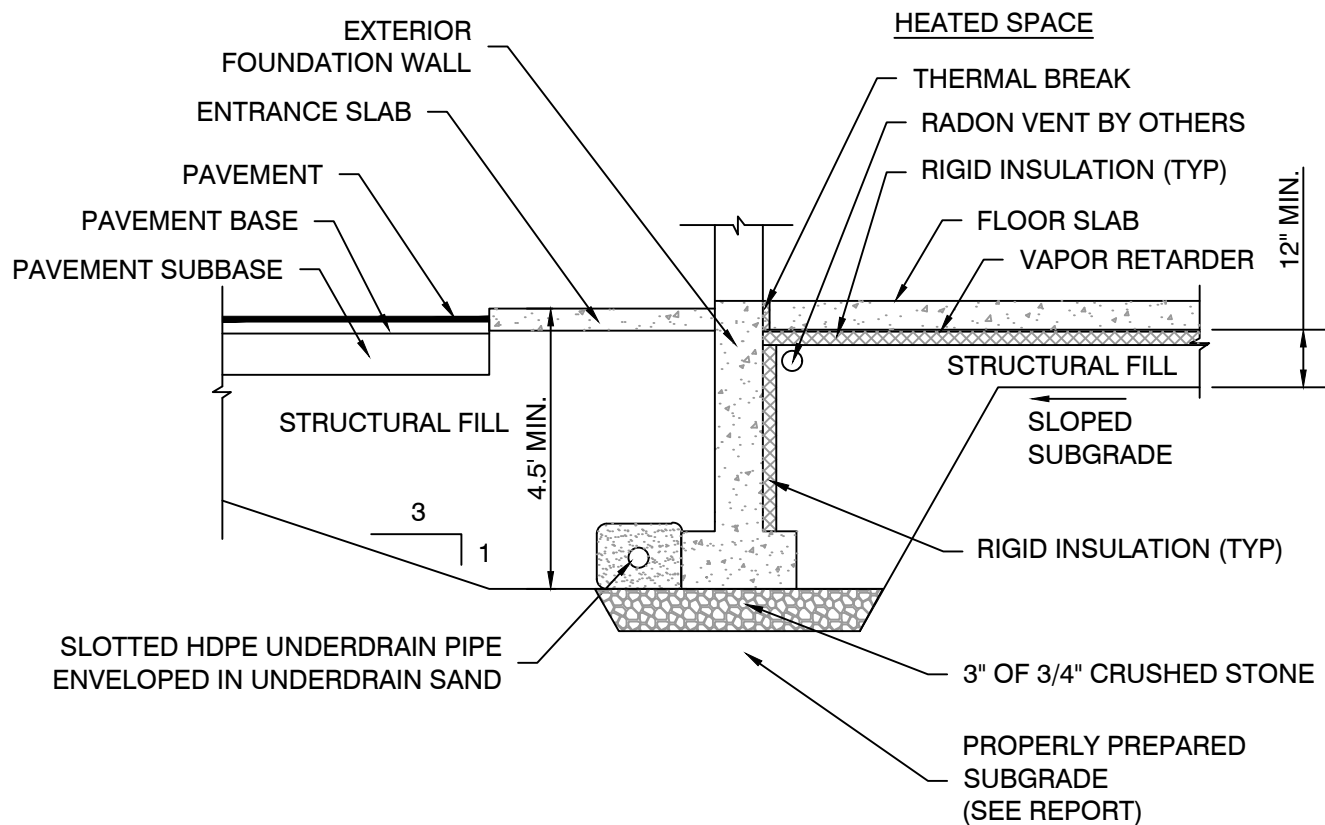
Job No.: 13-1270.1  
Date: 10/27/2017

Scale: 1" = 40'  
Sheet: 1

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**NOTE:**

1. UNDERDRAIN INSTALLATION AND MATERIAL GRADATION RECOMMENDATIONS ARE CONTAINED WITHIN THIS REPORT.
2. DETAIL IS PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY, NOT FOR CONSTRUCTION.



**S.W. COLE**  
ENGINEERING, INC.

BRUNSWICK SCHOOL DEPARTMENT  
**FOUNDATION DETAIL SKETCH**

PROPOSED ELEMENTARY SCHOOL  
JORDAN ACRE SCHOOL SITE  
BRUNSWICK, MAINE

Job No.: 13-1270.1  
Date : 02/01/2018

Scale: Not to Scale  
Sheet: 2

## **APPENDIX C**

### **Exploration Logs and Key**



# BORING LOG

BORING NO.: **B-101**  
SHEET: 1 of 2  
PROJECT NO.: 13-1270.1  
DATE START: 10/16/2017  
DATE FINISH: 10/16/2017

CLIENT: Brunswick School Department  
PROJECT: Proposed Elementary School  
LOCATION: 75 Jordan Avenue, Brunswick, Maine

## Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): TOTAL DEPTH (FT): 83.8 LOGGED BY: Patrick Otto  
DRILLING CO.: S. W. Cole Explorations, LLC DRILLER: Scott Hollabaugh DRILLING METHOD: Cased Boring  
RIG TYPE: Track Mounted Diedrich D-50 AUGER ID/OD: N/A / N/A SAMPLER: Standard Split-Spoon  
HAMMER TYPE: Automatic / Automatic HAMMER WEIGHT (lbs): 140 / 300 CASING ID/OD: 4 in / 4 1/2 in CORE BARREL:  
HAMMER EFFICIENCY FACTOR: 0.87 HAMMER DROP (inch): 30 / 16  
WATER LEVEL DEPTHS (ft): 10/16/2017 Water introduced during drilling

## GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level  
▽ At time of Drilling D = Split Spoon Sample Pen. = Penetration Length WOR = Weight of Rods  
▽ At Completion of Drilling U = Thin Walled Tube Sample Rec. = Recovery Length WOH = Weight of Hammer  
▽ After Drilling R = Rock Core Sample bpf = Blows per Foot RQD = Rock Quality Designation S<sub>v</sub> = Field Vane Shear Strength, kips/sq.ft.  
V = Field Vane Shear mpf = Minute per Foot PID = Photoionization Detector q<sub>u</sub> = Unconfined Compressive Strength, kips/sq.ft.  
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0.5-2.5	24/18	5-5-4-4		0.2 2 1/2" ASPHALT		
									1.5 Loose, brown gravelly SAND, some silt (FILL)		
			2D		2.5-4.5	24/15	4-3-3-3		2.4 Loose, dark brown silty SAND (FILL)		
									Loose, brown medium/coarse SAND, some silt (Probable FILL)		
	5		3D		5-7	24/20	2-2-3-3		4.5 Loose, dark brown silty SAND (Probable FILL)		
			4D		7-9	24/18	3-8-7-6		6.0 Medium dense, brown gravelly medium/coarse SAND, trace silt		
	10		5D		10-12	24/18	6-9-11-7		10.0 Medium dense, rust brown-brown-black medium/coarse SAND, some gravel, some silt with occasional silt seams		
			6D		15-17	24/20	5-5-9-7		13.0 Medium dense, gray-rust brown fine/medium SAND, some silt		Added drilling polymer
	15								18.0 Loose, gray fine/medium SAND, some silt		
	20		7D		20-22	24/18	4-5-5-3				
			8D		25-27	24/12	3-2-3-3				
	25										
	30		9D		30-32	24/20	2-1 FOR 12"-2		29.0 Very loose, layered gray SAND and silty clay		
			10D		35-37	24/13	3-5-4-4		34.0 Loose, gray fine SAND with frequent silt seams		
	35										
									39.0 Very loose, layered gray silty CLAY and sand		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

(Continued Next Page)

BORING NO.: **B-101**



# BORING LOG

CLIENT: Brunswick School Department  
 PROJECT: Proposed Elementary School  
 LOCATION: 75 Jordan Avenue, Brunswick, Maine

BORING NO.: **B-101**  
 SHEET: 2 of 2  
 PROJECT NO. 13-1270.1  
 DATE START: 10/16/2017  
 DATE FINISH: 10/16/2017

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			11D	X	40-42	24/20	2-1-2-1				
	45		12D	X	45-47	24/22	2-2-4-8	q <sub>p</sub> =1 -1.5 ksf			
									46.0		Medium, brown silty CLAY
									47.0		Loose, brown fine/medium SAND, some silt
	50		13D	X	50-52	24/24	1-1-1-2		49.0		Very loose, layered gray silty CLAY and sand
	55		14D	X	55-57	24/24	WOR FOR 12"-2-2		54.0		Soft, gray silty CLAY with sand seams
											Hydraulic push rod probe from 57'-83.5'
	60										
	65										
	70										
	75										
	80										
					83.5-		40 FOR 3"		83.0		Probable granular soils
									83.8		Bottom of Exploration at 83.8 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: **B-101**

**BORING NO.: B-102**



# BORING LOG

BORING NO.: **B-103**  
SHEET: 1 of 2  
PROJECT NO. 13-1270.1  
DATE START: 10/12/2017  
DATE FINISH: 10/12/2017

CLIENT: Brunswick School Department  
PROJECT: Proposed Elementary School  
LOCATION: 75 Jordan Avenue, Brunswick, Maine

## Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): TOTAL DEPTH (FT): 52.0 LOGGED BY: Patrick Otto  
DRILLING CO.: S. W. Cole Explorations, LLC DRILLER: Scott Hollabaugh DRILLING METHOD: Cased Boring  
RIG TYPE: Track Mounted Diedrich D-50 AUGER ID/OD: N/A / N/A SAMPLER: Standard Split-Spoon  
HAMMER TYPE: Automatic / Automatic HAMMER WEIGHT (lbs): 140 / 300 CASING ID/OD: 4 in / 4 1/2 in CORE BARREL:  
HAMMER EFFICIENCY FACTOR: 0.87 HAMMER DROP (inch): 30 / 16  
WATER LEVEL DEPTHS (ft): 10/12/2017 Water introduced during drilling

## GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level  
▽ At time of Drilling D = Split Spoon Sample Pen. = Penetration Length WOR = Weight of Rods  
▽ At Completion of Drilling U = Thin Walled Tube Sample Rec. = Recovery Length WOH = Weight of Hammer  
▽ After Drilling R = Rock Core Sample bpf = Blows per Foot RQD = Rock Quality Designation S<sub>v</sub> = Field Vane Shear Strength, kips/sq.ft.  
V = Field Vane Shear mpf = Minute per Foot PID = Photoionization Detector q<sub>u</sub> = Unconfined Compressive Strength, kips/sq.ft.  
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0.5-2.5	24/18	3-3-5-3		0.2 2" ASPHALT		
									1.5 Basketball Court - Loose, brown silty gravelly SAND (FILL)		
			2D		2.5-4.5	24/20	3-3-4-4				
	5		3D		5-7	24/15	3-4-3-4				
			4D		7-9	24/15	4-5-5-4				
	10		5D		10-12	24/20	5-5-5-5		8.0 Loose to medium dense, brown gravelly medium/coarse SAND, some silt		
									9.5 Loose to medium dense, brown fine/medium SAND, some silt with occasional silt seams between 15-17'		
	15		6D		15-17	24/14	5-9-9-9				Added drilling polymer
	20		7D		20-22	24/10	6-6-8-7				
	25		8D		25-27	24/14	7-9-10-9				
	30		9D		30-32	24/13	7-8-9-8				
	35		10D		35-37	24/12	4-9-11-9				
									39.0 Medium dense, brown fine/medium SAND,		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

(Continued Next Page)

BORING NO.: **B-103**





# BORING LOG

CLIENT: Brunswick School Department  
 PROJECT: Proposed Elementary School  
 LOCATION: 75 Jordan Avenue, Brunswick, Maine

BORING NO.: **B-103**  
 SHEET: 2 of 2  
 PROJECT NO. 13-1270.1  
 DATE START: 10/12/2017  
 DATE FINISH: 10/12/2017

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			11D	X	40-42	24/15	10-8-7-7		some silt with frequent silt seams		
	45		12D	X	45-47	24/15	8-9-11-12		41.7 Medium dense, gray fine/medium SAND, some silt with occasional silt seams		
	50		13D	X	50-52	24/20	6-5-4-4		49.0 Loose, layered gray SAND and clayey silt		
									52.0 Bottom of Exploration at 52.0 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: **B-103**



# BORING LOG

BORING NO.: **B-104**  
SHEET: 1 of 2  
PROJECT NO. 13-1270.1  
DATE START: 10/12/2017  
DATE FINISH: 10/12/2017

CLIENT: Brunswick School Department  
PROJECT: Proposed Elementary School  
LOCATION: 75 Jordan Avenue, Brunswick, Maine

## Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): TOTAL DEPTH (FT): 52.0 LOGGED BY: Patrick Otto  
DRILLING CO.: S. W. Cole Explorations, LLC DRILLER: Scott Hollabaugh DRILLING METHOD: Cased Boring  
RIG TYPE: Track Mounted Diedrich D-50 AUGER ID/OD: N/A / N/A SAMPLER: Standard Split-Spoon  
HAMMER TYPE: Automatic / Automatic HAMMER WEIGHT (lbs): 140 / 300 CASING ID/OD: 4 in / 4 1/2 in CORE BARREL:  
HAMMER EFFICIENCY FACTOR: 0.87 HAMMER DROP (inch): 30 / 16  
WATER LEVEL DEPTHS (ft): 10/12/2017 Water introduced during drilling

## GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level  
▽ At time of Drilling D = Split Spoon Sample Pen. = Penetration Length WOR = Weight of Rods  
▽ At Completion of Drilling U = Thin Walled Tube Sample Rec. = Recovery Length WOH = Weight of Hammer  
▽ After Drilling R = Rock Core Sample bpf = Blows per Foot RQD = Rock Quality Designation S<sub>v</sub> = Field Vane Shear Strength, kips/sq.ft.  
V = Field Vane Shear mpf = Minute per Foot PID = Photoionization Detector q<sub>u</sub> = Unconfined Compressive Strength, kips/sq.ft.  
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0-2	24/16	3-4-5-4		Lawn Area - loose, dark brown SAND and silt with organics (FILL)		
			2D		2-4	24/16	4-3-4-5		Loose, brown SAND, some silt		
	5		3D		5-7	24/16	4-4-4-5		Loose, brown medium/coarse SAND, some silt		
			4D		7-9	24/16	3-4-6-6		Loose to medium dense, brown medium/coarse SAND, some gravel with occasional silt seams		
	10		5D		10-12	24/21	5-5-5-12		Loose to medium dense, brown fine/medium SAND, some silt with occasional silt seams/layers		Added drilling polymer
	15		6D		15-17	24/16	5-6-7-8				
	20		7D		20-22	24/15	6-7-8-6				
	25		8D		25-27	24/17	6-6-9-8				
	30		9D		30-32	24/13	4-3-6-6		Loose, brown silty fine/medium SAND with frequent silt seams/layers		
	35		10D		35-37	24/18	6-4-5-6		Loose to medium dense, brown fine/medium SAND, some silt		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

(Continued Next Page)

BORING NO.: **B-104**



# BORING LOG

**CLIENT:** Brunswick School Department  
**PROJECT:** Proposed Elementary School  
**LOCATION:** 75 Jordan Avenue, Brunswick, Maine

**BORING NO.:** B-104  
**SHEET:** 2 of 2  
**PROJECT NO.** 13-1270.1  
**DATE START:** 10/12/2017  
**DATE FINISH:** 10/12/2017

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			11D	X	40-42	24/15	5-5-6-6				
	45		12D	X	45-47	24/18	9-5-4-3				
									46.0		Loose, gray sandy silty CLAY
									47.0		Medium dense, gray fine/medium SAND, some silt
	50		13D	X	50-52	24/15	9-10- 11-10				

52.0 Bottom of Exploration at 52.0 feet

Stratification lines represent approximate  
 boundary between soil types, transitions may  
 be gradual. Water level readings have been  
 made at times and under conditions stated.  
 Fluctuations of groundwater may occur due to  
 other factors than those present at the time  
 measurements were made.

**BORING NO.:** B-104



# BORING LOG

BORING NO.: **B-105**  
SHEET: 1 of 1  
PROJECT NO. 13-1270.1  
DATE START: 10/12/2017  
DATE FINISH: 10/12/2017

CLIENT: Brunswick School Department  
PROJECT: Proposed Elementary School  
LOCATION: 75 Jordan Avenue, Brunswick, Maine

## Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): TOTAL DEPTH (FT): 35.0 LOGGED BY: Patrick Otto  
DRILLING CO.: S. W. Cole Explorations, LLC DRILLER: Scott Hollabaugh DRILLING METHOD: Hollow Stem Auger  
RIG TYPE: Track Mounted Diedrich D-50 AUGER ID/OD: 2 1/4 in / 5 5/8 in SAMPLER: Standard Split-Spoon  
HAMMER TYPE: Automatic / Automatic HAMMER WEIGHT (lbs): 140 / 300 CASING ID/OD: N/A / N/A CORE BARREL:  
HAMMER EFFICIENCY FACTOR: 0.87 HAMMER DROP (inch): 30 / 16  
WATER LEVEL DEPTHS (ft): 23 ft 10/12/2017 Soils wet/saturated below 20'

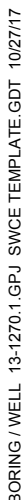
## GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level  
At time of Drilling  
At Completion of Drilling  
After Drilling  
D = Split Spoon Sample  
U = Thin Walled Tube Sample  
R = Rock Core Sample  
V = Field Vane Shear  
Pen. = Penetration Length  
Rec. = Recovery Length  
bpf = Blows per Foot  
mpf = Minute per Foot  
WOR = Weight of Rods  
WOH = Weight of Hammer  
RQD = Rock Quality Designation  
PID = Photoionization Detector  
S<sub>v</sub> = Field Vane Shear Strength, kips/sq.ft.  
q<sub>u</sub> = Unconfined Compressive Strength, kips/sq.ft.  
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D	X	0-2	24/22	3-4-5-6		Lawn Area - Loose, dark brown SAND and silt with organics (FILL)		
			2D	X	2-4	24/20	7-7-9-8		Medium dense, brown SAND, some silt		
	5		3D	X	5-7	24/18	4-5-9-7		Medium dense to loose, brown medium/coarse SAND, some gravel, trace silt		
			4D	X	7-9	24/16	6-5-6-5				
	10		5D	X	10-12	24/18	4-3-4-4				
			6D	X	15-17	24/20	4-4-6-5		Medium dense to loose, brown fine/medium SAND, some silt		
	15										
	20		7D	X	20-22	24/18	4-8-11-7				
			8D	X	25-27	24/22	2-3-5-7				
	25										
	30		9D	X	30-32	24/20	6-7-8-6				
	35										
			10D	X	35-				Bottom of Exploration at 35.0 feet		24" running sands in augers - no sample

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: **B-105**





# BORING LOG

CLIENT: Brunswick School Department  
 PROJECT: Proposed Elementary School  
 LOCATION: 75 Jordan Avenue, Brunswick, Maine

BORING NO.: **B-107**  
 SHEET: 1 of 1  
 PROJECT NO. 13-1270.1  
 DATE START: 10/13/2017  
 DATE FINISH: 10/13/2017

## Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): TOTAL DEPTH (FT): 27.0 LOGGED BY: Patrick Otto  
 DRILLING CO.: S. W. Cole Explorations, LLC DRILLER: Scott Hollabaugh DRILLING METHOD: Hollow Stem Auger  
 RIG TYPE: Track Mounted Diedrich D-50 AUGER ID/OD: 2 1/4 in / 5 5/8 in SAMPLER: Standard Split-Spoon  
 HAMMER TYPE: Automatic / Automatic HAMMER WEIGHT (lbs): 140 / 300 CASING ID/OD: N/A / N/A CORE BARREL:  
 HAMMER EFFICIENCY FACTOR: 0.87 HAMMER DROP (inch): 30 / 16  
 WATER LEVEL DEPTHS (ft): 23 ft 10/13/2017 Soils wet/saturated below 21'

## GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level  
 At time of Drilling  
 At Completion of Drilling  
 After Drilling  
 D = Split Spoon Sample  
 U = Thin Walled Tube Sample  
 R = Rock Core Sample  
 V = Field Vane Shear  
 Pen. = Penetration Length  
 Rec. = Recovery Length  
 bpf = Blows per Foot  
 mpf = Minute per Foot  
 WOR = Weight of Rods  
 WOH = Weight of Hammer  
 RQD = Rock Quality Designation  
 PID = Photoionization Detector  
 S<sub>v</sub> = Field Vane Shear Strength, kips/sq.ft.  
 q<sub>u</sub> = Unconfined Compressive Strength, kips/sq.ft.  
 N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0.5-2.5	24/7	5-5-6-5		0.2 2 1/2" ASPHALT Sidewalk adjacent to school - medium dense, brown silty gravelly SAND with brick (FILL)		
			2D		2.5-4.5	24/1	6-5-6-6				
	5		3D		5-7	24/13	7-8-7-5		4.5 Medium dense, brown medium/coarse SAND, some gravel, trace silt		
			4D		7-9	24/18	7-7-5-4				
	10		5D		10-12	24/18	3-6-6-5				
			6D		15-17	24/20	3-4-8-5		13.0 Medium dense to loose, brown fine/medium SAND, some silt with occasional silt seams between 20-22'		
	20		7D		20-22	24/18	4-4-6-3				
	25		8D		25-27	24/22	4-4-7-6				

27.0 Bottom of Exploration at 27.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: **B-107**



# BORING LOG

BORING NO.: **B-108**

SHEET: 1 of 1

PROJECT NO. 13-1270.1

DATE START: 10/16/2017

DATE FINISH: 10/16/2017

CLIENT: Brunswick School Department

PROJECT: Proposed Elementary School

LOCATION: 75 Jordan Avenue, Brunswick, Maine

## Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): TOTAL DEPTH (FT): 12.0 LOGGED BY: Patrick Otto  
DRILLING CO.: S. W. Cole Explorations, LLC DRILLER: Scott Hollabaugh DRILLING METHOD: Hollow Stem Auger  
RIG TYPE: Track Mounted Diedrich D-50 AUGER ID/OD: 2 1/4 in / 5 5/8 in SAMPLER: Standard Split-Spoon  
HAMMER TYPE: Automatic / Automatic HAMMER WEIGHT (lbs): 140 / 300 CASING ID/OD: N/A / N/A CORE BARREL:  
HAMMER EFFICIENCY FACTOR: 0.87 HAMMER DROP (inch): 30 / 16  
WATER LEVEL DEPTHS (ft): 10 ft 10/16/2017 Soils saturated below 10'

## GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level  
At time of Drilling  
At Completion of Drilling  
After Drilling  
D = Split Spoon Sample  
U = Thin Walled Tube Sample  
R = Rock Core Sample  
V = Field Vane Shear  
Pen. = Penetration Length  
Rec. = Recovery Length  
bpf = Blows per Foot  
mpf = Minute per Foot  
WOR = Weight of Rods  
WOH = Weight of Hammer  
RQD = Rock Quality Designation  
PID = Photoionization Detector  
S<sub>v</sub> = Field Vane Shear Strength, kips/sq.ft.  
q<sub>u</sub> = Unconfined Compressive Strength, kips/sq.ft.  
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H <sub>2</sub> O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
			1D		0.5-2.5	24/20	5-5-4-6		0.3 3 1/2" +/- ASPHALT		
			2D		2.5-4.5	24/17	5-6-7-11		Medium dense, brown medium SAND, some silt (FILL)		
	5		3D		5-7	24/16	12-12-14-14		Medium dense, brown-rust brown medium/coarse SAND, some gravel, trace silt		
			4D		7-9	24/22	8-8-12-12				
	10		5D		10-12	24/20	5-4-5-7		9.5 Loose, brown coarse SAND, some gravel, trace silt	10	
									12.0 Bottom of Exploration at 12.0 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: **B-108**







## KEY TO NOTES & SYMBOLS

### Test Boring and Test Pit Explorations

All stratification lines represent the approximate boundary between soil types and the transition may be gradual.

#### Key to Symbols Used:

w	-	water content, percent (dry weight basis)
q <sub>u</sub>	-	unconfined compressive strength, kips/sq. ft. - laboratory test
S <sub>v</sub>	-	field vane shear strength, kips/sq. ft.
L <sub>v</sub>	-	lab vane shear strength, kips/sq. ft.
q <sub>p</sub>	-	unconfined compressive strength, kips/sq. ft. – pocket penetrometer test
O	-	organic content, percent (dry weight basis)
W <sub>L</sub>	-	liquid limit - Atterberg test
W <sub>P</sub>	-	plastic limit - Atterberg test
WOH	-	advance by weight of hammer
WOM	-	advance by weight of man
WOR	-	advance by weight of rods
HYD	-	advance by force of hydraulic piston on drill
RQD	-	Rock Quality Designator - an index of the quality of a rock mass.
γ <sub>T</sub>	-	total soil weight
γ <sub>B</sub>	-	buoyant soil weight

#### Description of Proportions:

Trace:	0 to 5%
Some:	5 to 12%
"Y"	12 to 35%
And	35+%
With	Undifferentiated

#### Description of Stratified Soils

Parting:	0 to 1/16" thickness
Seam:	1/16" to 1/2" thickness
Layer:	½" to 12" thickness
Varved:	Alternating seams or layers
Occasional:	one or less per foot of thickness
Frequent:	more than one per foot of thickness

**REFUSAL: Test Boring Explorations** - Refusal depth indicates that depth at which, in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

**REFUSAL: Test Pit Explorations** - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.



## **APPENDIX D**

### **Hydrologic Soils Classification, Infiltration Testing and Laboratory Test Results**

13-1270

December 16, 2013

PDT Architects  
Attention: Lyndon Keck, AIA  
49 Dartmouth Street  
Portland, ME 04101

Subject: Hydrologic Soil Classification and Infiltration Testing  
Jordan Acres School  
75 Jordan Avenue  
Brunswick, Maine

Dear Lyndon:

In accordance with our Proposal dated November 8, 2013, we have completed hydrologic soil classification and infiltration testing at the Jordan Acres School in Brunswick, Maine. This letter summarizes our findings and its contents are subject to the limitations set forth in Appendix A.

## **INTRODUCTION**

### **Project Understanding**

Based on information provided by FST, Inc. (project civil engineer), we understand the former Jordan Acres School site is being considered for redevelopment with infiltration of stormwater as a preferred stormwater management scheme.

### **Scope and Purpose**

Our scope of work included: hydrologic soil observations in test pit explorations at six proposed stormwater management areas, infiltration testing at two of the stormwater management area, soil laboratory testing and preparation of this letter.

The purpose of our work was to document subsurface information relative to guidelines described in the Maine Stormwater Management Rules (06-096 CMR 500, amended December 27, 2006). This information includes depth to seasonal high groundwater,

depth to restrictive layers, depth to seepage and depth to bedrock, within approximately 8 feet of the soil surface, and soils classification in accordance with the standards of the National Cooperative Soil Survey (Soil Survey Manual, 1993; National Soil Survey Handbook, 1996). The soils observed on-site were classified to the soil series level, which the USDA Natural Resources Conservation Service has classified into Hydrologic Soil Groups.

## **EXPLORATION AND TESTING**

### **Explorations**

Six test pit explorations (TP-101 through TP-106) were made on the site by the Brunswick Public Works Department on December 4, 2013. The test pit locations were selected by FST, Inc. (project civil engineer) and established in the field by S. W. Cole Engineering, Inc. (S.W.COLE) using a mapping grade Trimble GPS. The approximate test pit locations are shown on the Exploration Location Plan attached as Appendix A. We documented soils observed at the test pit locations. Test pit logs are attached as Appendix B.

### **Infiltration Testing**

We also conducted infiltration testing in accordance with ASTM D 3385-09 for a stormwater management feasibility study. Infiltrometer Tests I-1 and I-2 were conducted in test pits adjacent to test pit locations TP-105 (I-1) and TP-102 (I-2), as shown on the "Exploration Location Plan" attached as Sheet 1. Infiltrometer Test I-1 was conducted at a depth of 6 feet and I-2 at a depth of 6.4 feet.

### **Laboratory Testing**

Three samples were selected for laboratory gradation analyses from the six test pits excavated on December 4, 2013. The three samples were selected at or below the soil layer where infiltration testing was conducted. The three samples represent the range of soil material observed in the six test pits either at or below the infiltration testing zone. The results of gradation testing are shown in Appendix C.

## FINDINGS

### Hydrologic Soils Classification

We classified soils in the test pits we observed as Adams, Adams variant and Udorthents. The Adams soils are variants because colors in the solum are browner than allowed in the soil series. The variant and filled phase observed do not change the soil Hydrologic Soil Group Classifications. These soils occur in sandy glacio-fluvial materials overlain by fine sandy loam or sandy loam fill or native soils. The Udorthents soils observed in TP-103 are similar to the Adams soil series but the native Adams soil is covered with about 43 inches of existing fill. These Udorthents have the same Hydrologic Soil Group Classification as the Adams soil. We did not observe a seasonal groundwater table or restrictive layer in any test pit except for TP-101. TP-101 had a seasonal groundwater table at 102 inches in depth. The results of our subsurface findings are summarized below in Table 1.

**TABLE 1**

Test Pit	Soil Series	Depth (feet)				Hydrologic Soil Group*
		Bedrock	Seasonal Water Table (mottling)	Restrictive Layer	Groundwater Seepage	
TP-101	Adams variant	>108"	102"	>108"	102"	A
TP-102	Adams variant filled	>114"	>114"	>114"	not observed	A
TP-103	Udorthents	>108"	>108"	>108"	not observed	A**
TP-104	Adams variant F.S.L.	>120"	>120"	>120"	not observed	A
TP-105	Adams variant F.S.L.	>120"	>120"	>120"	not observed	A
TP-106	Adams variant F.S.L.	>120"	>120"	>120"	Not observed	A

\* Hydrologic Soil Group classification is made by USDA- Natural Resources Conservation Service.

\*\*Hydrologic Soil Group based on native soil condition

The USDA Soil Interpretation Record for Adams Series Soils is attached in Appendix B. The Adams Variant and Udorthents Soil Series have similar characteristics.

**Infiltration Testing**

During infiltrometer testing, water was added to both rings up to a certain level and maintained at that level over a period of time by adding water to the rings. The measured volume of water added to the rings to maintain a constant head of water over specific timed intervals is used to calculate the incremental infiltration rate. Approximately 18 gallons of water was added to the inner and outer rings over the first 15 minute trial period during test I-1 and approximately 30 gallons of water was added to the rings over the first 15 minute trial period during test I-2. The soils at test I-1 were silts and sands, whereas the soils at test I-2 were sand with some gravel. During testing, we were unable to sustain a constant water level at either test location (i.e. water drained from the rings faster than we could replace it to maintain a constant head of water).

According to ASTM D 3385-09, the data obtained from infiltrometer tests may be difficult or unreliable in soils with hydraulic conductivity greater than about  $3.9 \times 10^{-3}$  inches/sec ( $1 \times 10^{-2}$  cm/sec) or less than  $3.9 \times 10^{-7}$  inches/sec ( $1 \times 10^{-6}$  cm/sec).

**Laboratory Gradation Analyses**

The laboratory gradation testing indicates the on-site soils are dominated by medium and coarse grained sand with some gravel and less than 2 percent fines.

**CONCLUSIONS AND RECOMMENDATIONS**

Based on our findings, we interpret the sandy site soils to be well to somewhat excessively drained and feasible to infiltrate stormwater. Although it was not possible to sustain a constant water level during infiltration testing and we were unable to measure the infiltration rate, we interpret the infiltration rate to be rapid. Based on the gradation test results, the Hazen's approximation of permeability is estimated to be on the order of 0.01 cm/sec.

Based on our experience with similar soils in the Brunswick area, we recommend an infiltration rate of 1.5 inches/hour (approximately 0.001 cm/sec) be considered for planning purposes.

**CLOSURE**

The scope of our services has been limited to the assessment of subsurface conditions at discrete locations on the former Jordan Acres School site in Brunswick, Maine. This report has been prepared for the exclusive use of PDT Architects. Our services were conducted, compiled and reported in general accordance with guidelines described in the Maine Stormwater Management Rules (06 096 CMR 500, amended December 27, 2006). No warranty, expressed or implied, is made. The conclusions and recommendations presented in this report are based upon the data obtained from the discrete locations explored, conditions can vary at other locations across the site .

We appreciate the opportunity to be of service on this phase of your project. If you have any questions, please do not hesitate to call us.

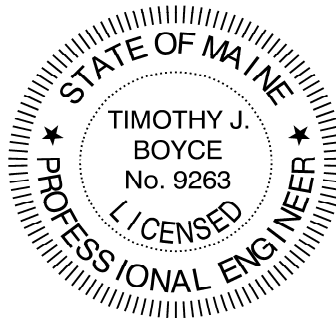
Sincerely,

**S. W. Cole Engineering, Inc.**

Stephen H. Howell, C.S.S. #187  
Certified Soil Scientist



Timothy J. Boyce, P.E.  
Senior Geotechnical Engineer



Attachments:

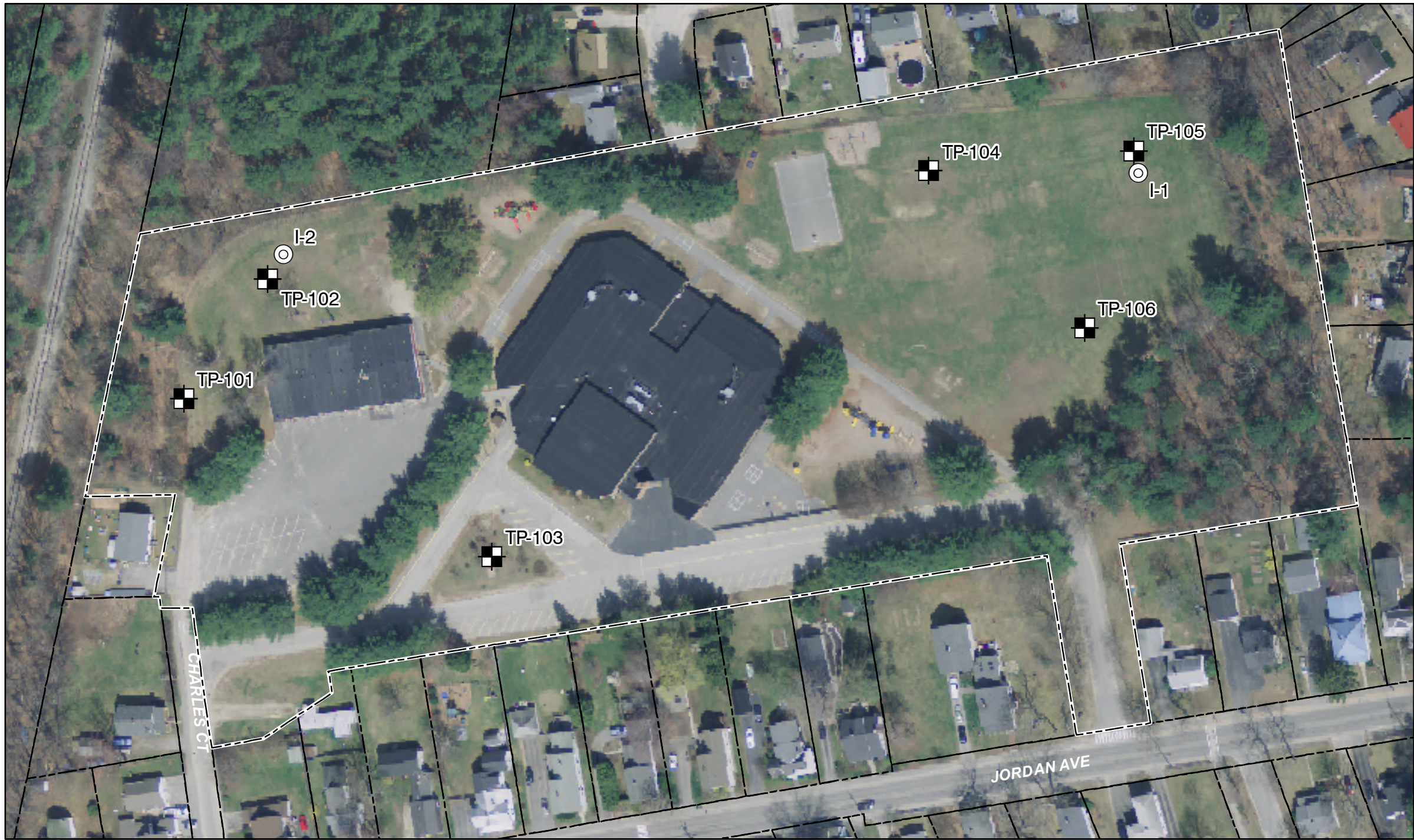
- Appendix A Exploration Location Plan
- Appendix B Hydrologic Soil Test Pit Logs
- Appendix C Soil Gradation Test Results

SHH-TJB:tjb



## APPENDIX A





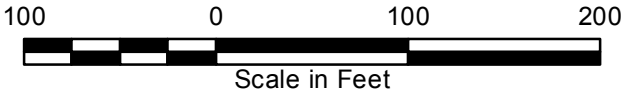


**NOTES:**

1. EXPLORATION LOCATION PLAN PREPARED FROM IMAGERY ENTITLED MAINE 0.075m ORTHOPHOTOGRAPHY 2012 PROVIDED BY THE MAINE GEOLIBRARY.
2. THE EXPLORATIONS WERE LOCATED IN THE FIELD BY TAPED MEASUREMENTS FROM EXISTING SITE FEATURES.
3. THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S.W. COLE ENGINEERING, INC. REPORT.
4. THE PURPOSE OF THIS PLAN IS ONLY TO DEPICT THE LOCATION OF THE EXPLORATIONS IN RELATION TO THE EXISTING CONDITIONS AND IS NOT TO BE USED FOR CONSTRUCTION.

**LEGEND**

-  APPROXIMATE BORING LOCATION
-  APPROXIMATE INFILTRMETER TEST LOCATION



PDT ARCHITECTS  
**EXPLORATION LOCATION PLAN**  
STORMWATER MANAGEMENT FEASIBILITY STUDY  
JORDAN ACRES SCHOOL  
75 JORDAN AVENUE  
BRUNSWICK, MAINE

Job No.	13-1270	Scale	1" = 100'
Date:	12/16/2013	Sheet	1



## **APPENDIX B**



## Soil Description and Classification

Job Number: 13-1270

Project Name: Stormwater Mngt. Feasibilty Study

Applicant Name: PDT Architects

Symbol: NA O Horizon Thickness: 0"

Symbol: NA O Horizon Thickness: 0"

Test Pit TP101 Hydric (y/n) N  
Soil Name: Adams variant

Test Pit TP102 Hydric (y/n) N  
Soil Name: Adams variant, filled

Horiz		Texture	Consistence	Color	Mottling
	1				
	2				
	3				
	4				
Ap	5				
	6	f. sandy loam	friable	v. dk. gray. brwn.	none
	7				
	8				
	9				
	10				
	12				
Bs	14	sandy loam		dark yellowish brown	
	16				
BC	18	f. fine sand	loose	lgt. olive brwn.	
	20				
C	25	loamy sand			
	30				
	35				
	40				
C2	45	grav. c. sand		olive brown	
	50				
	55				
	60				
2Bhs	65	grav. medium sand	friable to firm	dk. brown	
	70	Limit of observation = 9.0'; seepage and standing water at 8.5' in depth; 7.5' to 9.0' olive brown, loose, grav. c. sand; less than 30% pockets of cemented dk. brown grav. sand at 5.0 to 7.5' in depth			
	75				
	80				

Horiz		Texture	Consistence	Color	Mottling
	1				
	2				
	3				
Ap	4	f. sandy loam	friable	v. dk. gray. brown	one
	5	(old fill)			
	6				
	7				
	8				
	9				
	10				
	12	(old fill)			
Ap2	14	f. sandy loam		brown	
	16	with broken			
	18	bricks and			
	20	concrete			
Bs	25	f. sandy loam		yellowish brown	
	30				
C	35	loamy sand	loose	lgt. olive brwn.	
	40				
	45				
	50				
C2	55	grav. c. sand		lgt. olive brwn.	
	60				
	65				
C3	70	gravelly coarse sand			
	75				
	80				

Limit of observation = 9.5'; no seasonal groundwater or restriction observed to greater than 9.5' in depth; 0 - 24" in depth is old fill

C.S.S.

Name:

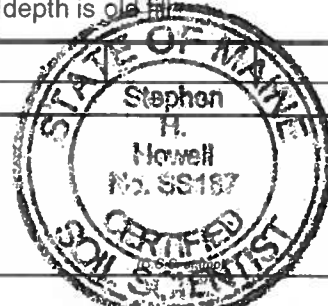
STEPHEN H. HOWELL

Date:

12/16/13

License #:

55 #187



**Soil Description and Classification**

Job Number: 13-1270

**Project Name:** Stormwater Mngt. Feasibility Study

**Applicant Name:** PDT Architects

**Symbol:** NA **O Horizon Thickness:** 0'

**Symbol:** NA **O Horizon Thickness:** 0

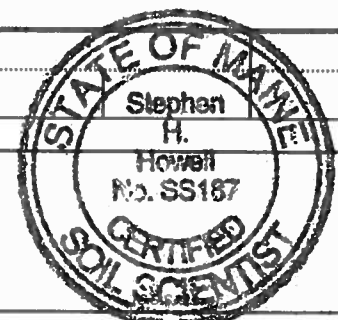
**Test Pit** TP103 **Hydric (y/n)** N  
**Soil Name:** Udorthents

**Test Pit** TP104 **Hydric (y/n)** N  
**Soil Name:** Adams variant fine sandy loam

Hor z		Texture	Consistence	Color	Mottling
Ap	1				
	2				
	3	f. sandy loam	friable	brown	none
	4	(old fill)			
	5				
	6				
	7				
	8				
	9				
	10				
	12				
	14				
Ap2	16	grav fsl/sl			
	18	(old fill)			
	20				
	25				
	30				
	35				
	40				
	45				
Bs	45	f. sand	ooso	yellowish wn	
C	50				
	55				
	60	gravelly coarse sand		light olive brown	
	65	Limit of observation = 9.0'; olive, loose, grav. c. sand at 8.5-9.0' in depth; no seasonal groundwater or restriction observed to greater than 9.0' in depth			
	70				
	75				
	80				

Hor z		Texture	Consistence	Color	Mottling
Ap	1				
	2				
	3	f. sandy loam	friable	brown	none
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	12				
	14				
Bs	12	f. fine sand	loose	dk. yell. brown	
BC	16			lgt. olive brown	
	18				
C	20				
	25				
	30				
	35	grav. c. sand		olive	
	40				
	45				
	50				
	55				
	60				
	65				
	70				
	75				
	80				

Limit of observation = 10.0'; no seasonal groundwater or restrictive layer observed to greater than 10.0' in depth



C.S.S.	Name: <b>STEPHEN H. HOWELL</b>	Date: <b>12/16/13</b>
		License #: <b>SS # 187</b>

**Soil Description and Classification**

Job Number: 13-1270

**Project Name:** Stormwater Mngt. Feasibility Study

**Applicant Name:** PDT Architects

**Symbol:** NA **O Horizon Thickness:** 0"

**Symbol:** NA **O Horizon Thickness:** 0"

**Test Pit** TP105 **Hydric (y/n)** N

**Test Pit** TP106 **Hydric (y/n)** N

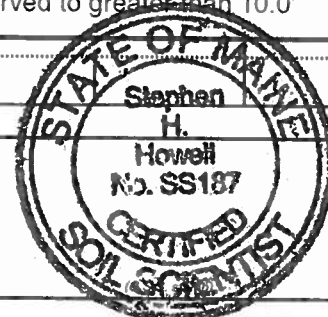
**Soil Name:** Adams variant fine sandy loam

**Soil Name:** Adams fine sandy loam

Horiz		Texture	Consistence	Color	Mottling
Ap	1				
	2				
	3	f.s. loam	friable	brown	none
	4				
	5				
	6				
	7				
	8				
Bs	9				
	10	l.f. sand	loose	yellowish brown	
	12				
BC	14				
	16			light olive brown	
	18				
	20				
	25	gravelly coarse sand		olive	
	30				
	35				
	40				
	45				
	50				
	55				
	60				
	65	Limit of observation = 10.0'; olive, loose gravelly sand at 7.5' to 10.0' in depth; no seasonal groundwater or restriction observed to greater than 10.0' in depth			
	70				
	75				
	80				

Horiz		Texture	Consistence	Color	Mottling
Ap	1				
	2				
	3	f.s. loam	friable	brown	none
	4				
	5				
	6				
	7				
	8				
	9				
Bhs	10			v.d. grayish brown	
	12				
Bs	14	l.f. sand	loose	yellowish brown	
	16				
BC	18			light olive brown	
	20				
	25				
	30	fine sand		olive	
C	35				
	40				
	45	fine sand/v.f. sand			
	50				
C3	55	gravelly coarse sand			
	60				
	65	Limit of observation = 10.0'; f. sand to 7.5' in depth and gravelly c. sand below to 10.0' in depth; no seasonal groundwater or restriction observed to greater than 10.0'			
	70				
	75				
	80				

C.S.S.	Name: <b>STEPHEN H. HOWELL</b>	Date: <b>12/16/13</b>
		License #: <b>SS # 187</b>





NY0025

## SOIL INTERPRETATIONS RECORD

MLRA(S): 141, 142, 143, 144A, 144B

REV. HEW, JWW, 7-64

TYPIC MAPLORHODS, SANDY, MIXED, FRIGID

ADAMS SERIES

THE ADAMS SERIES CONSISTS OF DEEP, WELL-DRAINED TO EXCESSIVELY-DRAINED SOILS ON SAND PLAINS. THEY FORMED IN DELTAIC OR OUTWASH SAND. TYPICALLY THESE SOILS HAVE A PINKISH-GRAY SAND SURFACE LAYER 4 INCHES THICK. THE SUBSOIL FROM 4 TO 10 INCHES IS DARK REDDISH-BROWN AND BROWN LOAMY SAND AND FROM 10 TO 26 INCHES IS BROWN AND YELLOWISH-BROWN LOOSE SAND. THE SUBSTRATUM FROM 26 TO 60 INCHES IS GRAYISH-BROWN LOOSE SAND. SLOPES RANGE FROM 0 TO 60 PERCENT.

ESTIMATED SOIL PROPERTIES (A)													
DEPTH (IN.)	USDA TEXTURE		UNIFIED		AASHTO		FRAC- T > 3 IN (PCT)	PERCENT OF MATERIAL LESS THAN 3" PASSING SIEVE NO.				LIQUID LIMIT	PLAS- TICITY INDEX
0-4	S, LFS, LS		SM, SP-SM		A-1, A-2, A-3, A-4		0	4	10	40	200		
4-26	LS, S, LFS		SM, SP-SM		A-1, A-2, A-3, A-4		0	95-100	95-100	45-85	5-40	-	NP
26-60	S, COS		SP-SM, SW-SM, SP		A-1, A-2, A-3		0-1	95-100	95-100	35-95	5-40	-	NP
								90-100	70-100	20-90	0-10	-	NP
DEPTH (IN.)	CLAY (PCT)	MOIST BULK DENSITY (G/CM3)	PERMEA- BILITY (IN/HR)	AVAILABLE WATER CAPACITY (IN/IN)	SOIL REACTION (PH)	SALINITY (MMHOS/CM)	SHRINK- SWELL POTENTIAL	EROSION FACTORS	WIND EROD. GROUP	ORGANIC MATTER (PCT)	CORROSIVITY		
0-4	0-5	1.00-1.30	6.0-20	0.05-0.12	4.5-5.5	-	LOW	K	T	-	STEEL	CONCRETE	
4-26	0-5	1.10-1.45	6.0-20	0.04-0.10	4.5-5.5	-	LOW	17	5	1-4	LOW	HIGH	
26-60	0-5	1.20-1.50	>20	0.03-0.04	4.5-6.0	-	LOW	17	-	-			
FLOODING				HIGH WATER TABLE		CEMENTED PAN		GEOROCK		SUBSIDENCE		HYD	POTENT'L
FREQUENCY	DURATION	MONTHS	DEPTH (FT)	KIND	MONTHS	DEPTH (IN)	HARDNESS (IN)	DEPTH (IN)	HARDNESS (IN)	INIT. TOTAL (IN)	GRP	FROST ACTION	
NONE			>6.0			-		>60		-	A	LOW	

SANITARY FACILITIES (B)		CONSTRUCTION MATERIAL (B)	
SEPTIC TANK ABSORPTION FIELDS	0-15%: SEVERE-POOR FILTER 15+%: SEVERE-POOR FILTER, SLOPE	ROADFILL	0-15%: GOOD 15-25%: FAIR-SLOPE 25+%: POOR-SLOPE
SEWAGE LAGOON AREAS	0-7%: SEVERE-SEEPAGE 7+%: SEVERE-SLOPE, SEEPAGE	SAND	PROBABLE
SANITARY LANDFILL (TRENCH)	0-15%: SEVERE-SEEPAGE, TOO SANDY 15+%: SEVERE-SLOPE, SEEPAGE, TOO SANDY	GRAVEL	IMPROBABLE-TOO SANDY
SANITARY LANDFILL (AREA)	0-15%: SEVERE-SEEPAGE 15+%: SEVERE-SLOPE, SEEPAGE	TOPSOIL	0-15%: POOR-TOO SANDY 15+%: POOR-SLOPE, TOO SANDY
DAILY COVER FOR LANDFILL	0-15%: POOR-SEEPAGE, TOO SANDY 15+%: POOR-SEEPAGE, TOO SANDY, SLOPE	WATER MANAGEMENT (B)	
BUILDING SITE DEVELOPMENT (B)		POND RESERVOIR AREA	0-8%: SEVERE-SEEPAGE 8+%: SEVERE-SEEPAGE, SLOPE
SHALLOW EXCAVATIONS	0-15%: SEVERE-CUTBANKS CAVE 15+%: SEVERE-SLOPE, CUTBANKS CAVE	EMBANKMENTS DIKES AND LEVEES	SEVERE-SEEPAGE, PIPING
DWELLINGS WITHOUT BASEMENTS	0-8%: SLIGHT 8-15%: MODERATE-SLOPE 15+%: SEVERE-SLOPE	EXCAVATED PONDS AQUIFER FED	SEVERE-NO WATER
DWELLINGS WITH BASEMENTS	0-8%: SLIGHT 8-15%: MODERATE-SLOPE 15+%: SEVERE-SLOPE	DRAINAGE	DEEP TO WATER
SMALL COMMERCIAL BUILDINGS	0-8%: SLIGHT 8-15%: MODERATE-SLOPE 15+%: SEVERE-SLOPE	IRRIGATION	0-3%: DROUGHTY, FAST INTAKE 3+%: DROUGHTY, FAST INTAKE, SLOPE
LOCAL ROADS AND STREETS	0-8%: SLIGHT 8-15%: MODERATE-SLOPE 15+%: SEVERE-SLOPE	TERRACES AND DIVERSIONS	0-8%: TOO SANDY 8+%: SLOPE, TOO SANDY
LAWNS, LANDSCAPING AND GOLF FAIRWAYS	0-15%: SEVERE-DROUGHTY 15+%: SEVERE-SLOPE, DROUGHTY	GRASSED WATERWAYS	0-8%: DROUGHTY 8+%: SLOPE, DROUGHTY

## REGIONAL INTERPRETATIONS

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## RECREATIONAL DEVELOPMENT (B)

RECREATIONAL DEVELOPMENT (B)			
CAMP AREAS	0-5% LFS,LS: SLIGHT 8-15% LFS,LS: MODERATE-SLOPE 15-2% LFS,LS: SEVERE-SLOPE 0-15% S: SEVERE-TOD SANDY 15-2% S: SEVERE-SLOPE TOD SANDY	PLAYGROUNDS	0-2% LFS,LS: SLIGHT 2-6% LFS,LS: MODERATE-SLOPE 6-4% LFS,LS: SEVERE-SLOPE 0-6% S: SEVERE-TOD SANDY 6-4% S: SEVERE-SLOPE TOD SANDY
PICNIC AREAS	0-5% LFS,LS: SLIGHT 8-15% LFS,LS: MODERATE-SLOPE 15-4% LFS,LS: SEVERE-SLOPE 0-15% S: SEVERE-TOD SANDY 15-2% S: SEVERE-SLOPE TOD SANDY	PATHS AND TRAILS	0-15% LFS,LS: SLIGHT 15-25% LFS,LS: MODERATE-SLOPE 25-4% LFS,LS: SEVERE-SLOPE 0-25% S: SEVERE-TOD SANDY 25-4% S: SEVERE-TOD SANDY, SLOPE

CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE	25+ % S: SEVERE-TOD S HIGH LEVEL MANAGEMENT
---	--

[illegible]

## WOODLAND SUITABILITY (C)

CLASS- DETERMINING PHASE		ORD SYM	MANAGEMENT PROBLEMS					POTENTIAL PRODUCTIVITY			TREES TO PLANT
		EROSION HAZARD	EQUIP. LIMIT	SEEDLING MORTALITY	WIND THREAT	PLANT COMPETITION	COMMON TREES	SITE INDEX	PROD CLASS		
0-16%		6S	SLIGHT	SLIGHT	SEVERE	SLIGHT		EASTERN WHITE PINE	56	6	EASTERN WHITE PINE
15-36%		6S	SLIGHT	MODER.	SEVERE	SLIGHT		RED PINE	56	5	RED PINE
36+		6R	MODER.	SEVERE	SEVERE	SLIGHT		RED SPRUCE	36	5	EUROPEAN LARCH
								SUGAR MAPLE	47	2	

## WINDBREAKS

[illegible]

## WILDLIFE HABITAT SUITABILITY (D)

CLASS- DETERMINING PHASE	WILDLIFE HABITAT SUITABILITY (D)											
	POTENTIAL FOR HABITAT ELEMENTS						POTENTIAL AS HABITAT FOR:					
	GRAIN & SEED	GRASS & LEGUME	WILD HERB	HARDWD TREES	CONIFER PLANTS	SHRUBS	WETLAND PLANTS	SHALLOW WATER	OPENLD WILDF	WOODLD WILDF	WETLAND WILDF	RANGELD WILDF
0-25% LFS,LS	POOR	FAIR	FAIR	POOR	POOR	-	V. POOR	V. POOR	POOR	POOR	V. POOR	-
25-35% LFS,LS	V. POOR	FAIR	FAIR	POOR	POOR	-	V. POOR	V. POOR	POOR	POOR	V. POOR	-
0-60% S	V. POOR	POOR	POOR	POOR	POOR	-	V. POOR	V. POOR	POOR	POOR	V. POOR	-
35+% LFS,LS	V. POOR	POOR	FAIR	POOR	POOR	-	V. POOR	V. POOR	POOR	POOR	V. POOR	-
POTENTIAL NATIVE PLANT COMMUNITIES												

POTENTIAL NATIVE PLANT COMMUNITY (RANGELAND OR FOREST UNDERSTORY VEGETATION)

POTENTIAL NATIVE PLANT COMMUNITY (RANGELAND OR FOREST UNDERSTORY VEGETATION)						
COMMON PLANT NAME	PLANT SYMBOL (NLSFN)	PERCENTAGE COMPOSITION (DRY WEIGHT) BY CLASS DETERMINING PHASE				
POTENTIAL PRODUCTION (LBS./AC. DRY WT):						
FAVORABLE YEARS						
NORMAL YEARS						
UNFAVORABLE YEARS						

## FOOTNOTES

FOOTNOTES  
A ESTIMATED ENGINEERING PROPERTIES BASED ON TEST DATA FROM 3 PEDON IN MAINE  
B RATINGS BASED ON NSM PART II, SECTION 403, MARCH 1978  
C RATINGS BASED ON NATIONAL FORESTRY MANUAL, SEPT. 1980  
D RATINGS BASED ON SOILS 74, JAN. 1972

## APPENDIX C

# Report of Gradation

ASTM C-117 &amp; C-136

Project Name BRUNSWICK ME - JORDAN ACRES SCHOOL REDEVELOPMENT - INFILTRATION EVALUATION

Client PDT ARCHITECTS, P.A.

Exploration **TP101**

Material Source **5.5-7.5**

Project Number 13-1270

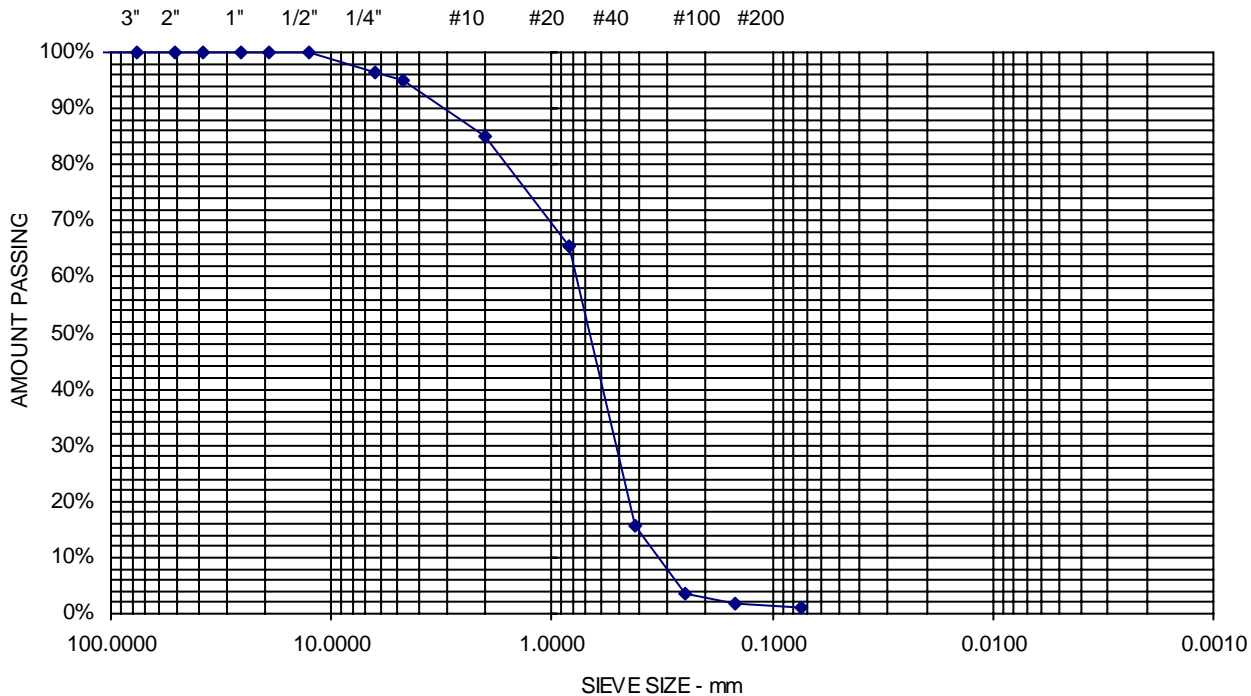
Lab ID 16911B

Date Received 12/9/2013

Date Completed 12/10/2013

Tested By JASON ORCUTT

<u>STANDARD DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
150	6"	100	
125	5"	100	
100	4"	100	
75	3"	100	
50	2"	100	
38.1	1-1/2"	100	
25.0	1"	100	
19.0	3/4"	100	
12.5	1/2"	100	
6.3	1/4"	97	
4.75	No. 4	95	5.1% Gravel
2.00	No. 10	85	
850	No. 20	66	
425	No. 40	16	93.9% Sand
250	No. 60	4	
150	No. 100	2	
75	No. 200	1.1	1.1% Fines



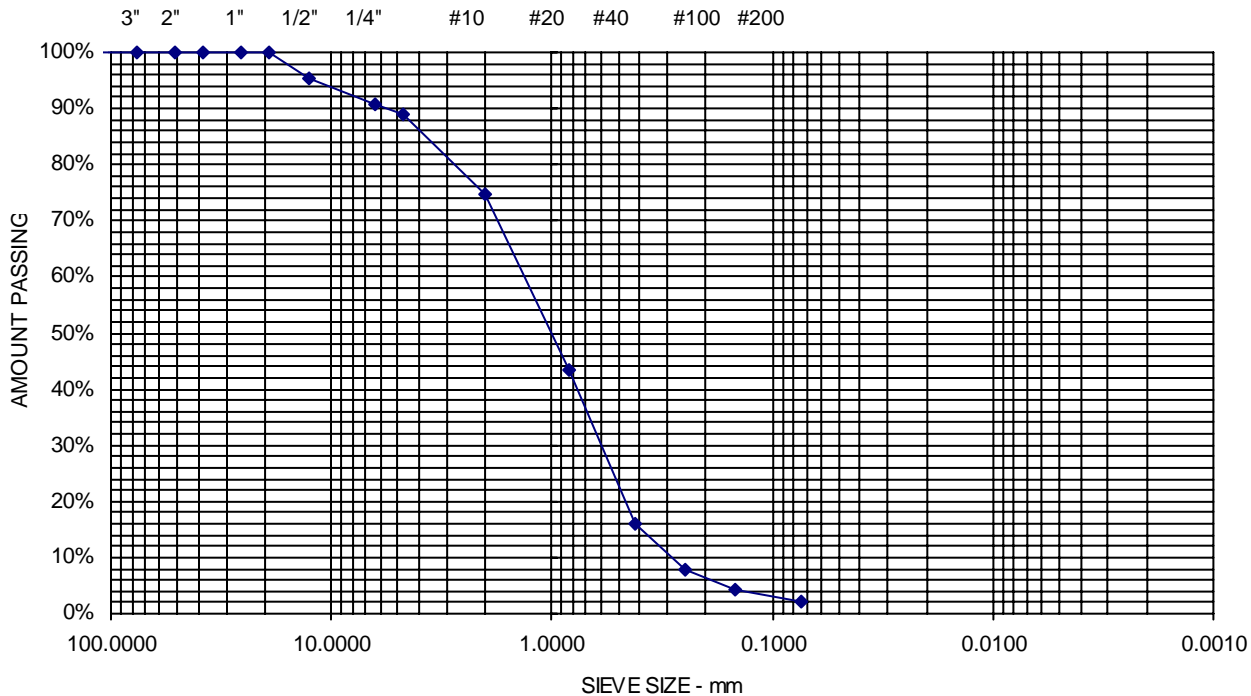
Comments:

**Sheet**

Project Name BRUNSWICK ME - JORDAN ACRES SCHOOL REDEVELOPMENT -  
 INFILTRATION EVALUATION  
 Client PDT ARCHITECTS, P.A.  
 Exploration **TP104**  
 Material Source **5.5-6.5**

Project Number 13-1270  
 Lab ID 16913B  
 Date Received 12/9/2013  
 Date Completed 12/10/2013  
 Tested By JASON ORCUTT

<u>STANDARD DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
150	6"	100	
125	5"	100	
100	4"	100	
75	3"	100	
50	2"	100	
38.1	1-1/2"	100	
25.0	1"	100	
19.0	3/4"	100	
12.5	1/2"	96	
6.3	1/4"	91	
4.75	No. 4	89	11.2% Gravel
2.00	No. 10	75	
850	No. 20	43	
425	No. 40	16	86.8% Sand
250	No. 60	8	
150	No. 100	4	
75	No. 200	2.0	2% Fines



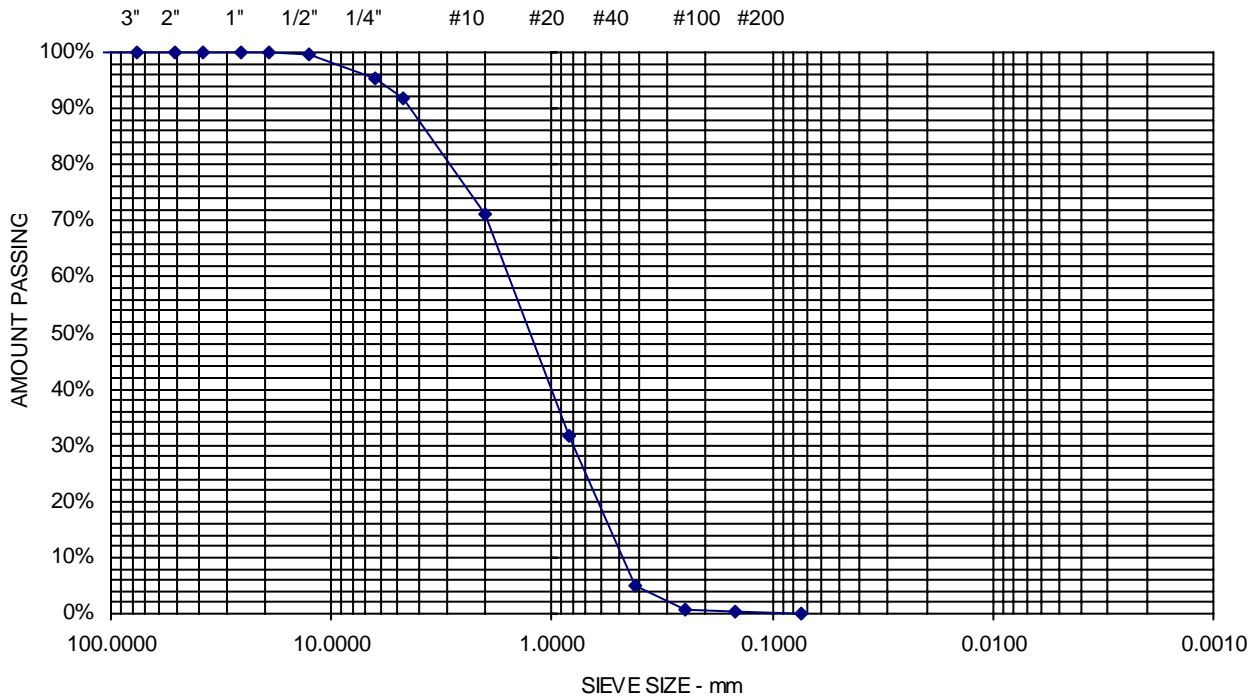
# Report of Gradation

ASTM C-117 &amp; C-136

Project Name BRUNSWICK ME - JORDAN ACRES SCHOOL REDEVELOPMENT -  
 INFILTRATION EVALUATION  
 Client PDT ARCHITECTS, P.A.  
 Exploration **TP105**  
 Material Source **5.0-7.5**

Project Number 13-1270  
 Lab ID 16912B  
 Date Received 12/9/2013  
 Date Completed 12/10/2013  
 Tested By JASON ORCUTT

<u>STANDARD DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
150	6"	100	
125	5"	100	
100	4"	100	
75	3"	100	
50	2"	100	
38.1	1-1/2"	100	
25.0	1"	100	
19.0	3/4"	100	
12.5	1/2"	100	
6.3	1/4"	95	
4.75	No. 4	92	8.2% Gravel
2.00	No. 10	71	
850	No. 20	32	
425	No. 40	5	91.6% Sand
250	No. 60	1	
150	No. 100	0	
75	No. 200	0.1	0.1% Fines



Comments:

**Sheet**

This report has been prepared for the exclusive use of Brunswick School Department for specific application to the proposed Elementary School on Jordan Acre School Site in Brunswick, Maine. S. W. Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct our services in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S.W.COLE's scope of services has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S.W.COLE should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S.W.COLE.





SECTION 2-B

PROPOSAL FORM  
SHORT FORM  
PUBLIC SCHOOL PROJECT

TO: \_\_\_\_\_ (Name)

\_\_\_\_\_ (Address)

\_\_\_\_\_

A. Having carefully examined the form of contract, general conditions and plans and specifications dated April 1, 2020 prepared by CHA Architects, 49 Dartmouth Street, Portland, Maine 04101 for Kate Furbish Elementary - Discovery Classroom as well as the premises and conditions affecting the work, we the undersigned propose to furnish all labor, equipment and materials necessary for and reasonably incidental to the construction and completion of this proposal for the amount of:

Base Bid \_\_\_\_\_ Dollars \$ \_\_\_\_\_

B. Alternate prices as follows: Not Used.

C. This proposal includes the following addenda to the plans and specifications:

Addendum No. \_\_\_\_\_, Dated \_\_\_\_\_ Addendum No. \_\_\_\_\_, Dated \_\_\_\_\_  
Addendum No. \_\_\_\_\_, Dated \_\_\_\_\_ Addendum No. \_\_\_\_\_, Dated \_\_\_\_\_

D. The undersigned agrees, if awarded the contract, to complete the Work in the Contract Documents on or before August 28, 2020.

This proposal includes the cost of a 100% contract performance bond and a 100% contract payment bond.

Any material or materials not specified in the bidding document but deemed worthy of consideration may be introduced by the bidder in a separate letter attached to this proposal. A cost comparison must be included giving the comparison with the material specified and the reason for the suggested substitution. The basic bid shall be as specified.

The undersigned agrees, if this proposal is accepted, to sign a contract and deliver it, along with the bonds and affidavits of all insurance specified within twelve (12) calendar days after the date of notification of such acceptance, except if the 12th day falls on a holiday, a Saturday or Sunday, then the conditions will be fulfilled if the required documents are received before 12:00 o'clock noon on the day following the holiday, or the Monday following the Saturday or Sunday, and as a guarantee thereof, herewith submits a certified or cashiers check or bid bond as required.

SIGNED: \_\_\_\_\_

BY: \_\_\_\_\_

\_\_\_\_\_  
P.O. Address

NOTE: If bidder is a corporation, write state of incorporation, and if a partnership, give full names of all partners.

**00 43 13**  
**Contractor Bid Bond**

We, the undersigned, insert company name of Contractor, select type of entity of insert name of municipality in the State of insert name of state as principal, and insert name of surety as Surety, are hereby held and firmly bound unto select title of obligee in the penal sum of five percent of the bid amount, for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns, signed this insert day, i.e.: 8th day of select month, select year, which is the same date as that of the bid due date.

The condition of the above obligation is such that whereas the principal has submitted to the Owner, or State of Maine, to a certain bid, attached hereto and hereby made a part hereof, to enter into a contract in writing, for the construction of insert name of project as designated in the contract documents

Now therefore:

If said bid shall be rejected, or, in the alternate,

If said bid shall be accepted and the principal shall execute and deliver a contract in the form of contract attached hereto, properly completed in accordance with said bid, and shall furnish a bond for the faithful performance of said contract, and for the payment of all persons performing labor or furnishing material in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said bid, then this obligation shall be void.

Otherwise, the same shall remain in force and effect- it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received hereby stipulates and agrees that the obligation of said Surety and its bonds shall be in no way impaired or affected by any extension of the time within which the Obligee may accept such bid and said Surety does hereby waive notice of any such extension.

**00 43 13**  
**Contractor Bid Bond**

In witness whereof, the principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set above.

Signed and sealed this insert day, i.e.: 8th day of select month, select year, which is the same date as that of the bid due date.

**Contractor**

\_\_\_\_\_  
(Signature)

*insert name and title*

*insert company name*

*insert address*  
*insert city state zip code*

**Surety**

\_\_\_\_\_  
(Signature)

*insert name and title*

*insert company name*

*insert address*  
*insert city state zip code*

If Contractor is a partnership, all partners shall execute the bond. A power of attorney document indicating that it still is in full force and effect shall be provided by the person executing this bond.

SECTION 2-E

STATE OF MAINE  
CONSTRUCTION CONTRACT

Public School Project

THIS AGREEMENT made the date of month in the year 2020 by and between the State of Maine through the School Administrative Unit name hereinafter called the *Owner*, and Contractor company name hereinafter called the *Contractor*.

WITNESSETH, That the *Owner* and the *Contractor* for the consideration hereinafter named agree as follows:

ARTICLE 1 SCOPE OF WORK

§ 1.1 The *Contractor* shall furnish all of the materials and perform all the work described in the specifications and shown on the drawings for the project entitled: title of project shown on documents.

§ 1.2 The specifications and the drawings have been prepared by firm name, acting as Designer and named in the documents as the Architect or Engineer. This firm has responsibilities for defining the scope of work governed by their agreement with the *Owner*, the specifications and the drawings, and the General Conditions and Special Provisions of the contract.

ARTICLE 2 COMPLETION DATE

§ 2.1 The work to be performed under this contract shall be completed on or before date. For each calendar day the project remains uncompleted \$0.00 shall be charged as liquidated damages.

ARTICLE 3 CONTRACT SUM

§ 3.1 The *Owner* shall pay the *Contractor* for the performance of the contract, subject to additions and deductions provided by approved Change Orders in current funds as follows: amount in words dollars and 00cents, \$0.00

ARTICLE 4 CONTRACT BONDS

§ 4.1 Contract bonds are not required if the contract amount is less than \$125,000 unless bonds are specifically mandated by the contract documents.

§ 4.2 On this project, the *Contractor* shall furnish the *Owner* the appropriate contract bonds in the amount of 100% of the contract amount.

ARTICLE 5 PROGRESS PAYMENTS

§ 5.1 The *Owner* shall make payments on account of the contract as provided therein as follows: Each month 95% of the value, based on contract prices of labor and materials incorporated in the

work and of materials suitably stored at the site thereof up to the first day of that month, as certified by the Architect or Engineer.

§ 5.2 The *Owner* may cause the *Contractor* to be paid such portion of the amount retained hereunder as he deems advisable.

#### ARTICLE 6 FINAL PAYMENT

§ 6.1 Final payment shall be due 60 days after completion and acceptance of the work, provided the *Contractor* has submitted evidence satisfactory to the *Owner* that all payrolls, material bills and other indebtedness connected with the work has been paid.

#### ARTICLE 7 CONTRACT DOCUMENTS

§ 7.1 The General Conditions of the contract, Special Provisions, the written specifications and the drawings, and any Addenda, together with this agreement, form the contract; they are as fully a part of the contract as if hereto attached or herein repeated.

§ 7.2 Specifications: *date of issuance*

§ 7.3 Drawings: *each sheet number and title*

§ 7.4 Addenda: *each addenda number and date, or "none"*

#### ARTICLE 8 OTHER PROVISIONS

§ 8.1 *There are no other provisions.*

The *Owner* and the *Contractor* hereby agree to the full performance of the covenants herein.

IN WITNESS WHEREOF the parties hereby execute this agreement the day and year first above written.

OWNER

CONTRACTOR

\_\_\_\_\_  
(Signature) (Date)

\_\_\_\_\_  
(Signature) (Date)

\_\_\_\_\_  
(Printed name and title)

\_\_\_\_\_  
(Printed name and title)

\_\_\_\_\_  
(School Administrative Unit name)

\_\_\_\_\_  
(Contractor company name)

DEPARTMENT OF EDUCATION	
Contract Reviewed by:	Contract Approved by:
_____ (Signature) (Date)	_____ (Signature) (Date)
School Construction Coordinator	Planning, Design & Construction Division

**00 61 13.13**  
**Contractor Performance Bond**

Bond No.: insert bond number

We, the undersigned, insert company name of Contractor, select type of entity of insert name of municipality in the State of insert name of state as principal, and insert name of surety as Surety, are hereby held and firmly bound unto select title of obligee in the penal sum of the Contract Price \$ insert the Contract Price in numbers for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The condition of the above obligation is such that if the principal shall promptly and faithfully perform the contract entered into this insert day, i.e.: 8th day of select month, select year, which is the same date as that of the construction contract, for the construction of insert name of project as designated in the contract documents, then this obligation shall be null and void.

Otherwise, the same shall remain in force and effect- it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received hereby stipulates and agrees that the obligation of said Surety and its bonds shall be in no way impaired or affected by any extension of the time which the Obligee may accept during the performance of the contract and said Surety does hereby waive notice of any such extension.



**00 61 13.13**  
**Contractor Performance Bond**

In witness whereof, the principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set above.

Signed and sealed this insert day, i.e.: 8th day of select month, select year, which is the same date as that of the construction contract.

**Contractor**

\_\_\_\_\_  
(Signature)

*insert name and title*

*insert company name*

*insert address*  
*insert city state zip code*

**Surety**

\_\_\_\_\_  
(Signature)

*insert name and title*

*insert company name*

*insert address*  
*insert city state zip code*

If Contractor is a partnership, all partners shall execute the bond. A power of attorney document indicating that it still is in full force and effect shall be provided by the person executing this bond.

**00 61 13.16**  
**Contractor Payment Bond**

Bond No.: insert bond number

We, the undersigned, insert company name of Contractor, select type of entity of insert name of municipality in the State of insert name of state as principal, and insert name of surety as Surety, are hereby held and firmly bound unto select title of obligee in the penal sum of the Contract Price \$ insert the Contract Price in numbers for the use and benefit of claimants, defined as an entity having a contract with the principal or with a subcontractor of the principal for labor, materials, or both labor and materials, used or reasonably required for use in the performance of the contract, for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The condition of the above obligation is such that if the principal shall promptly satisfy all claims and demands incurred for all labor and materials, used or required by the principal in connection with the work described in the contract entered into this insert day, i.e.: 8th day of select month, select year, which is the same date as that of the construction contract, for the construction of insert name of project as designated in the contract documents, and shall fully reimburse the obligee for all outlay and expense with said obligee may incur in making good any default of said principal, then this obligation shall be null and void.

Otherwise, the same shall remain in force and effect- it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received hereby stipulates and agrees that the obligation of said Surety and its bonds shall be in no way impaired or affected by any extension of the time which the Obligee may accept during the performance of the contract and said Surety does hereby waive notice of any such extension.

**00 61 13.16**  
**Contractor Payment Bond**

In witness whereof, the principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set above.

Signed and sealed this *insert day, i.e.: 8th* day of *select month, select year*, which is the same date as that of the construction contract.

**Contractor**

\_\_\_\_\_  
(Signature)

*insert name and title*

*insert company name*

*insert address*  
*insert city state zip code*

**Surety**

\_\_\_\_\_  
(Signature)

*insert name and title*

*insert company name*

*insert address*  
*insert city state zip code*

If Contractor is a partnership, all partners shall execute the bond. A power of attorney document indicating that it still is in full force and effect shall be provided by the person executing this bond.

EXHIBIT A

Section 2-F

PARTIAL LIEN WAIVER

\_\_\_\_\_, having furnished labor, services or materials in connection with the renovation, rehabilitation, repair and construction of buildings and other improvements upon property owned by Brunswick Elementary School in the Town of Brunswick, Maine, does hereby acknowledge that it has furnished or caused to be furnished labor, services and materials to said real estate, acknowledging that upon approval of Requisition No. \_\_\_\_\_ it will have received payment in full for all labor services and materials furnished through \_\_\_\_\_, 2020, hereby waives and releases all lien waivers and rights thereto which the undersigned may have for work, services and materials furnished to or at such real estate through that date, and states that the amount remaining on its subcontract for labor, services and materials to be performed after that date is \$\_\_\_\_\_.

Dated:

\_\_\_\_\_  
Print Name of Subcontractor or  
Materials Supplier Here

By: \_\_\_\_\_  
Its Duly Authorized Representative

\_\_\_\_\_, 2020

STATE OF MAINE

, SS.

Personally-appeared the above-named \_\_\_\_\_ and made oath that he/she is Duly authorized to execute this lien waiver on behalf of the above-named Subcontractor or Materials Supplier, and that his/her signature hereon represents his/her free act and deed and the free act and deed of the said Subcontractor or Materials Supplier.

\_\_\_\_\_  
Notary Public

Public School Projects  
Sec. 3-A

SECTION 3-A

STATE OF MAINE

STANDARD GENERAL CONDITIONS  
AND  
CONTRACT WORK

For

PUBLIC SCHOOL PROJECTS

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October 17, 1988

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## **ARTICLE 1. DEFINITIONS**

Whenever the following terms are used in these specifications or the contract, the intent and meaning shall be interpreted as follows:

**Designer:** The project Architect and/or Engineer whose name appears on the plans and/or specifications for the project, acting directly or through an authorized representative.

**Bid Security:** The security designated in the proposal, furnished by bidders as a guaranty of good faith to enter into a contract with the state, should a contract be awarded to that bidder.

**Bidder:** Any individual, partnership, or corporation submitting a proposal for the performance of the work described under the terms of the contract, acting directly or through a duly authorized representative.

**Bureau:** The Bureau of General Services.

**Calendar Days:** Consecutive days, as occurring on a calendar, taking into account the day of the week, month, year, and any religious, national or local holidays.

**Change Order:** A written agreement between the Owner and the Contractor, operating as a supplement to the contract, covering correction of: omissions, errors, and discrepancies between the plans and the proposal or estimates; or any alterations in the plans; or additional requirements; work, materials, and incidentals required to complete the construction of the project in an acceptable manner, and setting forth the basis of compensation for that supplemental work, if any. Before any change order modifies or becomes a part of the work, it must be duly signed by the Contractor, and the Owner, and approved by the Bureau of General Services and the Designer.

**Clerk of the Works:** The authorized representative of the Designer.

**Contract:** A written agreement between the Owner and the successful bidder, by which the Contractor is bound to perform the work specified, in accordance with plans, specifications, general conditions, and special provisions, that are a part of the contract documents, together with all supplemental agreements by which the Owner is bound to compensate the Contractor at mutually established and accepted rates or prices.

**Contract Bond:** The approved forms of security furnished by the Contractor and his surety, or sureties, which guarantee the faithful performance of all the terms of the contract and the payment of all bills, for labor, materials and equipment by the Contractor.



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Contract Documents: The contract documents consist of the contract, general conditions, special provisions, the plans and specifications including all addenda, change orders, and all other modifications thereof, that were incorporated in the documents subsequent to their execution.

Contractor: The individual, partnership, or corporation undertaking the execution of the general contract work under the terms of the contract with the Owner, acting directly or through a duly authorized representative.

Director of the Bureau of General Services: The State Director of the Bureau of General Services or his/her duly authorized representative.

Final Completion: The stage of the Work when the Work has been fully completed in accordance with the terms and conditions of the Contract Documents.

Owner: School Administrative Unit, acting through its duly authorized representative.

Plans: All official drawings or reproductions of drawings pertaining to the work provided for in the contract and such working plans as may be furnished or approved by the Owner or Designer from time to time.

Project: The entire improvement proposed by the Owner to be constructed in part or in whole pursuant to these specifications and contract documents. Where the word "Job" appears it shall mean the project.

Proposal or Bid: The written offer of the bidder, on a form prescribed to perform the work specified.

Provide: The word "provide" shall mean, "furnish and install," including connections to services if required, unless specified otherwise.

Sub-Contractor: The individual, the firm or corporation undertaking the execution of any part of the work under the terms of the contract by virtue of a written agreement between itself and the Contractor.

Substantial Completion: The stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use. Minor corrections and repairs that can be performed while the Owner has occupied the building and without undue annoyance to personnel will be acceptable under the definition of Substantial Completion. It shall also include major final cleaning required under the Contract, removal of all surplus equipment and material not required for completion of remaining work, and the placement of remaining materials and equipment in convenient locations as approved by the Owner.

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Superintendent: The representative of the Contractor, authorized by the Contractor to receive and fulfill instructions from the Designer.

Supplemental Agreement: A supplemental agreement is any agreement entered into between the Contractor and the Owner with the approval of the Bureau and the Designer subsequent to the execution of the contract.

Surety: The individual, partnership, or corporation who is bound jointly and severally with the Contractor and sub-Contractor to insure his faithful performance of the contract and for his payment of the bills for labor, materials and equipment by the Contractor and Sub-Contractors.

Work: See Project.

## **ARTICLE 2. INTENT, CORRELATION AND EXECUTION OF DOCUMENTS**

The intent of the Contract Documents is to prescribe a complete work or improvement. The Plans, including all revisions, General Conditions for Contract Work, Special Provisions, Instructions to Bidders, Proposal, Contract, Contract Bonds, and all other sections of the specifications, including all addenda, all dated and on file in the Bureau of General Services, prior to the time set for receiving proposals as prepared by the Designer, shall each become a part of the Contract Documents, and all proposals must be based on a full compliance therewith. Any Supplemental Agreements entered into subsequent to the Contract will become a part of said Contract.

The contract documents are complementary, and what is called for by any one shall be as binding as if called for by all. The intention of the documents is that, unless otherwise specified, the Contractor shall furnish all labor, materials, equipment, items, articles, tools, transportation, insurance, services, necessary supplies, operations or methods and incidentals that may be reasonably required to construct and complete the project, facility or improvement in a manner necessary for the proper execution of the work. Any deviations from the plans which may be required by the exigencies of the construction, or because of error, will in all cases, be determined by the Designer, and authorized in writing subject to approval by the Owner and Bureau of General Services. Materials or work described in words, which so applied, have a well-known technical or trade meaning shall be held to refer to such recognized standards. Since the plans and specifications cover the dimensions and features of the work and do not set forth the analysis of the design, it is the duty of the Contractor fulfilling them to ascertain the true intent in any case where it is doubtful.

Work not covered under any heading, section, branch, class or trade of the specifications, shall not be supplied unless it is shown on the drawings or is reasonably inferable there from as being necessary to produce the intended results.

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The Contractor shall take no advantage of any apparent error or omission in the plans and specifications, and the Designer shall be permitted to make such corrections and interpretations as may be deemed necessary for the fulfillment of the intent of the plans and specifications. Where errors or omissions appear in the contract documents, the Contractor shall promptly notify the Designer in writing of such errors or omissions. Inconsistencies in the contract documents are to be reported before proposals are received, whenever found.

Should the Drawings or the Specifications disagree in themselves or with each other, the Contractor shall provide the better quality or greater quantity of work and/or materials unless otherwise directed by written addendum to the Contract Documents.

The Contractor shall, upon his acceptance of a contract and before commencing work, contact the Designer and request a preconstruction conference. The purpose of this conference shall be as follows:

1. To introduce the members of the Designer's firm and the representative of the Owner and define their responsibilities in connection with this project.
2. To emphasize any special provisions applicable to the project.
3. To establish the work progress schedule and set up procedures for prompt review of all required shop drawings. If the Contract Sum exceeds \$ 10,000,000. the Contractor shall supply the Owner with the planned Critical Path Method ("CPM") schedule prior to the submission of the first payment requisition. The Contractor shall supply the Owner monthly with CPM "as built" schedule updates. The update shall include the dates of activities' start and completion; percent of work remaining for activities started but not completed; narrative report indicating a listing of monthly progress; any changes to critical path activities from the prior update; sources of delay and potential problems; and work planned for the next month. If any date is more than fifteen (15) days behind, the Contractor must submit a recovery schedule. When a Change Order is proposed, the Contractor must identify all schedule impacts which result from the Change Order.
4. To provide the Contractor with opportunity to discuss points of doubt and any apparent inconsistencies noted in the plans and specifications before proceeding to purchase material or execute the work.

During the further progress of work, regular meetings will be held at time intervals appropriate in the judgment of the Designer to review the work progress schedule, general project progress and any other questions, which might affect the execution of this contract.

### **ARTICLE 3: DETAIL DRAWINGS AND INSTRUCTIONS**

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The Designer shall furnish, with reasonable promptness, additional instructions by means of drawings or otherwise, that are necessary for the proper execution of the work. All such drawings and instruction shall be consistent with the contract documents, shall be true developments thereof, and shall be reasonably inferable there from.

The work shall be executed in conformity therewith and the Contractor shall do no work without proper drawings and instructions except as allowed by Article 13.

Immediately after being awarded the contract, the Contractor shall prepare an estimated progress schedule and submit same for Designer's approval. It shall indicate the dates for starting and completion of the various stages of construction.

**ARTICLE 4: COPIES FURNISHED**

Unless otherwise provided in the contract documents the Contractor will be furnished, free of charge, PDF files of all drawings, and specifications.

**ARTICLE 5: SHOP DRAWINGS**

The Contractor shall check and verify all field measurements and shall submit with such promptness as to cause no delay in the Contractor's own work or in that of any other Contractor, adequate copies, checked and approved by the Contractors of all shop drawings and schedules required for the work of the various trades. The Designer shall check and approve, with reasonable promptness, such scheduled drawings only for conformance with the design concept of the project and compliance with the information given in the contract documents. The Contractor shall make any corrections required by the Designer, and shall file with the Designer two corrected copies, and shall furnish such other copies as may be needed. The Designer's approval of such drawings or schedules shall not relieve the Contractor from responsibility for deviations from drawings or specifications, unless the Contractor has, in writing, called the Designer's attention to such deviations at the time of submission and secured the Designer's written approval; nor shall it relieve the Contractor from responsibility for errors in shop drawings or schedules.

**ARTICLE 6: DRAWINGS AND SPECIFICATIONS**

The Contractor shall keep, in good order, one copy of all drawings and specifications on the work, which will be made available to the Designer and to his representative.

**ARTICLE 7: OWNERSHIP OF DRAWINGS**

All drawings, specifications and copies thereof furnished by the Designer are the property of the Designer. They are not to be used on other work without written

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permission from the Designer, and, with the exception of the signed contract set, are to be returned to the Designer upon request, or at the completion of the work.

#### **ARTICLE 8: SAMPLES**

The Contractor shall furnish for review, with reasonable promptness, all samples as directed by the Designer. The Designer shall check and review such samples, with reasonable promptness, only for conformance with the design concept of the project and for compliance with the project and for compliance with the information given in the contract documents. The work shall be in accordance with reviewed samples.

#### **ARTICLE 9: MATERIALS, APPLIANCE, EMPLOYEES**

Unless otherwise stipulated, the Contractor shall provide and pay for all materials, labor, water, tools, equipment, light, power, transportation and facilities necessary for the execution and completion of the work.

Whenever an article or material is defined by describing a proprietary product, or by using the name of a manufacturer, the term "Or Approved Equal", if not inserted, shall be implied. The specific article or material mentioned shall be understood to establish minimum standards as to the type, function, standard of design, durability, efficiency and quality desired and shall not be construed to exclude other manufacturers' products of comparable quality, design and efficiency.

Materials and models of items, which the Contractor alleges to be equal to the materials and methods of items named in the specifications, shall be subject to the written approval by the Designer. If the alleged equals are to receive consideration in the bid award, written approval shall be received from the Designer at least ten days prior to the established bid opening dates. The use of alternate items will not be permitted without the approval of the Owner and Designer. All approved substitutions shall be in writing and approved by the Designer. The Contractor shall not be relieved of the responsibility to furnish articles or materials equal in quality, design and efficiency to those specified because of the approval of such alternate items by the Designer. The Designer's approval or rejection of a proposed substitution may be based on any of the previous considerations, and his decision may or may not express reasons for rejection and shall be final. Requests for substitutions shall originate and be submitted by the Contractor, not a Sub-Contractor. The materials or equipment shall be sufficiently described to enable the Designer to easily identify salient features.

Any material or products not specified in the bidding documents but being worthy of consideration may be introduced by the Contractor, or Sub-Contractor. The Contractor's submission shall include a cost comparison with the specified material and the reason for the suggested substitution. The basic proposal shall be as specified.

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It shall be understood by the general Contractor or Sub-Contractor that the attached letter describing the proposed changes will not be used in determining the low general Contractor or Sub-Contractor proposal submitted, unless the general Contractor or Sub-Contractor has submitted its list to the Designer 10 days prior to the date set for the receipt of their respective proposals and has received written approval by the Designer five days prior to the opening of the bid.

The Contractor shall guarantee his work against any defects in workmanship and materials for a period of one year from the date of the written acceptance of the project.

Materials and equipment shall be new, free from defects, perfect and complete, unless otherwise stipulated. Materials or equipment specified or shown on the drawings shall be applied or installed according to the directions with the manufacturer, or the recommendations of an association dealing primarily with the material, unless specifically designated otherwise. The scope of the direction furnished shall include the application of experienced personnel to each trade involved. In no case shall the installation be below the standard recommended by the manufacturer or association.

The Contractor shall be responsible to the Owner for the suitability of materials and equipment furnished and for full compliance with the specification.

The Contractor shall promptly pay all his employees when their pay is due, shall promptly pay when due all bills for materials, supplies and services going into the work, and all bills for insurance, workmen's compensation coverage, federal and state unemployment compensation, and Social Security charges applicable to said project. Before final settlement is made, the Contractor shall furnish to the Owner affidavits that all said payments have been made.

The Contractor shall at all times enforce strict discipline and good order among his employees, and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him.

#### **ARTICLE 10: ROYALTIES AND PATENTS**

The Contractor shall, for all time, secure to the Owner the free and undisputed right to the use of any and all patented articles or methods used in the work and shall defend at his own expense any and all suits for infringement or alleged infringement of such patents, and in the event of adverse award under patent suits, the Contractor shall pay such awards and hold the Owner harmless in connection with any patent suits that may arise as a result of installations made by the Contractor, or to any awards made thereunder.

#### **ARTICLE 11: SURVEYS, PERMITS, LAWS, TAXES AND REGULATIONS**

The Owner shall furnish all surveys unless otherwise specified.

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Permits and licenses necessary for the prosecution of the work shall be secured by the Contractor. Fees associated with the permits shall be paid directly by the Owner. The Contractor is responsible for fees associated with temporary structures and temporary signage. Easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the Owner, unless otherwise specified.

The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified. If the Contractor observes that the drawings and specifications are at variance therewith, the Contractor shall promptly notify the Designer in writing and any necessary changes shall be adjusted as provided in the contract for changes in the work. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations and without such notice to the Designer, the Contractor shall bear all costs arising there from.

Adherence to the Code of Federal Regulations 29 CFR Part 1926 and 29 CFR Part 1910 as adopted by the State Board of Occupational Safety and Health is required by statute.

The State is exempt from the payment of Federal Excise Taxes on articles not for resale and for the Federal Transportation Tax on all shipments. All quotes from the Contractor and Sub-Contractors shall be free of these taxes. The State is exempt from the payment of Maine State Sales and Use Taxes. All quotes from the Contractor and Sub-Contractors shall be free of these taxes.

In execution and performance of the Contract, the Contractor and all subcontractors agree to be aware of and to comply with the requirements and regulations of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et. seq.)

#### **ARTICLE 12: LABOR AND WAGES**

All Contractors and Sub-Contractors shall conform to the labor laws of the State of Maine, and all other laws, ordinances and legal requirements affecting the Work in Maine.

In the employment of laborers, preference shall first be given to residents of the State of Maine who are qualified to perform the work to which the employment relates, and if they cannot be obtained in sufficient numbers, then to citizens of the United States, who may reside in other states.

#### **ARTICLE 13: CONDITIONS AND CARE OF SITE AND PROTECTION OF THE WORK**

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The Contractor shall continuously maintain adequate protection of all work from damage and shall protect the property from injury or loss for the duration of this contract, and shall make good any such damage, injury or loss. He shall adequately protect adjacent property as provided by law and the contract documents.

The Contractor shall take all necessary precautions for the safety of employees on the work, and shall comply with all applicable provisions of federal, state and municipal safety laws and building codes, and shall prevent accidents or injury to persons on, about or adjacent to the premises where the work is being performed. The Contractor shall erect and properly maintain all necessary safeguards for the protection of workmen and the public at all times, as required by the condition and progress of the work, and shall post danger signs warning against all hazards created by the construction process, such as (but not limited to) protruding nails, hoists, well holes, elevator hatchways, scaffolding, window openings, stairways and falling materials. The Contractor shall designate a responsible member of his organization on the work, whose duty shall be the prevention of accidents. The Contractor shall report the name and position of any person so designated to the Designer.

The Contractor shall return to conditions existing prior to the start of work on the project, all aspects of the site that have not been altered, removed, or otherwise changed permanently by the work. The Contractor shall protect all existing buildings, structures, or other features from damage by any operation in connection with the project. Utilities encountered shall be protected and maintained in service until removed or abandoned. The Contractor shall exercise care in his work around such utilities as may be shown on the plot plan or otherwise found. Such utilities are not to be moved, replaced or abandoned.

The Contractor shall protect existing trees, and other aspects of the site, which will remain a permanent part of the site from damage during grading, excavation, filling, trucking, etc. If necessary, tree trunks shall be boxed, and barricades set up at sufficient distance to prevent damage to major tree branches.

Should the work or material of this or any other Contractor employed by the Owner become damaged when reasonably protected, the same shall be replaced by the Contractor causing the damage at no expense to the Owner.

In an emergency potentially affecting health or life or of serious damage to property or of adjoining property, the Contractor, without special instruction or authorization from the Designer or Owner, is hereby permitted to act on his own discretion, to prevent such threatened loss or injury, and the Contractor shall so act, without appeal, if so authorized or instructed. Any compensation claimed by the Contractor on account of emergency work, shall be determined by agreement.

### **ARTICLE 14: INSPECTION OF WORK**



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The Designer and his representatives, the Bureau of General Services representatives and the Owner, shall at all times have access to the work whenever it is in preparation or progress. The Contractor shall provide proper facilities for such access and for inspection.

If the specifications, the Designer's instructions, laws, ordinances or any public authority require any work to be specially tested or approved, the Contractor shall give the Designer timely notice of its readiness for observation by the Designer or inspection by another authority, and if the inspection is by another authority than the Designer, on the date fixed for such inspection, required certificates of inspection shall be secured by the Contractor. Observations by the Designer shall be promptly made, and where practicable, prior to work is covered or buried. If any work which will ultimately be covered, is covered prior to approval or consent of the Designer, it must, if requested by the Designer, be uncovered for examination at the Contractor's expense.

Reexamination of questioned work may be ordered by the Designer, and, if so ordered, the work must be uncovered by the Contractor. If such work were found in accordance with the contract documents, the Owner shall pay the cost of the reexamination and replacement. If such work were found not in accordance with the contract documents, the Contractor shall pay such cost, unless it is found that the defect in the work was caused by a Contractor employed as provided in Article 32, and in that event the Owner shall pay such cost.

The Bureau of General Services, through its representatives shall make periodic inspections of the work during the course of construction and make recommendations to the Designer, when employed. The Designer shall provide adequate inspection of materials, equipment, methods and changes in plans on all projects under his supervision.

### **ARTICLE 15: SUPERINTENDENCE: SUPERVISION**

The Contractor shall have, during the progress of all work, a competent superintendent and any necessary assistants. The superintendent shall not be changed except with the consent of the Owner unless a superintendent proves to be unsatisfactory to the Contractor and ceases to be in his employ. The superintendent shall represent the Contractor and all directions given to the superintendent in the absence of the Contractor shall be as binding as if given directly to the Contractor. Important directions shall be confirmed in writing to the Contractor. Other directions shall be confirmed on written request in each case. The Designer shall not be responsible for the acts or omissions of the superintendent or his assistants.

The Contractor shall give efficient supervision to the work using his best skill and attention. He shall carefully study and compare all drawings, specifications and other instructions and shall at once report to the Designer any error, inconsistency or omission which he may discover, but he shall not be liable to the Owner for any damage resulting

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from any errors or deficiencies in the contract documents or other instructions by the Designer.

**ARTICLE 16: CHANGES IN THE WORK**

The Owner reserves the right to increase or decrease any or all of the items of work indicated in the plans, proposal, and contract, or the elimination of any one or more of such items, without invalidating the contract. As the work progresses, the Owner may make such alterations in the plans, in the character of the work, or in the specified coordination of two or more concurrent contracts, as may be considered necessary or desirable in order to complete the construction. Such changes shall in no way invalidate the contract. All such work shall be executed under the conditions of the original contract except that any claim for extension of the time caused thereby shall be adjusted at the time of the ordering of such change.

In giving instructions, the Designer shall have authority to make minor changes in the work, not involving extra cost, and not inconsistent with the purposes of the building or project, but otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless in pursuance of a duly signed change order.

Should the Contractor encounter during the progress of the work, latent conditions at the site materially differing from those shown on the drawings or in the specifications, or unknown conditions of an unusual nature differing materially from those already encountered in such work, the attention of the Designer shall be immediately called for such conditions before they are disturbed. The Designer shall promptly investigate the conditions and if they do so materially differ, the contract shall, with the approval of the Owner and the Bureau be modified by a change order to provide for any increase or decrease in cost resulting from such conditions.

Should such alterations be productive of increased unit cost, or result in decreased unit cost to the Contractor, a fair and equitable sum therefore shall be agreed upon in writing before such work is begun, and shall be added to or deducted from the contract amount, as the case may be, by means of a written change order. The change order shall state the nature of the change, the location, the itemized estimate of unit quantities, the basis for payment, and the reason for the change. Such change order to be on approved forms.

When the change order has been properly signed by all parties and encumbered, it shall become a part of the contract.

The value of any such extra work or change shall be determined in one or more of the following ways:

- A. By estimate and acceptance in a lump sum.

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B. By unit prices named in the contract or subsequently agreed upon.

C. By cost and percentage or by cost and a fixed fee.

If none of the above methods is agreed upon, the Contractor, provided he receives an order as above, shall proceed with the work.

Under case (C.), he shall keep and present in such form as the Designer may direct, a correct account of the cost, together with vouchers. In any case, the Designer shall certify to the amount, including reasonable allowance for overhead and profit, due to the Contractor. Pending final determination of value, payments on account of changes shall be made on the Designer's certificate.

If the price of a change order cannot be agreed upon, nothing contained herein shall prevent the Designer, with approval from the Owner and BGS, from directing the Contractor to make a change in the work, with the price to be determined on either a cost and percentage basis or under the dispute resolution provision of this contract.

If the price of a change order cannot be agreed upon, an Owner and/or Designer initiated Construction Change Directive can order a change in the work prior to an agreement on the adjusted Contract Sum or Contract Time. The Cost of the work is to be determined by: 1) a cost and percentage basis 2) lump sum 3) unit prices or 4) under the Dispute Resolution provision of this contract.

When the subparagraphs (A) and (C) above are used to determine the value of the work, the allowance for overhead and profit combined, included in the total expense to the Owner, shall be based upon the following schedule:

For the Contractor, for any work performed by his own forces, 20% of the cost;  
For each Sub-Contractor, for work performed by his own forces, 20% of the cost;  
For the Contractor, for work performed by his Sub-Contractor, 10% of the amount due the Sub-Contractor.

Cost shall be limited to the following: Cost of materials, cost of delivery, cost of labor, including Social Security, old age and unemployment insurance (labor cost may include a pro ratio share of foremen's time, only in case an extension of contract time is granted on account of the change); workmen's compensation insurance; rental value of power tools and equipment.

Overhead shall include the following: bond premium, supervision, wages of timekeepers, watchmen and clerks, small tools, incidental, general office expense, and all other expenses not included in "cost".

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If the net value of a change results in a credit from the Contractor or Sub-Contractor the credit given shall be the net cost without overhead or profit. The cost as used herein shall include all items of labor, materials and equipment.

#### **ARTICLE 17: CLAIMS FOR EXTRA COST**

If the Contractor claims that any instructions by drawings or otherwise involve extra cost under this contract, he shall give the Designer written notice thereof within 10 days after the receipt of such instructions, and in any event before proceeding to execute the work, except in emergency endangering life or property, and the procedure shall then be as provided for in Section 16, "changes in work." No such claim shall be valid unless so made.

#### **ARTICLE 18: DEDUCTIONS FOR UNCORRECTED WORK**

If the Designer and Owner deem it inexpedient to correct work injured or done not in accordance with the contract, an equitable deduction from the contract amount shall be made therefore.

#### **ARTICLE 19: DELAYS AND EXTENSION OF TIME**

If the Contractor is delayed at any time in the progress of the work by any act or neglect of the Owner or the Designer, or of any employee of either, or by any separate Contractor employed by the Owner, or by changes ordered in the work or by strikes, lockouts, fire, unusual delay in transportation, unavoidable casualties Or by causes beyond the Contractor's control, or by any cause which the Designer shall decide to justify the delay, then the time of completion shall be extended for such reasonable time as the Designer may decide. Inclement weather or other natural causes shall not be reason to allow additional time under this contract.

No such extension shall be made for delay occurring more than seven days before claim therefore is made in writing to the Designer. In case of a continuing cause of delay, only one claim is necessary.

If no schedule or agreement stating the dates upon which drawings shall be furnished is made, then no claim for delay shall be allowed on account of failure to furnish drawings until two weeks after demand for such drawings and not then unless such claim be reasonable.

This article does not exclude the recovery of damages for delay by either party under other provisions in the contract document. The amount of Contractor's delay damages shall be limited to the Costs, overhead and profit items enumerated in Article 16. Recovery of delay damages is conditioned upon compliance with the notice requirements of Article 17.

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**ARTICLE 20: CORRECTION OF WORK**

The Contractor shall promptly remove from the premises all work condemned by the Designer as failing to conform to the contract, whether incorporated or not, and the Contractor shall promptly replace and re-execute his own work in accordance with the contract and without expense to the Owner and shall bear the expense of making good all work of other Contractors destroyed or damaged by such removal or replacement.

If the Contractor does not remove such condemned work within a reasonable time, fixed by written notice, the Owner may remove it and may store the material at the expense of the Contractor. If the Contractor does not pay the expenses of such removal within ten days time, thereafter, the Owner may, upon ten days written notice, sell such materials at auction or at private sale and shall account for the net proceeds thereof, after deducting all the costs and expenses that should have been borne by the Contractor.

The Contractor shall remedy any defects due to faulty materials or workmanship and pay for any damage to other work resulting therefrom, which shall appear within a period of one year from the date of final payment, or from the date of the Owner's substantial usage or occupancy of the project, whichever is earlier, and in accordance with the terms of any special guarantees provided in the contract. The Owner shall give notice of observed defects with reasonable promptness. All questions arising under this article will be decided by the Designer, notwithstanding final payment.

**ARTICLE 21: OWNER'S RIGHT TO DO WORK**

If the Contractor should neglect to prosecute the work properly or fail to perform any provisions of this contract, the Owner, after three days written notice to the Contractor may, without prejudice to any other remedy may make good such deficiencies and may deduct the cost thereof from the payment; then or thereafter due the Contractor, provided, however, that the Designer shall approve both such action and the amount charged to the Contractor.

**ARTICLE 22: OWNER'S RIGHT TO TERMINATE CONTRACT**

If the Contractor should be adjudged bankrupt, or if the Contractor should make a general assignment for the benefit of it's creditors, or if a receiver should be appointed on of account the Contractor's insolvency, or if the Contractor should persistently or repeatedly refuse or should fail, except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper materials or if the Contractor should fail to make prompt payment to Sub-Contractors or for material, or labor, or persistently disregard laws, ordinance or the instructions of the Designer, or otherwise be guilty of a substantial violation of any provision of the contract, then the Owner, upon the certificate of the Designer that sufficient cause exists to justify such action, may without prejudice to any other right or remedy and after giving the Contractor and the Contractor's surety seven days written notice, terminate the employment of the

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Contractor and take possession of the premises and of all materials, tools and appliances thereon and finish the work by whatever method the Owner may deem expedient. In such case the Contractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the contract amount shall exceed the expense of finishing the work including compensation for additional Designer, managerial and administrative services, such excess shall be paid to the Contractor. If such expense shall exceed such unpaid balance, the Contractor shall pay the difference to the Owner. The expense incurred through the Contractor's default, shall be certified by the Designer.

#### **ARTICLE 23: THE CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE CONTRACT**

If the work should be stopped under an order of any court, or other public authority, for a period of thirty days, through no act or fault of the Contractor or of anyone employed by him, then the Contractor, may, upon seven days written notice to the Owner and the Designer, terminate this contract and recover from the Owner, payment for all work executed and any proven loss sustained upon any plant or materials and reasonable profit and damage.

Should the Designer fail to issue any certificate for payment, through no fault of the Contractor, within seven days after the Contractor's formal request for payment or if the Owner should fail to pay to the Contractor within 30 days after presentation, any sum certified by the Designer, then the Contractor may, upon seven days' written notice to the Owner and the Designer, stop the work or terminate this Contractor as set out in the preceding paragraph.

#### **ARTICLE 24: PAYMENTS**

The Contractor shall, before the first application for payment, submit to the Designer in triplicate a "contract cost breakdown" form acceptable to the Designer, if required, this form shall be supported by such evidence as to its correctness as the Designer may direct and, shall be reviewed by the Designer and unless found to be in error, used as a basis for payments.

The Contractor shall submit to the Designer an application for each payment on the latest revision of the BGS "Requisition for payment" form, and, if required, receipts or other vouchers, showing his payments of materials and labor, including payments to sub-Contractors as required by Article 34.

Application for payment as the Work progresses may be made of the Owner but no more often than once a month, unless due to unusual circumstance the Owner may approve more frequent payment. Said requisition for payments shall be based on the proportionate quantities of the various classes of work completed or incorporated in the Work less retainage, in accordance with the Work progress schedule and the value thereof determined from the contract cost breakdown. Payments, upon authorization of

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the Designer, may be made on account of materials not incorporated in the Work but delivered and suitably stored at the site. Such payments shall be conditioned upon submission by the Contractor of bills of sale, or such other procedure as will adequately protect the Owner's interest including applicable insurance.

In the event any materials are delivered but not yet incorporated in the Work, have been included in any said "Requisition for Payment" and payment thereon made and said materials thereafter deteriorate, become damaged or destroyed or for any reason whatsoever become unsuitable or unavailable for use in the Work, then the full amount allowed therefore in any previous "Requisition for Payment", shall be deducted from the gross value of any subsequent payment or final payment unless the Contractor shall satisfactorily replace said material.

After said "Requisition for Payment" has been prepared by the Contractor in the required number of copies, it shall be submitted to the Designer for review. The Designer shall verify and approve the "Requisition for Payment", and forward all copies to the Owner for processing for payment by the Owner.

No certificate issued nor payment made to the Contractor, nor partial or entire use or occupancy of the Work by the Owner, shall be an acceptance of any Work or materials not in accordance with this contract. Except for those claims previously made by either party and still unsettled, the making and acceptance of the final payment shall constitute a waiver of all claims by the Owner, other than those arising from unsettled liens, those not complying with the requirements of the plans and specifications, those covered by warranties, and of all claims by the Contractor.

Title 5 M.R.S.A. Section 1746 as amended provides that in any contract awarded for any public improvement, the State shall withhold 5% of the money due the Contractor until the project under the contract has been accepted by or for the State, except that when the contract has been *substantially completed* the State may, upon request, further reduce the amounts withheld if it deems it desirable and prudent, or except when the Contractor elects to deposit with the Treasurer of the State certain Government Bonds as provided in Chapter 437, Public Laws of 1967.

With each monthly requisition the Contractor shall release and indemnify the owner from and against all liens on the project through the requisition date and shall supply partial lien waivers from all subcontractors through the date of the prior requisition.

All payments to be made in accordance with Title 10 MRSA Chapter 201-A "An Act to Ensure Prompt and Equitable Payment for Construction Services".

### **ARTICLE 25. PAYMENTS WITHHELD**

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The Designer may withhold or, on account of subsequently discovered evidence, nullify the whole or a part of any certificate to such extent as may be necessary in his reasonable opinion to protect the Owner from loss on account of:

- A. Defective work not remedied.
- B. Claims filed or reasonable evidence indicating probable filing of claims.
- C. Failure of the Contractor to make payments properly to Sub-Contractors for materials or labor.
- D. A reasonable doubt that the contract can be completed for the balance then unpaid.
- E. Damage to another Contractor.
- F. Damage to the premises or Work.
- G. Failure to carry out the Work in accordance with the Contract Documents.

When the above grounds are removed, payments shall be made for amounts withheld because of them.

#### **ARTICLE 26. CONTRACTOR'S INSURANCE REQUIREMENTS**

The Contractor shall not commence work under this contract until the Contractor has obtained all insurance required under this article and such insurance has been approved by the Owner, nor shall the Contractor allow any Sub-Contractor to commence work on a subcontract until all similar insurance required of the Sub-Contractor has been so obtained and approved.

The State and the Owner does not warrant or represent that the insurance required under this paragraph constitutes an insurance portfolio which adequately addresses all risks faced by the Contractor or its Sub-Contractors. The Contractor and Sub-Contractors of every tier shall satisfy themselves as to the existence, extent and adequacy of insurance prior to commencement of work.

The Contractor and any Sub-Contractor shall procure and maintain for the duration of the Project insurance of the types and limits set forth under this paragraph and such insurance as will protect themselves from claims which may arise out of or result from the Contractor's or Sub-Contractor's execution of the work, whether such execution be by themselves or by anyone directly or indirectly employed by any of them or by anyone for whose acts any of them may be liable. The insurance coverage provided by the Contractor and any Sub-Contractor will be primary coverage. All required insurance coverages shall be placed with carriers authorized to conduct business in the State of Maine by the Maine Bureau of Insurance.

- A. Workers' Compensation Insurance



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Worker's compensation insurance for all employees on site in accordance with the statutory workers' compensation law of the State of Maine.

Minimum acceptable limits for Employer's Liability are:

Bodily Injury By Accident	\$500,000
Bodily Injury by Disease	\$500,000 Each Employee
Bodily Injury by Disease	\$500,000 Policy Limit.

#### B. Liability Insurance

##### 1. General Liability Insurance

General liability insurance shall be on a form providing coverage not less than that of the 1996 occurrence version of the Insurance Services Office (ISO) Commercial General Liability Policy. This insurance shall cover bodily injury and property damage liability for all hazards of the Project including premise and operations, products and completed operations, contractual, and personal injury liabilities. It shall include collapse and underground coverage - as well as explosion coverage if explosion hazards exist. Aggregate limits shall apply on a per location or project basis.

Minimum acceptable limits are:

General aggregate limit:	\$2,000,000
Products and completed operations aggregate:	\$1,000,000
Each occurrence limit:	\$1,000,000
Personal injury aggregate:	\$1,000,000

##### 2. Automobile Liability Insurance

Automobile liability insurance against claims for bodily injury, death or property damage resulting from the maintenance, Ownership or use of all owned, nonowned and hired automobiles, trucks and trailers.

Minimum acceptable limit is \$1,000,000 any one accident or loss.

##### 3. Owners Protective Liability

For Contracts exceeding \$50,000 in total Contract amount, Contractor shall secure an Owners Protective Liability policy naming the Owner as the Named Insured.

Minimum acceptable limits are:

General aggregate limit:	\$2,000,000
Each occurrence limit:	\$1,000,000

##### 4. Pollution Liability

In the event that any disruption, handling, abatement, remediation, encapsulation, removal, transport, or disposal of contaminated or hazardous material is required, the Contractor or its Sub-Contractor shall secure a pollution liability policy in addition to any

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other coverages contained in this section. The insurance shall be provided on an occurrence based policy and shall remain in effect for the duration of the Project.

Minimum acceptable limit is \$1,000,000 per occurrence.

#### C. Property Insurance

Unless otherwise waived in writing by the Owner, the Contractor shall procure and maintain Builder's Risk insurance naming the Owner, Contractor and any Sub-Contractor as insureds as their interest may appear. Covered causes of loss form shall be all Risks of Direct Physical Loss, endorsed to include flood, earthquake, transit and sprinkler leakage where sprinkler coverage is applicable. Unless specifically authorized in writing by the Owner, the limit of insurance shall not be less than the initial contract amount and coverage shall apply during the entire contract period and until the work is accepted by the Owner.

#### D. Certificates of Insurance

Four original copies of all certificates of insurance in a form and issued by companies acceptable to the Owner shall be provided to the Designer prior to commencement of work. The certificates shall name the Owner as certificate holder and shall contain a provision that coverage afforded under the insurance policies will not be canceled or materially changed unless at least thirty (30) days prior written notice by registered letter has been given to the Owner.

### **ARTICLE 27: CONTRACT BONDS**

The Contractor shall furnish to the Owner and State upon execution of the contract, a contract performance bond and a contract payment bond; each for the full amount of the contract and issued by a surety company or surety companies authorized to do business in the State of Maine as approved by the Owner and State. The bonds shall be in accordance with and executed on the forms furnished in the specifications. The bonds shall allow for any addition or deductions to the contract.

The contract bonds shall continue in effect for the applicable periods limiting actions as provided by, as applicable, 14 MRSA Section 871 or Section 752 to protect the Owner's interest and to assure settlement of claims for the payment of all bills for labor, materials, and equipment by the Contractor.

The Contractor shall submit to the Bureau of General Services through the Designer, copies of the Contract Performance Bond and Contract Payment Bond for each of the Filed Sub-Bid Subcontractors that were required to submit Bid Bonds.

### **ARTICLE 28: DAMAGES**

1. The Contractor shall indemnify and hold harmless the Owner and the Designer and their agents and employees from and against all claims, damages, losses, and

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expenses including attorneys' fees arising out of or resulting from the performance of the work, provided that any such claim, damage, loss, or expense (a) is attributable to bodily injury sickness, disease or death, or injury to or destruction to tangible property (other than the work itself) including the loss of use resulting therefrom, and (b) is caused in whole or in part by a negligent act or omission of the Contractor, any Sub-Contractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

2. In any and all claims against the Owner or the Designer or any of their agents or employees, by any employee of the Contractor, any Sub-Contractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation under paragraph 1 shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the Contractor or any Sub-Contractor under Workmen's Compensation Acts, disability benefit acts, or other employee benefit acts.

3. The obligations of the Contractor under paragraph 1 shall not exceed the liability of the Designer, the Designer's agents or employees arising out of:

(a) The preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications; or

(b) The giving of or the failure to give directions or instructions by the Designer, the Contractor, agents or employees provided such giving or failure to give is the primary cause of the injury or damage.

### **ARTICLE 29: LIENS**

Neither the final payment nor any part of the retained percentage shall become due until the Contractor, shall deliver to the Owner a complete release of all liens arising out of this contract, or receipts in full in lieu thereof, and, an affidavit that so far as the Contractor has knowledge or information the releases and receipts include all the labor and material for which a lien could be filed; but the Contractor, may if any Sub-Contractor refuses to furnish a release or receipt in full, furnish a bond satisfactory to the Owner, to indemnify him against any lien. If any lien remains unsatisfied after all the payments are made, the Contractor shall refund to the Owner all moneys that the latter may be compelled to pay in discharging such lien, including all cost and reasonable attorney's fee.

### **ARTICLE 30: ASSIGNMENT**

Neither party to the contract shall assign the Contractor or sublet it as a whole without the written consent of the other, nor shall the Contractor assign any money due or to become due to him hereunder, without the previous written consent of the Owner.

**ARTICLE 31: MUTUAL RESPONSIBILITY OF CONTRACTORS**

Should the Contractor cause damage to any separate Contractor on the work, the Contractor agrees, upon due notice, to settle with such Contractor by agreement or arbitration, if he will so settle. If such separate Contractor sues the Owner or Designer on account of any damage alleged to have been so sustained, the Owner or Designer shall notify the Contractor, who shall defend such proceedings at the Contractor's expense and if any judgment against the Owner or Designer arises therefrom, the Contractor shall pay or satisfy it and pay all costs incurred by the Owner or Designer.

**ARTICLE 32: SEPARATE CONTRACTS**

The Owner reserves the right to let other contracts in connection with this work under similar general conditions. The Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work, and shall properly connect and coordinate his work with theirs.

If any part of the Contractor's work depends on proper execution or results upon the work of any other Contractor, the Contractor shall inspect and promptly report to the Designer any defects in such work that render it unsuitable for such proper execution and results. The Contractor's failure so to inspect and report shall constitute an acceptance of the other Contractor's work as fit and proper for the reception of his work, except as to defects which may develop in Contractor's work after the execution of the Contractor's work.

To insure the proper execution of the Contractor's subsequent work the Contractor shall measure work already in place and shall at once report to the Designer any discrepancy between the executed work and the drawings.

**ARTICLE 33: SUBCONTRACTS**

The Contractor shall not sublet any part of this contract without the written permission of the Owner.

The Contractor shall submit in writing to the Designer for approval a complete list of the names of all particular items of work he proposes to furnish and the names of the Sub-Contractors to whom the Contractor proposes to sublet work. The Sub-Contractors named shall be reputable firms of recognized standings with a record of satisfactory work. The Contractor shall not employ any Sub-Contractor or use any material that requires approval by any Specification Section until they have been approved, or where there is reason to believe the work will not be accomplished in accordance with the

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contract documents. The complete list of Sub-Contractors and materials must be submitted for approval to the Designer and Owner.

The Designer shall, on request, furnish to any Sub-Contractor, wherever practicable, evidence of the amounts certified on his account.

The Contractor agrees that he is as fully responsible to the Owner for the acts and omissions of his Sub-Contractor and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

Nothing contained in the contract documents shall create any contractual relation between any Sub-Contractor and the Owner.

**ARTICLE 34: RELATIONS OF CONTRACTOR AND SUB-CONTRACTOR**

The Contractor agrees to bind every Sub-Contractor and every Sub-Contractor agrees to be bound by the terms of the contract documents, as far as they are applicable to his work, including the following provisions of this article, unless specifically noted to the contrary in a subcontract approved in writing as adequate by the Owner or Designer.

The Sub-Contractor agrees:

A. To be bound to the Contractor by the terms of the contract documents, and to assume toward the Contractor all the obligations and responsibilities that the Contractor, by those documents, assumes toward the Owner.

B. To submit to the Contractor applications for payment in such reasonable time as to enable the Contractor to apply for payment as specified.

C. To make all claims for extras, for extensions of time and for damages for delays or otherwise, to the Contractor in the manner provided in the general conditions for like claims by the Contractor upon the Owner, except that the time for making claims for extra cost is one week.

The Contractor agrees:

D. To be bound to the Sub-Contractor by all the obligations that the Owner assumes to the Contractor under the contract documents, and by all the provisions thereof affirming remedies and redress to the Contractor from the Owner.

E. To pay the Sub-Contractor, upon the payment of certificates, the amount allowed to the Contractor on account of the Sub-Contractor's work to the extent of the Sub-Contractor's interest therein.

F. To pay the Sub-Contractor, upon the payment of certificates, if issued otherwise as in section E above, so that at all times the Sub-Contractor's total

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payments shall be as large in proportion to the value of the work done by the Sub-Contractor.

G. To pay the Sub-Contractor to such extent as may be provided by the contract Documents or the subcontract, if either of these provide for earlier or larger payments than the above.

H. To pay the Sub-Contractor on demand for subcontract work or materials as far as executed and fixed in place, less the retained percentage, at the time the certificate should issue, even though the Designer fails to issue it for any cause not the fault of the Sub-Contractor.

I. To make no demand for liquidated damages or penalty for delay in any sum in excess of such amount as may be specifically named in the subcontract.

J. That no claim for services rendered or materials furnished by the Contractor to the Sub-Contractor shall be valid unless written notice thereof is given by the Contractor to the Sub-Contractor during the first ten days of the calendar month following that in which the claim originated.

K. To give the Sub-Contractor an opportunity to present and to submit evidence in any progress conference or disputes involving subcontract work.

L. To pay the Sub-Contractor a just share of any fire insurance money received by him, the Contractor, under Article 26 of the General Conditions.

### **ARTICLE 35: DESIGNER'S STATUS**

The Designer shall be the Owner's representative during the construction period and he shall observe the work in progress on behalf of the Owner. He shall have authority to act on behalf of the Owner only to the extent expressly provided in the contract documents or otherwise in writing, which shall be shown to the Contractor. He shall have authority to stop the work whenever such stoppage may be necessary in his reasonable opinion to insure the proper execution of the contract.

The Designer shall be, in the first instance, the interpreter of the conditions of the contract and the judge of its performance. The Designer shall side neither with the Owner nor with the Contractor, but shall use the Designer's powers under the contract to enforce its faithful performance by both.

In case of the termination of the employment of the Designer, the Owner shall appoint a capable and reputable Designer whose status under the contract shall be that of the former Designer.

### **ARTICLE 36: CASH ALLOWANCES**

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The Contractor shall include the contract sum and all allowances named in the contract documents and shall cause the work so covered to be done by such Contractors and for such sums as the Designer may direct, the contract amount being adjusted in conformity therewith. The Contractor declares that the contract amount includes such sums for expenses and profit on account of cash allowances, as he deems proper. No demand for expenses or profit other than those included in the contract shall be allowed. The Contractor shall not be required to employ for any such work, persons against whom the Contractor has a reasonable objection.

#### **ARTICLE 37: USES OF PREMISES**

The Contractor shall confine his apparatus; the storage of materials and the operations of his workmen to limits indicated by law, ordinances, permits or directions of the Designer, and as required by the Contract Documents, and shall not unreasonably encumber the premises with his materials.

The Contractor shall not load or permit any part of the structure to be loaded with a weight which will endanger its safety. The Contractor shall enforce the Designer's instructions regarding signs, advertisements, fires, and smoking.

If any part of the building is completed and ready for occupancy, the Owner may, by written and mutual consent, without prejudice to any of the Owner's rights or the rights of the Contractor enter in and make use of such completed parts of the building. Such use or occupancy shall in no case be construed as an acceptance of any work or materials.

#### **ARTICLE 38: CUTTING, PATCHING AND DIGGING**

The Contractor shall do all cutting, fitting or patching of his work that may be required to make its several parts come together properly and fit it to receive or be received by work of other Contractors shown upon, or reasonable implied by, the drawings and specifications for the completed structure, and he shall make good after them as the Designer may direct.

Any cost caused by defective or ill-timed work shall be borne by the party responsible therefore. The Contractor shall not endanger any work by cutting, excavating or otherwise, and shall not cut or alter the work of any other Contractor save with the consent of the Designer. Cutting, drilling, or patching work of Contractors other than the general Contractor shall be done only with the permission and instruction of the general Contractor and Designer. Cutting of structural members must be approved by the Designer. All cutting, patching, and digging of other Contractors in or about the building shall be done under the supervision of the general Contractor who shall be responsible to see that the work is neatly done, and in a manner that will not endanger the structure or

harm the component parts, and that patching and back filling shall be done to restore the structure and surfaces to its original condition.

**ARTICLE 39: LAYOUT OF WORK**

The Contractor shall be responsible for the correct staking out of the new work on the site, and shall employ a competent engineer/surveyor to locate the building on the site. He shall run the axis lines locating the work, establish correct datum points, and check each line and point on the site to insure their correctness. All such lines and points shall be carefully preserved throughout the construction.

The Contractor shall lay out all work from dimensions given on plans. The Contractor shall take measurements and verify dimensions of existing or old work, if any, that affect his work or to which his work is to be fitted. The Contractor alone shall be responsible for the correctness of all measurements and shall verify all grades, lines, levels, elevations and dimensions shown on the drawings and report any errors or inconsistencies to the Designer prior to commencing work.

**ARTICLE 40: WORKMANSHIP**

All workmanship, materials or equipment, either at the site or intended for it shall conform with all respects with the requirements of all the contract documents, and shall be strictly first class, workmanlike installation and the best obtainable from the crafts and trades. Incomplete or careless workmanship will not be allowed. In all cases the materials, equipment and work shall be equal to or better than the grade specified and the best of their kind that is obtainable for the purpose for which they are intended. The Designer's decision on the quality of work shall be final.

All labor shall be performed by mechanics skilled in their respective trades. Prior to submitting a proposal, the Contractor shall become familiar with the local labor conditions, skilled and unskilled.

If, in the opinion of the Contractor, any work is indicated on the drawings or specified in such manner as would make it impossible to produce work of the highest quality, or should discrepancies appear between drawings, or drawings and specifications, the Contractor shall refer the same in writing to the Designer for interpretation before proceeding with the work.

If the Contractor fails to make such reference, no excuse will be entertained thereafter for failure to carry out the work in the satisfactory manner.

The Contractor shall guarantee the Contractor's work against any defects in workmanship and materials for a period of one year from the date of the written final acceptance of the project.



**ARTICLE 41: CLEANING UP**

The Contractor shall at all times keep the premises free from accumulation of waste materials or rubbish caused by his employees or work, and at the completion of the work he shall remove all his rubbish from and about the building and all his tools, scaffolding and surplus materials and shall leave his work "Broom Clean" or its equivalent, unless more exactly specified.

In case of failure to comply by the Contractor, the Owner may perform the cleanup and deduct the cost from any monies due the Contractor.

**ARTICLE 42: DISPUTE RESOLUTION**

If, in the performance of this contract, there arises a dispute between the Contractor and the Owner that cannot be resolved by the parties to the contract, the dispute shall be referred to the Director of the Bureau of General Services who, at his/her discretion, will submit the dispute to non-binding Alternate Dispute Resolution (ADR) or binding arbitration. If the parties in dispute are not satisfied with the results of ADR the Owner or the Contractor may resubmit the dispute to the Director of the Bureau of General Services for binding arbitration.

In any non-binding Alternative Dispute Resolution (ADR) or binding arbitration between the Owner and the Contractor, the Owner may elect to consolidate related claims between the Owner and the Designer. Any mediator and/or arbitrator shall be subject to the mutual approval of the Owner, the Contractor and, as applicable, the Designer, such approval not to be unreasonably withheld by any party.

**ARTICLE 43: COMPLETION TIME AND LIQUIDATED DAMAGES**

a) The Date(s) of Completion is stated in the Proposal Form Section 2-B and in the Contract Form Section 2-E. If the Contractor finds it impossible to complete the Work on or before the said Date(s) of Completion, he make a written request to the Owner for an Extension of Time setting forth therein the reasons for the request. If the Owner finds that the Work was delayed because of conditions beyond the control and without the fault of the Contractor he may extend the Date(s) of Completion which will then be in full force and effect, the same as though it was the original Date(s) of Completion. b) Time is an essential element of the Contract and it is important the Work be pressed vigorously to Completion. The cost to the Owner of Administration of the Contract, inspection and supervision will be increased as the time occupied in the Work, is lengthened. c) For each calendar day that the Work shall remain uncompleted after the Date(s) of Completion specified in the Contract, the amount per day, listed below in the Schedule of Liquidated damages, shall be deducted from any money due the Contractor, not as a penalty but as liquidated damages, provided, however that due account shall be taken of any adjustment of the Date(s) of Completion granted under the provisions of Paragraph (a) above. d) The Contractor shall expressly be prohibited from filing delay claims or attempting to recover damages for its scheduled early completion. The Owner and

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Designer have not requested accelerated schedules and cannot accommodate the Contractor if he chooses to accelerate the Work. The Owner and Designer have designed the Project to be done in an orderly fashion which allows for bad weather, minor changes in the Work, and an orderly submittal and review process of materials and workmanship. Any Contractor choosing to bid the project with accelerated completions, earlier than those allowed by the phasing plan, has a duty to inform the project owner of the Contractor's intention to achieve early completion and he shall also note early completion as a qualification on his bid form. The Owner reserves the right to reject all bids containing limitations or qualifications.

SCHEDULE OF LIQUIDATED DAMAGES

<u>Damages</u>	<u>Amount of Liquidated</u>
<u>Original Contract Amount</u>	<u>Per Day</u>
More than \$ 100,000 and less than \$ 3,000,000	\$ 750.00
More than \$ 3,000,000 and less than \$ 7,000,000	\$ 1000.00
More than \$ 7,000,000 and less than \$ 10,000,000	\$ 1500.00
More than \$ 10,000,000	\$ 1500.00 plus \$ 150 per \$ 1,000,000

**SECTION 01 00 00**  
**GENERAL REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Project Identification: Project consists of new construction of a one-story steel structure building with metal decking, storefront framing, and fiber-cement siding.
  - 1. Project Location: 75 Jordan Avenue, Brunswick, Maine.
  - 2. Owner: Brunswick School Department.
- B. Architect Identification: The Contract Documents were prepared for Project by CHA Architecture.
- C. Project will be constructed under a general construction contract. AIA A107 - Abbreviated Form of Agreement Between Owner and Contractor - Stipulated Sum
- D. Owner will furnish toilet accessories. The Work includes providing support systems to receive Owner's equipment and electrical connections.
  - 1. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
  - 2. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
  - 3. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
  - 4. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
  - 5. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
- E. Work Under Other Contracts: Owner has awarded a separate contract for performance of certain construction operations at Project site. Those operations may or may not be scheduled during this Contract. The separate contracts will include the following:
  - 1. Construction of Brunswick Elementary School building and site landscaping.
- F. Use of Premises: Contractor shall have shared use of premises for construction operations, including use of Project site, during construction period with Prime Contractor for the construction of Kate Furbish Elementary School, until Substantial Completion of the school. Projected date of Substantial Completion is July 31, 2020. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

## **1.2 CONTRACT MODIFICATIONS**

- 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.
- 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 the Architect.
- C. On Owner's approval of a Proposal Request, the Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

## **1.3 PAYMENT PROCEDURES**

- A. Submit the Schedule of Values to Architect at earliest possible date but no later than 7 days before the date scheduled for submittal of initial Applications for Payment.
  - 1. Provide a detailed breakdown of the agreed Contract Sum showing values allocated to each of the various parts of the Work, as specified herein and in other provisions of the Contract Documents.
- B. Provide a separate line item in the Schedule of Values for labor and materials where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed. Provide Labor and Materials breakdown for major portions of the Work such as sitework, windows, doors and frames, hardware, plumbing, heating and ventilating, electrical and other work as requested by the Architect.
- C. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
- D. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets or Contractor's electronic media driven form, including continuation sheets when required, as form for Applications for Payment.
- E. The Owner shall withhold 5% of the money due to Contractor until the work under the Contract has been accepted by or for the Owner. The Owner may, upon the completion of part or parts of the contract and with the approval of the General Contractor and Designer, pay all or part of the retainage on those parts completed as the Owner deems prudent, provided satisfactory release of lien has been provided.

## **1.4 PROJECT MEETINGS**

- A. Preconstruction Conference: Architect will schedule a preconstruction conference before starting construction, at a time convenient to Owner and Contractor, but no later than 15 days after execution of the Agreement. Conference will be held at Project site or another convenient location. Meeting will be conducted to review responsibilities and personnel assignments.
  - 1. Minimum agenda: Data will be distributed and discussed on the following:
    - a. Organizational arrangement of Contractor's forces and personnel, and those of subcontractors, materials suppliers, and the Architect;
    - b. Channels and procedures for communication;

- c. Construction schedule, including sequence of critical work;
  - d. Contract Documents, including distribution of required copies of Drawings and revisions;
  - e. Processing of Shop Drawings and other data submitted to the Architect for review;
  - f. Processing of field decisions and Change Orders;
  - g. Rules and regulations governing performance of the Work; and
  - h. Procedures for security, quality control, housekeeping, and related matters.
- B. Progress Meetings: Architect will conduct progress meetings at monthly intervals. Coordinate dates of meetings with preparation of payment requests.
- 1. Attendance: To the maximum extent practicable, assign the same person or persons to represent the Contractor at project meetings throughout progress of the Work. Subcontractors, materials suppliers, and other may be invited to attend those project meetings in which their aspects of the Work are involved
  - 2. Minimum agenda: Data will be distributed and discussed on the following:
    - a. Review progress of the Work since last meeting, including status of submittals for approval.
    - b. Identify problems which impede planned progress.
    - c. Develop corrective measures and procedures to regain planned schedule.
    - d. Complete other current business.

## **1.5 CONSTRUCTION SCHEDULE**

- A. Provide bar chart showing construction schedule. Revise as required during the construction period.

## **1.6 SUBMITTALS**

- A. General: Prepare and submit Submittals required by individual Specification Sections.
- 1. Number of Copies: Submit the number of copies of each submittal as indicated in individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
- D. Samples: Prepare physical units of materials or products, including the following:
- 1. When indicated, submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
  - 2. When indicated, submit full-size units or samples of size indicated, prepared from the same material to be used for the Work, physically identical with the product proposed for use, and that show full range of color and texture variations expected.

- E. Do not order or install materials until the Architect has reviewed the submittal.
- F. Substitutions:
  - 1. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved in writing for this Work by the Architect.
- G. "Or equal":
  - 1. Where the phrase "or equal," or "or equal as approved by the Architect," occurs in the Contract Documents, do not assume that the materials, equipment, or methods will be approved as equal unless the item has been specifically so approved for this Work by the Architect.
  - 2. The decision of the Architect shall be final.
- H. Timing of Submittals:
  - 1. Make submittals far enough in advance of scheduled dates for installation to provide time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery.
  - 2. In scheduling, allow at least ten working days for review by the Architect following his receipt of the submittal.

## **1.7 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 the types of testing and inspecting they are engaged to perform.
  - 2. Payment for these services will be made by the Owner.
  - 3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Tests:
  - 1. Concrete compression tests.
  - 2. Sitework soils compaction tests.
- C. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. Schedule times for tests, inspections, obtaining samples, and similar activities.

## **1.8 DELEGATED DESIGN**

- A. Performance and Design Criteria: Provide products and systems complying with specific performance and design criteria indicated where professional design services or certifications by a design professional are specifically required of Contractor by Contract Documents.

- B. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- C. Delegated design will be required for elements designed by a specialty professional, which may include:
  - 1. Elements normally fabricated off Work Site.
  - 2. Elements that require specialized fabrication equipment or a proprietary fabrication process not usually available at Work Site (i.e.: open web steel joists, wood trusses, combination wood and metal or plywood joists, prefabricated wood or metal buildings, noise and vibration isolation devices, elevators, fall protection and/or restraint).
  - 3. Elements requiring civil engineering, not normally a part of scope of services performed by architectural; structural; mechanical; electrical; or geotechnical disciplines of Consultant.

## **1.9 TEMPORARY FACILITIES**

- A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum.
- B. Field Offices: Prefabricated, mobile units with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading.
- C. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
- D. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- E. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
- F. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide gas/oil fired space heaters that are UL labeled and approved for construction space heating by appropriate agency. Provide adequate ventilation and thermostatic control. Heaters shall be located outside the building and combustion gases shall be vented outside the building. Maintain observation of units in operation.
  - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
- G. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- H. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

- I. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- J. Telephone and Facsimile Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities.
- K. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.
- L. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.
- M. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.

#### **1.10 CLOSEOUT PROCEDURES**

- A. Substantial Completion: On receipt of request for inspection for Substantial Completion, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
  - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  - 2. Results of completed inspection will form the basis of requirements for Final Completion.
- B. Project Record Documents: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.
  - 1. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings. Mark Record Prints to show the actual installation where installation varies from that shown originally for conceal construction (piping and wiring). 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.
  - 2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.



3. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating the operation and maintenance of the mechanical system. Include operation and maintenance data required in individual Specification Sections and as follows:
  1. Operation Data:
    - a. System, subsystem, and equipment descriptions, including operating standards.
    - b. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
    - c. Description of controls and sequence of operations.
    - d. Piping diagrams.
  2. Maintenance Data:
    - a. Manufacturer's information, including list of spare parts.
    - b. Name, address, and telephone number of Installer or supplier.
    - c. Maintenance procedures.
    - d. Maintenance and service schedules for preventive and routine maintenance.
    - e. Maintenance record forms.
    - f. Sources of spare parts and maintenance materials.
    - g. Copies of maintenance service agreements.
    - h. Copies of warranties and bonds.
  3. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.
- D. Warranties: Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
  1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.
  2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

- E. Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

#### **1.11 CUTTING AND PATCHING**

- A. Work included: This Section establishes general requirements pertaining to cutting (including excavating), fitting, and patching of the Work required to:
  - 1. Make the several parts fit properly.
  - 2. Uncover work to provide for installing, inspecting, or both, of ill-timed work.
  - 3. Remove and replace work not conforming to requirements of the Contract Documents.
  - 4. Remove and replace defective work.
  - 5. Connect to existing construction.
- B. Prior to cutting which effects structural safety, submit written request to the Architect for permission to proceed with cutting.
- C. Materials: For replacement of items removed, use materials complying with pertinent Sections of these Specifications.
- D. Perform cutting, demolition and patching, by methods that will prevent damage to other portions of the Work and provide proper surfaces to receive installation of repair and new work to Architect's approval.

#### **1.12 CLEANING**

- A. Progress Cleaning:
  - 1. Retained stored items in an orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing required protection of materials.
  - 2. At least twice each week, and more often if necessary, completely remove all scrap, debris, and waste material from the job site.
  - 3. As required preparatory to installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material.
- B. Final Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average residential building cleaning program. Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material.
  - 1. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
  - 2. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

3. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
  4. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  5. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
  6. Leave Project clean and ready for occupancy.
- C. Cleaning During Owner's Occupancy: Should the Owner occupy the Work or any portion thereof prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning shall be as determined by the Architect in accordance with the General Conditions of the Contract

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

**PART 3 - EXECUTION (Not Used)**

**END OF SECTION**

## SECTION 03 30 00 – CAST -IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.
- B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

#### 1.02 DESCRIPTION OF WORK:

- A. Work included: Provide labor, materials, and equipment necessary to complete the work of this Section and, without limiting the generality thereof, furnish and include the following:
  - 1. The extent of cast-in-place concrete work is shown on drawings and includes (but not by way of limitation) formwork, reinforcing, cast-in-place concrete, accessories, finishing, and casting in of items specified under other Sections of the Specifications or furnished by Owner that are required to be built-in with the concrete.
  - 2. Equipment support pads indicated on mechanical drawings to be installed by the Building Contractor.
  - 3. Cast-in-place retaining walls, exterior slabs on grade and other concrete shown on site drawings.

#### 1.03 RELATED WORK:

- A. Metal Fabrications: Section 05 50 00
  - 1. Expansion Anchors - Section 05 12 00
  - 2. Embedded Items - Section 05 50 00
- B. Anchor Bolts: Section 05 12 00
- C. Joint Sealants: Division 7
- D. Flooring Adhesive: Division 9
- E. Underslab Vapor Retarders/Wall Waterproofing: Division 7

#### 1.04 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the latest edition of the following except where more stringent requirements are shown or specified:

1. ACI "Manual of Concrete Practice".
2. ACI 117 "Standard Specifications for Tolerances for Concrete Construction and Materials".
3. ACI 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete."
4. ACI 212.3R "Chemical Admixtures for Concrete."
5. ACI 301 "Specifications for Structural Concrete for Buildings."
6. ACI 302.1R "Guide for Concrete Floor and Slab Construction."
7. ACI 304R "Guide for Measuring, Mixing, Transporting and Placing Concrete."
8. ACI 304.2R "Placing Concrete by Pumping Methods."
9. ACI 306 R "Cold Weather Concreting."
10. ACI 308 "Standard Practice for Curing Concrete."
11. ACI 309R "Guide for Consolidation of Concrete."
12. ACI 315 "ACI Detailing Manual."
13. ACI 318 "Building Code Requirements for Reinforced Concrete."
14. ACI 347R "Guide to Formwork for Concrete."
15. Concrete Reinforcing Steel Institute, "Placing Reinforcing Bars."
16. AISC "Code of Standard Practice for Steel Buildings and Bridges."
17. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

B. Materials and installed work may require testing and retesting, as directed by the Architect, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests not specifically indicated to be done at Owner's expense, including retesting of rejected materials and installed work, shall be done at Contractor's expense.

1.05 SUBMITTALS:

A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with Division 1.

- B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.
- C. All submittals shall be reviewed and returned to the Architect within 10 working days.
- D. Incomplete submittals will not be reviewed.
- E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with.
- F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.
- G. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.
- H. Electronic Submittals:
  - 1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.
  - 2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
  - 3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Bluebeam version 12 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
  - 4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.
  - 5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.

- I. Product Data: Submit producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
1. Reinforcement certified mill reports covering chemical and physical properties and yield strength.
  2. Patching products.
  3. Non-shrink grout.
  4. Curing compounds, where applicable.
  5. Admixtures.
  6. Expansion/Adhesive Anchors.
- J. Shop Drawings:
1. Shop Drawing Preparation: Electronic files of structural drawings will not be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings is prohibited. Shop drawings created from reproduced Construction Documents will be returned without review. Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315, showing bar schedules, stirrup and tie spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required at openings through concrete elements. Include supplemental reinforcing and bar supports necessary to support reinforcing steel at proper location within forms or slabs.
    - a. Review of the shop drawings will be made for the size and arrangement of reinforcement. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility.
    - b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided all items listed prior. **Incomplete submittals will not be reviewed.**
- K. Mix designs: Submit all laboratory test reports and materials for each mix design listed within. Prepare mixes by the field experience method and/or trial mixtures per the requirements of chapter 5 of ACI 318. Include the calculation of average strength and standard deviation. **Proportioning by water cement ratio method will not be permitted.**
- L. Sustainability Documentation: Refer to paragraph 1.06 of this section and Division 1.
- M. Samples: Submit samples of materials as specified and as otherwise requested by Architect, including names, sources and descriptions.

- N. Hot and Cold Weather Concrete Procedures: Submit a detailed written procedures for placement of concrete at the temperatures anticipated for the project. Include, but not by limitation, subgrade protection and/or heating, production/ready mix methods, transportation and conveying methods, placement, protection, termination of protection, curing and quality control/monitoring procedures. Procedures shall meet the requirements of the latest edition of ACI 305.1 and ACI 306.1 for hot weather and cold weather concreting, respectively.
- O. Curing Methods: Submit documentation of curing methods to be used for review. Account for anticipated project temperature ranges and conditions in curing methods.
- P. Contraction/Construction Joints: Submit plan indicating proposed location of contraction and construction joints in walls and slabs.
- Q. Test Reports: Test reports shall be submitted to the Owner, Architect and Engineer within 48 hour after completion of each test.

## PART 2 - PRODUCTS

### 2.01 FORM MATERIALS:

- A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.
  - 1. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

### 2.02 REINFORCING MATERIALS:

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Welded Wire Fabric: ASTM A 185, welded steel wire fabric. Provide welded wire fabric in flat sheets.



C. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers, and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use plastic, wire bar type supports or concrete block supports complying with CRSI recommendations, unless otherwise specified. Wood, clay brick and other unspecified devices are not acceptable.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class I) or stainless steel protected (CRSI, Class 2).

## 2.03 CONCRETE MATERIALS:

- A. Single-Source Supplier: Ready-mix concrete shall be from one supplier unless specific written approval is received from the Structural Engineer.
- B. Portland Cement: ASTM C 150, Type I or Type II, unless otherwise approved Use one brand of cement throughout project, unless otherwise acceptable to Architect.
- C. Normal Weight Aggregates: ASTM C 33. Provide from a single source for exposed concrete. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, or ochre which can cause stains on exposed concrete surfaces.
- D. Light Weight Aggregates: ASTM C 330.
- E. Water: Potable.
- F. Air-Entraining Admixture: ASTM C 260.
- G. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G containing not more than 1% chloride ions.
- H. Fiber reinforcement shall be Type III Synthetic Virgin Homopolymer Polypropylene Fibers conforming to ASTM C1116. Fiber reinforcing shall be added and distributed prior to incorporation of Super Plasticizer.
- I. Normal range water reducing admixture: ASTM C 494 Type A containing no calcium chloride.
- J. Accelerating Admixture: ASTM C 494, Type C or E.
- K. Air Detraining Admixture: ASTM C494, Type S, Specific Performance Admixture
- L. Blast Furnace Slag: ASTM C989
- M. Calcium Chloride is not permitted.

## 2.04 RELATED MATERIALS:

- A. Underslab Vapor Retarder: Provide vapor retarder over prepared sub base. Refer to architectural drawings, geotechnical report and/or division 7 specifications for additional requirements and vapor retarder location.
- B. Non-Shrink Cement-based Grout: Provide grout consisting of pre-measured, prepackaged materials supplied by the manufacturer requiring only the addition of water. Manufacturer's instructions must be printed on the outside of each bag.
  - 1. Non-shrink: No shrinkage (0.0%) and a maximum 4.0% expansion when tested in accordance with ASTM C-827. No shrinkage (0.0%) and a maximum of 0.3% expansion in the hardened state when tested in accordance with CRD-C-621.
  - 2. Compressive strength: A minimum 28 day compressive strength of 5000 psi when tested in accordance with ASTM C-109.
  - 3. Setting time: A minimum initial set time of 60 minutes when tested in accordance with ASTM C-191.
  - 4. Composition: Shall not contain metallic particles or expansive cement.
- C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M182, Class 2.
- D. Moisture-Retaining Cover: One of the following, complying with ANSI/ASTM C 171.
  - 1. Waterproof paper.
  - 2. Polyethylene film.
  - 3. Polyethylene-coated burlap.
- E. Liquid Membrane-Forming Curing Compound: Liquid type membrane forming curing compound complying with ASTM C 309, Type I, Class A unless other type acceptable to Architect. Curing compound shall not impair bonding of any material, including floor finishes, to be applied directly to the concrete. Demonstrate the non-impairment prior to use.
- F. Preformed Expansion Joint Formers:
  - 1. Bituminous Fiber Type, ASTM D 1751.
  - 2. Felt Void, Poly-Styrene Cap with removable top as manufactured by SUPERIOR.
- G. Slab Joint Filler: Multi-component polyurethane sealant (self-leveling type).
- H. Waterstops shall be Bentonite/Butyl Rubberbased product. Use in conjunction with manufacturer's approved mastic. Acceptable products include:
  - 1. "Waterstop Rx," by American Colloid Co.

2. "Adeka Ultra Seal MC-2010," by Asahi Denka Koeyo, Kik MN.

## 2.05 PROPORTIONING AND DESIGN OF MIXES:

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 318. Use material, including all admixtures, proposed for use on the project. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.
- B. Submit written reports to Architect of each proposed mix for each class of concrete. Do not begin concrete production until mixes have been reviewed by Architect.
- C. Proportion design mixes to provide concrete with the following properties:
  1. Footings and foundation walls
    - a. Strength: 3,500 psi at 28 days.
    - b. Aggregate: 3/4"
    - c. Design Air Dry Density: 145 pcf Normal Weight
    - d. W/C Ratio: 0.55 maximum
    - e. Entrained Air: 6% +/- 1.5%
    - f. Slump: 4" maximum
  2. Interior slabs on grade:
    - a. Strength: 3,000 psi at 28 days
    - b. Aggregate: 3/4" minimum, 1 1/2" maximum
    - c. Design Air Dry Density: 145 pcf Normal Weight
    - d. W/C Ratio: 0.54 maximum
    - e. Entrapped Air only (no entrainment), not to exceed 3% at point of discharge
    - f. Slump: 4" maximum
  3. Exterior Slabs and all other exposed Site Concrete not specified elsewhere:
    - a. Strength: 5,000 psi at 28 days
    - b. Aggregate: 3/4"

- c. Design Air Dry Density: 145 pcf Normal Weight
  - d. W/C Ratio: 0.40 maximum
  - e. Entrained Air: 6% +/- 1.5%
  - f. Slump: 4" maximum
- 4. Add air entraining admixture at manufacturers prescribed rate to result in concrete at point of placement having the above noted air contents.
  - 5. Additional slump may be achieved by the addition of a mid-range or high-range water reducing admixture. Maximum slump after the addition of admixture shall be 6 or 8 inches for mid-range or high range water reducing admixtures, respectively.
- D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor, when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Structural Engineer before using in work.
- 1. Water may be added at the project only if the maximum specified slump and design mix maximum water/cement ratio is not exceeded.
  - 2. Additional dosages of superplasticizer should be used when delays occur and required slump has not been maintained. A maximum of two additional dosages will be permitted per ACI 212.3R recommendations.

## 2.06 CONCRETE MIXING:

- A. Job-Site Mixing will not be permitted.
- B. Ready-Mix Concrete: Must comply with the requirements of ASTM C 94, and as herein specified. Provide batch ticket for each batch discharged and used in work, indicating project name, mix type, mix time and quantity.
  - 1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required by Structural Engineer.
  - 2. When the air temperature is between 85 degrees F. and 90 degrees F., reduce the mixing and delivery time from 1 1/2 hours to 75 minutes, and when the air temperature is above 90 degrees F., reduce the mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

### 3.01 FORMS:

- A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.
- B. Design, construct, erect, maintain, and remove forms for cast-in-place concrete work in compliance with ACI 347.
- C. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
- D. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.
- E. Vertical dovetail slots may be required for masonry tie installation. Coordinate dovetail slot spacing and location with division 4 specifications and Architectural drawings.
- F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, dovetail slots, reglets, recesses, and the like to prevent swelling and for easy removal.
- G. Provide temporary openings where interior area of formwork is inaccessible for clean out, for inspection before concrete placement and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.
- H. Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- I. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.
  - 1. Unless otherwise indicated, provide ties for concrete surfaces to be exposed to view in the final condition so portion remaining within concrete after removal is 1" (minimum) inside concrete.
  - 2. Form ties shall not leave holes larger than 1" diameter in concrete surface. Repair holes left by form ties after removal of formwork.
- J. Provision for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

- K. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement as required to eliminate mortar leaks and maintain proper alignment.

### 3.02 PLACING REINFORCEMENT:

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
1. Subgrade tolerance shall conform to a tolerance of  $+0/-1\ 1/2"$ . Base tolerance (fine grading) for slabs shall conform to a tolerance of  $+0''/-3/4''$  in. Confirm compliance of above tolerances with surveyed measurements taken at 20 ft. intervals in each direction.
  2. Concrete reinforcing and/or welded wire fabric shown on structural drawings is provided for structural purposes only; additional reinforcement may be necessary for reinforcing support, the anchorage of structural embedded items, and the anchorage of non-structural embedded items including but not by limitation radiant tubing. This reinforcing is not shown on the structural drawings as it is part of the contractor's means and methods and shall be included at no cost to the Owner.
  3. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
  4. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.
  5. Place reinforcement to obtain specified coverage for concrete protection within tolerances of ACI-318. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
  6. Install welded wire fabric in flat sheets in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

### 3.03 JOINTS:

- A. Construction Joints: Locate and install construction joints, which are not shown on drawings, so as not to impair strength and appearance of the structure, as acceptable to Architect. Submit plan indicating proposed location of construction joints for review prior to beginning work.
1. Provide keyways at least  $1-1/2"$  deep in construction joints in walls, and slabs; bulkheads reviewed by the Engineer, designed for this purpose may be used for slabs.

2. Roughened surfaces shall be used between walls and footings unless shown otherwise on the drawings. The footing surface shall be roughened to at least an amplitude of 1/4" for the width of the wall before placing the wall concrete.
3. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.
4. Joints in slabs on grade shall be located and detailed as indicated on the drawings. If saw-cut joints are required, the early-entry dry-cut process shall be used. Refer to ACI 302, section 8.3.12.

### 3.04 INSTALLATION OF EMBEDDED ITEMS:

- A. General: Set, securely anchor and build into work prior to concrete placement all anchorage devices and all other embedded items, including but not by limitation reinforcement, reinforcing dowels, embedded plates, anchor rods, anchor inserts, sleeves, load transfer plates, diamond dowels and shelf bulk heads required for other work that is attached to, bear upon, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto. Notify other trades to permit installation of their work. Templates to be utilized for setting of anchorage devices shall be constructed in a manner to allow mechanical consolidation of concrete without disturbance. Embedments shall be placed in a timely fashion to permit the inspection of embedments prior to concrete placement. **“Wet Setting” of embedded items into plastic concrete is strictly prohibited.**
- B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface.
- C. Provide PVC sleeves where pipes and/or conduit pass through exterior concrete or slabs. Sleeves or penetrations shall not be placed through footings, piers, pedestals, drop caps, columns or pilasters unless specifically noted.
- D. Tolerances: Tolerances for Anchor Bolts/Rods, other embedded items and bearing surfaces shall meet the requirement set forth in the latest edition of the American Institute of Steel Construction “Code of Standard Practice for Steel Buildings and Bridges,” and ACI 117. The more stringent criteria from these documents shall apply.

### 3.05 INSTALLATION OF GROUT

- A. Place grout for base plates in accordance with manufacturer's recommendations.
- B. Grout below setting plates as soon as practicable to facilitate erection of steel and prior to removal of temporary bracing and guys. If leveling bolts or shims are used for erection grout shall be installed prior to addition of any column load.
- C. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials and allow to cure. For proprietary grout materials, comply with manufacturer's instructions.

### 3.06 PREPARATION OF FORM SURFACES:

- A. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.
- B. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating material manufacturer's directions. Do not allow excess form coating to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

3.07 CONCRETE PLACEMENT:

- A. Preplacement Review: Footing bottoms are subject to review by the Geotechnical Engineer. Reinforcement and all concrete preparation work shall be subject to review by the Structural Engineer. Verify that reinforcing, ducts, anchors, seats, plates and other items cast into concrete are placed and securely held. Notify Engineer/Project Special Inspector 48 hours prior to scheduled placement and obtain approval or waiver of review prior to placement. Be sure that all debris and foreign matter is removed from forms.
- B. Slab Preplacement Meeting: Conduct a slab preplacement meeting to review placement, finishing and curing. Meeting to include, at a minimum: architect, structural engineer, flooring adhesive representative, flooring installer, concrete supplier and concrete finisher.
- C. Concrete shall be placed in the presence of an approved testing agency.
- D. General: Comply with ACI 304, and as herein specified.
  - 1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing.
  - 2. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and in a manner which will assure that the required quality of the concrete is maintained.
  - 3. Conveying equipment shall be approved and shall be of a size and design such that detectable setting of concrete shall not occur before adjacent concrete is placed. Conveying equipment shall be cleaned at the end of each operation or work day. Conveying equipment and operations shall conform to the following additional requirements:
    - a. Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. An arrangement shall be used at the discharge end to prevent apparent segregation. Mortar shall not be allowed to adhere to the return length of the belt. Long runs shall be discharged into a hopper or through a baffle.



- b. Chutes shall be metal or metal-lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long, and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.
    - c. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation is not apparent in the discharged concrete.
    - d. Concrete shall not be conveyed through pipe made of aluminum alloy. Standby equipment shall be provided on the site.
    - e. Tined rakes are prohibited as a means of conveying fiber reinforced concrete.
  - 4. Do not use reinforcement as bases for runways for concrete conveying equipment or other construction loads.
- E. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 18 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
  - 1. Consolidate placed concrete by mechanical vibrating equipment. Hand-spading, rodding or tamping as the sole means for the consolidation of concrete will only be permitted with special permission from the Engineer. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
  - 2. Use vibrators designed to operate with vibratory equipment submerged in concrete, maintaining a speed of not less than 8000 impulses per minute and of sufficient amplitude to consolidate the concrete effectively. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine, generally at points 18 inches maximum apart. Place vibrators to rapidly penetrate placed layer and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion maintain the duration of vibration for the time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix, generally from 5 to 15 seconds. A spare vibrator shall be kept on the job site during all concrete placing operation.
- F. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
  - 1. Consolidate concrete using internal vibrators during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. Do not sprinkle water on plastic surface.
  - 3. Maintain reinforcing in proper position during concrete placement operations.

4. Slab thicknesses indicated on the drawings are minimums. Provide sufficient concrete to account for structure deflection, subgrade fluctuations, and to obtain the specified slab elevation at the flatness and levelness indicated here within.
  5. Finish: See "Monolithic Slab Finishes" in this specification for slab finish requirements.
- G. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
1. When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C), and not more than 80 degrees F (27degrees C) 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 and other materials containing antifreeze agents or chemical accelerators.
  4. All temporary heat, form insulation, insulated blankets, coverings, hay or other equipment and materials necessary to protect the concrete work from physical damage caused by frost , freezing action, or low temperature shall be provided prior to start of placing operations.
  5. When the air temperature has fallen to or is expected to fall below 40 degrees F, provide adequate means to maintain the temperature in the area where concrete is being placed between 50 and 70 degrees F.
- H. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.
  2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
  3. Wet forms thoroughly before placing concrete.
  4. Do not use retarding admixtures without the written acceptance by the Architect.

### 3.08 FINISH OF FORMED SURFACES:

- A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This concrete surface shall have texture imparted by form facing material, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4 in. in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This as-cast concrete surface shall be obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.
- C. Grout Cleaned Finish: Provide grout cleaned finish to scheduled concrete surfaces which have received smooth form finish treatment. Combine one part Portland cement to 1-1/2 parts fine sand by volume and mix with water to consistency of thick paint. Proprietary additives may be used at Contractor's option. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.
  - 1. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
- D. Related Unformed Surfaces: At tops of walls and grade beams, horizontal offset surfaces occurring adjacent to formed surfaces, strike-off, smooth and finish with a texture matching adjacent unformed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

### 3.09 FLOOR FLATNESS AND LEVELNESS

- A. Floor flatness/levelness tolerances: Tolerances for various floor uses shall conform to the requirements set forth in ACI 117 and ACI 302 for "flat" floor profile.
  - 1. Minimum Test Area Flatness/Levelness:  $F_F35/F_L25$
  - 2. Minimum Local F Number:  $F_F25/F_L15$
- B. Levelness criteria shall be applied to slabs-on-grade only.
- C. Contractor shall measure floor finish within 72 hours after slab finishing and provide corrective measures for finishes not within tolerance. Corrective procedures shall be reviewed by the Architect prior to implementation.

### 3.10 MONOLITHIC SLAB FINISHES:

- A. Slab finishes for areas to receive floor coverings in the final condition shall be coordinated with the Architect and flooring adhesive representative prior to slab placement, determined in the slab preplacement meeting. First placement shall occur at the slab finish control area indicated on the plans. Coordinate with architect and flooring adhesive representative to be on site during initial slab finishing to advise finisher of proper slab finish level to be used at this and other similar areas throughout the project.
- B. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds, and as otherwise indicated.
  - 1. After placing slabs, plane surface to a tolerance not exceeding 1/2 in. in 10 ft. when tested with a 10-ft. straightedge. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms or rakes.
- C. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, and as otherwise indicated.
- D. Trowel Finish: Apply trowel finish to monolithic slab surfaces indicated, including slab surfaces to be covered with carpet, resilient flooring, paint or other thin-film finish coating system.
- E. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.
- F. Slab Joints: Where indicated, sawn slab contraction joints shall be "soft cut", immediately after concrete surface is firm enough not to be torn or damaged by the blade.

### 3.11 CONCRETE CURING AND PROTECTION:

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 308 as herein specified.
- B. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof, as herein specified unless noted otherwise. Curing shall commence as soon as concrete surfaces are sufficiently hard as to withstand surface damage.
- C. Curing of Slabs-on Grade:
  - 1. Slabs-on-grade shall be cured by wet curing methods unless otherwise noted.
  - 2. Slabs-on-grade to receive floor coverings with adhesives shall be cured by means of a moisture retaining covering. Coordinate curing with flooring adhesive manufacturer and flooring installer. Submit curing methods to Architect for review and approval.

- D. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
- E. Protection From Mechanical Injury: During the curing period and duration of construction, the concrete shall be protected from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration. All finished concrete surfaces shall be protected from damage by construction equipment, materials, or methods, by application of curing procedures, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to overstress the concrete.

### 3.12 REMOVAL OF FORMS:

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as joints, slabs and other structural elements, may not be removed in fewer than 14 days or until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
- C. Form facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and support.

### 3.13 REUSE OF FORMS:

- A. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and latency, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

### 3.14 MISCELLANEOUS CONCRETE ITEMS:

- A. Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

### 3.15 CONCRETE SURFACE REPAIRS:

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to the Architect.

1. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush coat the area to be patched with approved bonding agent. Place patching mortar after bonding compound has dried.
  2. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, form tie holes, cracks, spalls, air bubbles, honeycomb, rock pockets, fins, and other projections on surface and stains and other discolorations that cannot be removed by cleaning.

### 3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION:

- A. Testing Agency/Project Special Inspector shall verify reinforcement, including foundation reinforcement and slab reinforcement (WWF or reinforcing bar). Agent shall verify WWF or reinforcement has been chair/placed with proper clearances.
- B. The Owner shall employ a Testing Laboratory to inspect, sample and test the materials and the production of concrete and to submit test reports. Concrete testing shall be performed by technicians certified by the Maine Concrete Technician Certification Board and/or ACI Concrete Field Testing Technician Grade I.
- C. Concrete shall be sampled and tested for quality control during placement. Quality control testing shall include the following, unless otherwise directed by the Architect.
- D. See Submittals section for report requirements.
- E. Sampling Fresh Concrete: ASTM C 172.
  1. Slump: ASTM C143; One test for each set of compressive strength test specimens. Sample shall be taken from middle third of the load per ASTM C172. A slump test must be run prior to the incorporation of the CFP fibers per recommendations of ACI 544. A slump test must be run prior to and following the addition of a water reducer (superplasticizer) per recommendations of ACI 301.
  2. Air Content: ASTM C231 "Pressure method for normal weight concrete." One test for each set of compressive strength specimens measured at point of discharge.
  3. Concrete Temperature: Per ASTM C-1064; One test each time a set of compression test specimens are made.

4. Compression Test Specimen: ASTM C31; one set of 5 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
    - a. An insulated Cure Box for specimen curing shall be supplied by Testing Agency for initial curing as defined in ACI C31.
    - b. Means of heating or cooling the Cure Box shall be provided by the Inspection Agency if required in order to maintain a temperature between 60 and 80 degrees F. Contractor shall provide an electrical source to the Testing Agency when required for temperature control.
    - c. A maximum-minimum thermometer shall be provided in the Cure Box by the Testing Agency to record the temperature range of the Cure Box during specimen curing. The Testing Agency shall record the maximum/minimum temperature of the Cure Box when transferring the specimens to the laboratory.
    - d. Test Specimens shall be moist cured.
    - e. Refer to ASTM C31 for additional requirements for Test Specimens.
  5. Compressive Strength Tests: ASTM C39; one set for each 50 cu. yds. or fraction thereof, of each concrete class placed in any one day or for each 4,000 sq. ft. of surface area placed; 1 specimen tested at 7 days, 3 specimens tested at 28 days, 1 specimen retained in reserve for later testing if required.
  6. Pumped concrete shall be tested at point of discharge per ACI 301.
- F. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods, as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

**END OF SECTION**

## SECTION 05 12 00 – STRUCTURAL STEEL

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.
- B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

#### 1.02 DESCRIPTION OF WORK:

- A. Extent of structural steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.
- B. Structural steel is that work defined in AISC “Code of Standard Practice” and as otherwise shown on drawings.

#### 1.03 RELATED WORK

- 1. Section 05 20 00 – Open Web Steel Joists
- 2. Section 05 30 00 – Metal Deck
- 3. Section 05 50 00 - Metal Fabrications

#### 1.04 QUALITY ASSURANCE:

- A. Codes and Standards: Comply with latest provisions of the following, except as otherwise indicated:
  - 1. AISC “Code of Standard Practice for Steel Buildings and Bridges”, Latest Edition.
    - a. Exclude the word “structural” in reference to the “Design Drawings” in section 3.1 of the Code.
  - 2. AISC “Specification for Structural Steel Buildings”, including “Commentary” and Supplements issued thereto.
  - 3. AISC “*Specifications for Structural Joints using ASTM A 325 or A 490 Bolts*” approved by the Research Council on Structural Connections of the Engineering Foundation.
  - 4. AISC 341, “Seismic Provisions for Steel Buildings”.



5. AWS D1.1 - "Structural Welding Code" - Steel.
  6. AWS D1.3 - "Structural Welding Code" - Sheet Steel.
  7. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use."
  8. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).
- B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS D1.1 "Standard Qualification Procedure."
1. Provide certification that welders to be employed in work have satisfactorily passed AWS D1.1 qualification tests and maintained a current certification. Current certification and/or continuity log shall be submitted and be available in the field.
  2. If re-certification of welders is required, retesting will be the Contractor's responsibility.
- C. Fabricator Qualifications:
1. Fabricator must be a member of the American Institute of Steel Construction (AISC), be certified for BU – Certified Building Fabricator. Fabricator shall be certified at time of bidding and for duration of project.

#### 1.05 SUBMITTALS

- A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with this section and Division 1.
- B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.
- C. All submittals shall be reviewed and returned to the Architect within 10 working days.
- D. INCOMPLETE SUBMITTALS WILL NOT BE REVIEWED.
- E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in Division 1 have been complied with.
- F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.

G. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.

H. Electronic Submittals:

1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.
  2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
  3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Bluebeam version 12 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
  4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.
  5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.
- I. Product Data: Submit producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
1. Structural steel certified mill reports for each grade of steel covering chemical and physical properties and yield strengths.
  2. High-strength bolts (each type), including nuts and washers.
  3. Structural steel primer paint (where applicable).
  4. Structural steel top coat paint (where applicable). (Refer to Division 9.)

5. AWS D1.1 Welder certifications.
6. Expansion/Adhesive Anchors (coordinate with section 03 30 00).
- J. Fabricator's Quality Control Procedures: Fabricator shall submit their written procedural and quality control manuals, and evidence of periodic auditing of fabrication practices by an approved inspection Agency.
- K. Fabricator's Certificate of Compliance: At completion of fabrication, fabricator shall submit a certificate of compliance stating that the work was performed in accordance with the construction documents.
- L. Shop Drawings:
  1. Shop Drawing Review: Electronic files of structural drawings will not be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings and/or Erection Drawings is prohibited. Shop drawings and/or Erection drawings created from reproduced Construction Documents will be returned without review.
    - a. Review of the shop drawings will be made for the size and arrangement of the members and strength of the connections. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility.
    - b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided and shall include; erection and piece drawings indicating all members, braced frames, moment frames and connections. Incomplete submittals will not be reviewed.
  2. Connection Design: Submit design calculations prepared and stamped by a Professional Engineer registered in the State of Maine for all beam and column connections not tabulated in the AISC "Manual of Steel Construction" (ASD or LRFD). Submit design for all building braced frames and moment frames where applicable, as indicated on design drawings. Connection designs shall be submitted prior to or with the Shop Drawing Submittal.
    - a. Fabricator and Erector are responsible to provide connections that meet the requirements of AISC standards. All shop and field welds, bolts, plates and miscellaneous components required to provide complete connection assemblies shall be provided.
    - b. Unless indicated otherwise, simple shear connections shall be provided for the full uniform load capacity of the beam for non-composite construction, and 1.5 times the full uniform load capacity of the beam for composite construction. All connections shall have a minimum of 2 bolts rows in the line of force, and no

connection capacity shall be less than 10 kips (unfactored). A tabulation of the simple shear connections shall be provided with the connection submittal.

- c. Braced frame connections: A brace force has been provided on the drawings.
  - d. Braced frame connections shall be designed utilizing the Uniform Force Method, with a connection geometry that does not induce a moment on the connected beam or column.
  - e. To the greatest extent possible and where required herewithin, welds shall be designed and detailed to be installed downhand.
  - f. Moment connections not specified, that are part of the lateral resisting system, shall be designed for  $1.1 R_y M_p$  of the beam or girder, where  $R_y$  is equal to 1.1, and shall utilize full penetration welds for the flange connections. Unless noted otherwise, moments shall be considered reversible. Design shall include all column and/or beam web stiffener and/or doubler requirements. Backing materials shall be removed and reinforcing fillet welds shall be applied as indicated in the "Execution" portion of this specification.
3. Test Reports: Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include data on type(s) of test conducted and test results.
4. Sustainability Documentation: Refer to paragraph 1.07 of this section and Division 1.

#### 1.06 DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials to site at such intervals to insure uninterrupted progress of work.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place, in ample time to not delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
- D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Steel materials shall be stored in a manner to avoid ponding of precipitation on members. Repair or replace damaged materials or structures as directed.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS:

- A. Structural Steel Shapes, Plates and Bars (U.N.O): ASTM A 36 minimum, higher strength steel is acceptable.
- B. Structural Steel Hot Rolled Wide Flange Shapes: ASTM A 992 Grade 50 (ASTM A572 Grade 50 with special requirements per AISC Technical Bulletin #3, dated March 1997)

- C. Steel Tube: ASTM A 500, Grade B,  $F_y = 46$  ksi.
- D. Steel Pipe: ASTM A 53, Grade B.
- E. Anchor Bolts: ASTM F1554, Grade 36 weldable steel, unless noted otherwise on drawings. Anchor rods that are to be exposed to weather, located in unheated enclosures, or in contact with pressure treated lumber shall be hot dipped galvanized. All anchor bolts shall be headed or double nutted. "J" or "L" type anchor bolts are not permitted. Unless otherwise noted, specified embedment it to top face of head or nut.
- F. Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular low-carbon steel bolts and nuts. Provide hexagonal heads and nuts for all connections.
- G. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
  - 1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A325 or ASTM A490. Refer to drawings for diameter.
  - 2. Direct tension indicator washers or bolts may be used at Contractor's option.
  - 3. Provide hot-dipped galvanized fasteners at relieving angles.
- H. Steel Shear Studs: Headed type manufactured from steel conforming to ASTM A108 Grade C1015 by KSM or Nelson. Refer to Drawings for diameter and length.
- I. Deformed Bar Anchors, manufactured by Nelson and attached to structural steel. Refer to drawings for diameter and length.
- J. Electrodes for Welding:
  - 1. Minimum 70 ksi electrodes. Filler material shall meet the grouping requirements per AWS D1.1 Table 3.1 for matching strength of connected materials.
  - 2. All filler metal used welding shall meet the following Charpy V-Notch (CVN) requirements.
    - a. 20 ft-lb at 0 degrees Fahrenheit unless noted otherwise.
    - b. 20 ft-lb at -20 degrees Fahrenheit and 40 ft-lb at 70 degrees Fahrenheit at all complete joint penetration (CJP) groove welds.
- K. Structural Steel Coatings shall be as specified in the Structural Steel Coatings section of this specification, and as specified in Division 9.
- L. Steel Coatings for Exterior Exposed Steel: Except where indicated to be primed and painted, Hot Dipped Galvanized per ASTM A123/A123M (latest edition). Galvanizing shall be applied in a manner to provide Class C faying surfaces for slip critical connections. See Structural Steel Coatings section for additional requirements for galvanizing and painting.

M. Non Shrink Cement-Based Grout: See Section 03 30 00

N. Drilled Anchors: Expansion and adhesive by HILTI, SIMPSON or POWERS/RAWL as indicated on the drawings.

## 2.02 FABRICATION:

A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings.

1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs and other defects.

B. Connections: Weld or bolt shop connections, as indicated.

1. Provide field bolted connections, except where welded connections or other connections are indicated.
2. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.

C. High-Strength Bolted Connection: Install high-strength threaded fasteners in accordance with AISC "Specification for Structural Joints using ASTM A 325 or A 490 Bolts". Unless otherwise indicated, all bolted connections are to be tightened to the snug tight condition as defined by AISC.

D. Welded Construction: Comply with AWS Codes for procedures, appearance and quality of welds, and methods used in correcting welding work.

E. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings.

F. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

G. Weld Access Holes at Moment Connections:

1. Weld access hole fabrication details, including but not by limitation, cutting methods and smoothness shall meet the requirements of FEMA 353, "Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications". This document is available at [www.fema.gov](http://www.fema.gov).
- H. Fabricator, Erector and General Contractor shall coordinate safety requirements for the project, in accordance with OSHA Part 1926. Provide all necessary pieces and fabrications as required to safely erect and access the structure for the duration of project construction.
- I. Camber, if any, is indicated on the drawings. Camber indicated is the required camber at time of erection. Contractor shall survey camber prior to placing metal deck.

## 2.03 STRUCTURAL STEEL COATINGS

- A. Coordinate coating requirements with the Architect, and with Division 9 of the specifications.
- B. To the greatest extent possible, structural steel coatings shall be shop applied.
- C. Coordinate steel markings with coating system to eliminate "bleed through" on steel permanently exposed to view.
- D. Galvanizing, priming and painting for structural steel permanently exposed to view shall meet the requirements of Section 10 of the Code of Standard Practice, "Architecturally Exposed Structural Steel".
- E. Provide venting/drainage holes in closed tubular members to be hot-dipped galvanized. Holes shall be provided in a location hidden from view in the final condition and in a manner that will not reduce the strength of the member. Hole locations shall be clearly indicated on the Shop Drawings and are subject to review by the Architect.
- F. Follow manufacturer's installation and safety instructions when applying coatings. Adhere to recoat time recommendations set forth by manufacturer.
- G. General: Shop priming of structural steel is not required for heated, interior steel not exposed to view unless noted otherwise.
- H. Steel which is to receive spray-on fireproofing shall not to be primed or painted, unless specified by the Architect.
- I. Coatings: All exterior steel and/or steel permanently exposed to view shall receive a coating. Unless noted otherwise, refer to Division 9 specifications for products and surface preparation requirements.

- J. Brick masonry loose lintels and relieving angle assemblies, including fasteners, shall be hot dipped galvanized, unless noted otherwise on the Architectural Drawings. Complete all shop fabrication prior to galvanizing assemblies.
- K. Unheated structural steel to be enclosed with architectural finishes, including but not by limitation, canopy members and/or roof pop-up members shall be primed with rust inhibitive mio-zinc filled primer, Tnemec Series 394 unless noted otherwise. Follow manufacturer's instructions for surface preparation and application. Substitution shall be equal to the above specified products, and shall be submitted for review.
- L. Steel Embedded in Concrete/Below Grade: Steel which is embedded in concrete, below grade/slab level, or as otherwise indicated on the drawings, shall be field painted with cold-applied asphalt emulsion complying with ASTM D 1187. Paint embedded areas only. Do not paint surfaces which are to be welded until welding is complete.
- M. Field Touch-up: Touch-up all paint and galvanizing damage, including but not by limitation, damage caused during shipping, erection, construction damage, and field welded steel. See Division 9 specifications for additional requirements.

### PART 3 - EXECUTION

#### 3.01 ERECTION:

- A. General: Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
- B. Erection Procedures: Comply with "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).
- C. Surveys: Employ a Registered Land Surveyor to verify elevations of concrete bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect and Structural Engineer. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been approved by Structural Engineer of Record. Additional surveys required to verify out-of-alignment work and/or corrective work shall be performed at the contractor's expense.
- D. Temporary Shoring and Bracing: This is the sole responsibility of the Contractor. Provide temporary shoring and bracing members with connections of sufficient strength to support imposed loads. Remove temporary members and connections when all permanent members are in place, and all final connections are made, including the floor and roof diaphragms. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds. Comply with OSHA Standard referenced previous. Retain the services of a Specialty Structural Engineer (Not the Engineer of Record) to design specialty shoring and bracing.
- E. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.



1. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
2. Welding to anchor bolts for corrective measures is strictly prohibited without prior written approval from the Engineer.

F. Setting Plates and Base Plates:

1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations. Refer to division 3 of the project Specifications for anchor bolt installation requirements in concrete.
2. Clean concrete bearing surfaces of bond-reducing materials. Clean bottom surface of setting and bearing plates.
3. Set loose and attached base plates for structural members on wedges or shims until fully grouted support is provided. If shown on drawings, anchor bolt nuts under base plates are not intended for erection support of base plate or column.
4. Pack non-shrink grout solidly between bearing surfaces and bases or leveling plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure. For proprietary grout materials, comply with manufacturer's instructions.

G. Concrete slabs that are part of elevated floors framing systems shall achieve 28-day design strength prior to the application of any superimposed loads such as curtain walls, masonry veneer, mechanical equipment and stairs. Additional testing beyond that specified in division 3 required to verify the concrete strength prior to application of superimposed loads shall be done at the Contractor's expense.

H. When installing expansion bolts or adhesive anchors, the contractor shall take measures to avoid drilling or cutting any existing reinforcement or damaging adjacent concrete. Holes shall be blown clean with compressed air and/or cleaned per manufacturer's recommendations prior to the installation of anchors.

I. Field Assembly:

1. Set structural frames accurately to lines and elevations indicated.
2. Align, adjust, level and plumb members of complete frame in to the tolerances indicated in the AISC Code of Standard Practice and in accordance with OSHA regulations.
3. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly.
4. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
5. Splice members only where indicated and accepted on shop drawings.

6. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
  7. Composite shear studs / deformed bar anchors shall be installed using stud welding process with an appropriately sized insulating ferrule. Fillet welding of shear studs is not permitted. Ferrules shall be broken free from the shear studs and removed from the deck surface along with all other debris.
- J. Tolerances: Erection tolerances shall meet the “Code of Standard Practice” except as noted. Cumulative tolerances of framing elements shall not exceed the available tolerances of façade support systems to ensure and provide a plumb façade face.
- K. Coat columns, base plates, and brace elements encased in concrete and/or below grade with cold-applied asphalt emulsion. Coordinate coating with concrete work.
- L. Erection bolts: Remove erection bolts. On exposed welded construction and at all braced frame members fill holes with plug welds and grind smooth at exposed surface.
- M. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as accepted by the Engineer of Record. Finish gas-cut sections equal to a sheared appearance when permitted.
- N. Coating Damage: Touch up shop applied paint or galvanizing whenever damaged or bare. See “Coatings” sections for additional requirements.
- O. Field Cut Beam Web Penetrations:
1. Field cut beam web penetrations are not permitted without written approval from the Structural Engineer.
  2. Gas cutting torches are not permissible for cutting beam web penetrations without written approval from the Structural Engineer.
  3. Beams with field cut beam web penetrations may require reinforcement, subject to the evaluation by the Structural Engineer.
  4. The evaluation of field cut web penetrations by the Structural Engineers for Design-Build Subcontractors, including but not by limitation, Mechanical, Electrical, Plumbing and Sprinkler Subcontractors shall be compensated by the General Contractor or Design-Build Subcontractor.
  5. The cost of executing field cut web penetrations and the associated beam reinforcement for Design-Build Subcontractors, including but not by limitation, Mechanical, Electrical, Plumbing and Sprinkler Subcontractors shall be paid for by the General Contractor or Design-Build Subcontractor.
  6. Field cut beam web penetrations may not be permitted in certain locations, subject to the

evaluation by the Structural Engineer.

- P. Welders shall have current evidence of passing and maintaining the AWS D1.1 Qualifications test available in the field.
- Q. Welding electrodes, welding process, minimum preheat and interpass temperatures shall be in accordance with AISC and AWS specifications. Any structural steel damaged in welding shall be replaced.
- R. Field Welded Moment Connections:
  - 1. Backing materials for top and bottom flanges for field welded moment connections shall be removed, backgouge the weld root, and apply a reinforcing fillet weld.
  - 2. Where top flange steel backing materials are utilized, the backing may be left in place. In this case, the backing material shall be welded with a reinforcing fillet weld.

### 3.02 QUALITY CONTROL:

- A. General: Contractor is responsible for maintaining quality control in the field and for providing a structure that is in strict compliance with the Contract Documents.
  - 1. Required inspection and testing services are intended to assist the Contractor in complying with the Contract Documents. These specified services, however, do not relieve the Contractor of his responsibility for compliance, nor are they intended to limit the Contractor's quality control efforts in the field.
- B. Testing: Owner shall engage an Independent Testing Agency to inspect all high-strength bolted and welded connections, to perform tests and prepare reports of their findings. All connections must pass these inspections prior to the installation of subsequent work which they support.
  - 1. Testing agency shall conduct tests and state in each report which specific connections were examined or tested, whether the connections comply with requirements, and specifically state any deviations therefrom.
  - 2. Contractor shall provide access for testing agency to places where structural steel work is being fabricated, produced or erected so that required inspection and testing can be accomplished. Testing agency may inspect structural steel at plant before shipment. The Engineer, however, reserves the right, at any time before final acceptance, to reject material not complying with specified requirements.
- C. Inspection Requirements (to be performed by the Independent Testing Agency):
  - 1. Bolted Connections: Inspect all bolted connections in accordance with procedures outlined in the AISC "Specification for Structural Joints using ASTM A325 or A490 Bolts.
  - 2. Snug Tight Bolted Connections:

- a. The inspector shall monitor the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is used to tighten all bolts.
  - b. If the inspector does not monitor the installation of bolts, he shall visually inspect the connection to determine that all plies of connected material have been drawn together and conduct tests on a sampling connection bolts to determine if they have been tightened to the snug tight condition. The test sample shall consist of 10% of the bolts in the connection, but not less than two bolts, selected at random. If more than 10% of the tested bolts fail the initial inspection, the engineer reserves the right to increase the number of bolts tested.
3. Slip Critical Bolted Connections:
  - a. The inspector shall monitor the calibration of torquing equipment and the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is used to tighten all bolts.
  - b. If the inspector does not monitor the calibration or installation procedures, he shall test all bolts in the affected connection using a manual torque wrench to assure that the required pretension has been reached.
4. Field Welded Connections: inspect and test during fabrication of structural steel assemblies, and during erection of structural steel all welded connections in accordance with procedures outline in AWS D1.1. Record types and location of defects found in work. Record work required and performed to correct deficiencies.
  - a. Certify welders and conduct inspections and tests as required. Submit welder certifications to Engineer of Record. Perform visual inspection of all welds. Primary and secondary welds, including fillet welds, full penetration welds, and deck puddle welds, applied in the field and/or shop, shall be visually inspected.
  - b. Welds deemed questionable by visual inspection shall receive non-destructive testing. In addition, all partial and full penetration welds, and any other welds indicated on the drawings are to receive non-destructive testing. Non-destructive testing methods include the following:
    1. Radiographic Inspection (RT): ASTM E 94 and ASTM E 142; minimum quality level "2-2T".
    2. Ultrasonic Inspection (UT): ASTM E 164.
    3. Magnetic Particle (MT) inspection procedures may be utilized at the inspectors discretion in addition to RT or UT inspection. MT procedures shall not replace RT or UT procedures without permission from the Structural Engineer.

- c. All welds deemed unacceptable shall be repaired and retested at the Contractor's expense.

D. Composite Shear Studs/Deformed Bar Anchors:

1. Verify shear stud quantity and arrangement.
  2. Visually inspect stud weld. A weld less than 360 degrees is cause for further testing by bending to 15 degrees per item 2 below. Strike all studs with a 3 pound sledge hammer with moderate force. Studs shall make a ringing sound when struck with the hammer. If a stud or studs breaks free, or fails to make a ringing sound, further testing shall be performed per item 4.
  3. One stud in 100 shall be tested by bending to 15 degrees from vertical, and one stud in 200 shall be tested by bending to 30 degrees from vertical. Single bent studs may be left bent. Failure of stud weld during bend testing is cause for further testing per item 4.
  4. When failure occurs during bend testing, additional bend testing shall be performed on 10 studs to either side of failed stud. Bend studs to 30 degrees from vertical. If failure occurs during additional testing, continue testing in series of 10 studs beyond failed stud until no failure occurs.
  5. Straighten all studs that were bent in multiple stud testing. Replace all studs that fail.
- E. Inspector shall verify that all ferrules are removed when applicable and that metal deck is free of debris prior to concrete placement.
- F. Testing and inspection reports shall be submitted to the Owner, Architect and Engineer within 48 hours of completion of each test or inspection.
- G. Nonconforming Work: Contractor shall be responsible for correcting deficiencies in structural steel work which inspections laboratory test reports have indicated to be not in compliance with requirements. Additional tests and/or surveys shall be performed, at the Contractor's expense, as may be necessary to show compliance of corrected work. Any costs associated with the Engineer's review and disposition of faulty works shall be borne by the Contractor.

**END OF SECTION**

## SECTION 05 20 00 – OPEN WEB STEEL JOISTS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS:

- A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.
- B. Examine all other sections of the Specifications for requirements which affect work of this section whether or not such work is specifically mentioned in this section.
- C. Coordinate work with that of all trades affecting or affected by work of this section. Cooperate with such trades to assure the steady progress of all work under the Contract.

#### 1.02 DESCRIPTION OF WORK:

- A. Extent of steel joists is shown on drawings, including basic layout and type of joists required.
- B. Related work specified elsewhere:
  1. Section 05 12 00 - Structural Steel
  2. Section 05 30 00 - Metal Decking
  3. Section 05 50 00 - Metal Fabrications

#### 1.03 QUALITY ASSURANCE:

- A. Codes and Standards:
  1. Steel Joist Institute (SJI) Standard Specifications, Load Tables and Weight Tables-latest revisions-for:
    - a. K-Series Open Web Steel Joists as designated on the Contract Drawings.
  2. Steel Joist Institute (SJI) Recommended Code of Standard Practice for Steel Joists and Joist Girders, latest revision.
  3. AWS D1.1 "Structural Welding Code" – Steel
  4. AWS D1.3 "Structural Welding Code" - Sheet Steel
  5. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

- B. Qualification for Welding Work: Qualify welding processes and welding operators in accordance with AWS D1.1 "Standard Qualification Procedure".
1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
  2. If recertification of welders is required, retesting will be the Contractor's responsibility.

1.04 SUBMITTALS:

- A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with this section and Division 1.
- B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.
- C. All submittals shall be reviewed and returned to the Architect within 10 working days.
- D. Incomplete submittals will not be reviewed.
- E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in Division 1 have been complied with.
- F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.
- G. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.
- H. Electronic Submittals:
  1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.
  2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.

3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Bluebeam version 12 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
  4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.
  5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.
- I. Product Data: Submit manufacturer's specifications and installation instructions for each type of joist and accessories. Include manufacturer's certification that joists comply with SJI Standard Specifications. Product data shall include:
1. Joist steel component certified mill reports for each grade of steel covering chemical and physical properties and yield strengths.
  2. Steel joist primer paint.
  3. Welder certifications
- J. Shop Drawings:
1. Shop Drawing Review: Electronic files of structural drawings will not be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings and/or Erection Drawings is prohibited. Shop drawings and/or Erection drawings created from reproduced Construction Documents will be returned without review.
    - a. Review of the shop drawings will be made for the size and arrangement of the members and strength of the connections. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility.
    - b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided and shall include; erection and piece drawings indicating all joist members, bridging, connections and accessories. Incomplete submittals will not be reviewed.
  2. Design



- a. Unless noted otherwise, steel joists shall be designed to support the uniformly distributed loads per the "Standard Load Tables" by the Steel Joist Institute. An allowance for MEP equipment and architectural component loads has been included in the uniformly distributed design loads. The joist design shall allow a 150 pound concentrated hanger load be applied at any location along either the top or bottom chord of the joists that is part of the MEP equipment and architectural component allowance, without additional reinforcement.
  - b. Calculations for SP joists: Submit design calculations for special steel joists indicated on Contract Drawings by SP designation, Joist Girders or as otherwise noted. Submit calculations stamped by a Registered Professional Engineer licensed to practice in the State of Maine. Design joists for the loads indicated on the Contract Drawings with a vertical deflection due to live load not exceeding: 1/360 of the span for floor joists, 1/360 of the span for roof joists where plaster ceiling is attached or suspended, and 1/240 of the span for all other roof joists. Concentrated loads applied to SP joists are to be applied as Live Loads unless otherwise indicated.
3. Evidence of in-plant inspections: Per SJI requirements, each manufacturer shall verify his ability to manufacturer steel joists through periodic in-plant inspections. Inspections shall be performed by an independent testing agency. Submit evidence of participation in SJI in-plant inspections program.
  4. Test Reports: Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include data on type(s) of test conducted and test results.
  5. Sustainability Documentation: Refer to paragraph 1.06 of this section and Division 1.

#### 1.05 DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials to site at such intervals to insure uninterrupted progress of work.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
- C. Deliver, store and handle steel joists as recommended in SJI Standard Specifications and SJI Technical Digest #9 "Handling and Erection of Steel Joists and Joist Girders". Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Handle and store joists in a manner to avoid deforming members and to avoid excessive stresses. Protect joist members and packaged materials from corrosion and deterioration.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS:

- A. Steel: Comply with SJI Standard Specifications.

- B. Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular hexagon type, low carbon steel
- C. High-Strength Bolts and Nuts: ASTM A325, Type I, heavy hex structural bolts, heavy hex nuts and hardened steel washers.
- D. Steel Primer Paint: Manufacturer's standard shop paint conforming to Steel Structures Painting Council Specification: SSPC-Paint 15 "Steel Joist Shop Primer", or a shop paint which meets the minimum performance requirements of SSPC-Paint 15.

2.02 FABRICATION:

- A. General: Fabricate steel joists in accordance with SJI Standard Specifications.
- B. Holes in Chord Members: Provide holes in chord members where shown for securing other work to steel joists; deduct area of holes from the area of chord when calculating strength of member.
- C. Openings in Web: Coordinate openings in joist and joist girder webs to allow through passage of HVAC, sprinklers, etc. in locations shown on the drawings.
- D. Extended Ends: Provide extended ends on joists where shown and where deck extends beyond supports, complying with manufacturer's standards and requirements of applicable SJI Standard Specifications and Load Tables. Unless noted otherwise, "R" type extended ends shall be utilized.
- E. Uplift: Roof joists shall be designed for a net uplift of 15 psf.
- F. Camber: Camber in accordance with SJI Standard Specifications. Joists shall not be manufactured with negative camber.
- G. Bridging:
  - 1. Provide horizontal or diagonal type bridging for "open web" joists, complying with SJI Standard Specifications and any additional requirements shown on Contract Drawings. Bridging layout shall be clearly indicated on the shop drawings.
  - 2. Provide bridging anchors for ends of bridging lines terminating at walls or beams.
  - 3. Provide bottom chord bridging for uplift, in accordance with SJI Standard Specifications, and SJI Technical Digest #6 "Structural Design of Steel Roof Joists to Resist Uplift Loads" when the above noted uplift load is greater than zero.
- H. End Anchorage: Provide end anchorages to secure joists to adjacent construction, complying with SJI Standard Specifications, unless otherwise indicated. Roof joists shall be anchored to resist the above noted uplift force.

1. Minimum final connection each side of joist seat, unless noted otherwise, shall be as follows:

- a. "K" Joists: 2 inches, 1/8" fillet weld or (2) 1/2" diameter A307 Bolts

I. Shop Painting:

1. Remove loose scale, heavy rust and other foreign materials from fabricated joists and accessories before application of shop paint in accordance with SSPC-SP 1 and SSPC-SP 2.
2. Apply one shop coat of primer paint, SSPC-Paint 15, or better, to steel joists 2.0 to 3.0 mils DFT (dry film thickness) measurement in accordance with SSPC-PA 2.

PART 3 - EXECUTION

3.01 ERECTION:

- A. General: Place and secure steel joists in accordance with SJI Standard Specifications, final shop drawings, and as herein specified. Comply with "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).
- B. Placing Joists:
  1. Do not start placement of steel joists until supporting work is in place and secured.
  2. Place joists on supporting work, adjust and align in accurate location and spacing before permanently fastening.
  3. Provide temporary bridging, connections and anchors to ensure lateral stability during construction.
- C. Bridging: Install bridging simultaneously with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.
- D. Fastening:
  1. Joist at column lines shall be bolted with a minimum (2) 3/4" diameter A325 bolts in a slip critical type connection. Stabilizer plates welded to the columns shall be provided at the bottom chord angles at all column lines. Do not weld bottom chord angles to stabilizer plate unless noted otherwise.
  2. Field weld joists to supporting steel framework in accordance with SJI Standard Specifications for type of joists used. Coordinate welding sequence and procedure with placing of joists.

3. Bolt joists to supporting steel framework in accordance with SJI Standard Specifications for type of joists used.
- E. Reinforcement for Concentrated Loads: Reinforcing angles shall be applied for concentrated loads in excess of 150 pounds applied to joists. The reinforcing angles shall transfer the concentrated loads to a joist panel point. Unless noted otherwise, hung elements shall be attached to the joist top chords. Hangers and hanger accessories shall be designed by a Specialty Structural Engineer Registered in the State of Maine (Not the Engineer of Record).
- F. Touch-up painting: Clean field welds, bolted connections, and abraded areas, and apply same type of primer paint as used in shop.

### 3.02 QUALITY CONTROL:

- A. General: Contractor is responsible for maintaining quality control in the field and for providing a structure that is in strict compliance with the Contract Documents.
- B. Required inspection and testing services are intended to assist the Contractor in complying with the Contract Documents. These specified services, however, do not relieve the Contractor of his responsibility for compliance, nor are they intended to limit the Contractor's quality control efforts in the field.
- C. Testing: Owner shall engage an Independent Testing Agency to inspect all puddle welded connections, to perform tests and prepare reports of their findings. All connections must pass these inspections prior to the installation of subsequent work which they support.
- D. Joist Inspection Requirements (to be performed by the Independent Testing Agency):
- E. Testing:
  1. Joist connections, bringing connections and field splices shall be tested as indicated in specification section 05120. Work found to be defective will be removed and replaced at the Contractor's expense.
  2. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests. If re-certification of welders is required, re-testing will be the Contractor's responsibility.

**END OF SECTION**

## SECTION 05 30 00 – METAL DECKING

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.
- B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

#### 1.02 DESCRIPTION OF WORK

- A. Extent of roof deck is shown on the drawings and includes roof deck, welding washers and sump plates or pans.

#### 1.03 RELATED WORK

- 1. Section 05 12 00 - Structural Steel
- 2. Section 05 20 00 – Open Web Steel Joists
- 3. Section 05 50 00 - Metal Fabrications

#### 1.04 QUALITY STANDARDS

- A. Codes and Standards: Comply with provisions of the following codes and standards, except where more stringent requirements are indicated or specified:
  - 1. AISI "Specification for the Design of Cold Formed Steel Structural Members".
  - 2. AWS D1.1 "Structural Welding Code" - Steel
  - 3. AWS D1.3 "Structural Welding Code" - Sheet Steel
  - 4. Steel Deck Institute (SDI) "Design Manual for Floor Decks and Roof Decks".
  - 5. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).
- B. Qualification of field welding: Qualify welding process and welding operators in accordance with AWS D1.1 "Standard Qualification Procedure."

#### 1.05 SUBMITTALS

- A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with this section and Division 1.
- B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.
- C. All submittals shall be reviewed and returned to the Architect within 10 working days.
- D. Incomplete submittals will not be reviewed.
- E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in Division 1 have been complied with.
- F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.
- G. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.
- H. Electronic Submittals:
  - 1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.
  - 2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
  - 3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Bluebeam version 12 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
  - 4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.

5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.
- I. Product Data: Submit manufacturer's specifications and installation instructions for each type of decking and accessories. Include manufacturer's certification as may be required to show compliance with these specifications.
- J. Sustainability Documentation: Refer to paragraph 1.06 of this section and Division 1.
- K. Shop Drawings:
  1. Shop Drawing Review: Electronic files of structural drawings **will not** be provided to the contractor for preparation of shop drawings.
    - a. Submit detailed drawings showing layout and types of deck panels, galvanizing, shop paint, anchorage details, and conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing, and all other accessories. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility.
    - b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided and shall include; erection and piece drawings. Incomplete submittals will not be reviewed.

## PART 2 - PRODUCTS

### 2.01 GENERAL:

- A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
  1. United Steel Deck
  2. Wheeling Corrugating Co.
  3. Epic Metals Corporation
  4. Vulcraft
- B. Materials:
  1. Steel for Metal Deck Units:
    - a. Floor Deck Units: ASTM A653, Structural Quality, grade 40 or higher
    - b. Roof Deck Units: ASTM A653, Structural Quality, grade 33 or higher.

2. Miscellaneous Steel Shapes: ASTM A36 minimum.
3. Sheet metal Accessories: ASTM A526, commercial quality, galvanized.
- C. Galvanizing: Conform to ASTM 924-94 with minimum coating class of G60 (Z180) as defined in ASTM A653-94.
- D. Paint: Manufacturer's baked on, rust inhibitive paint, for application to metal surfaces which have been chemically cleaned and phosphate chemical treated.
- E. Flexible closure Strips: Manufacturer standard vulcanized, closed-cell, synthetic rubber.

## 2.02 FABRICATION:

- A. General: Form deck units in lengths to span 3 or more supports, unless otherwise noted on the drawings, with flush, telescoped or nested 2" laps at ends and interlocking or nested side laps, unless otherwise indicated. For roof deck units, provide deck configurations complying with SDI "Roof Deck Specifications," of metal thickness, depth and width as shown.
- B. Metal Cover Plates: Fabricate metal cover plates for end-abutting floor deck units of not less than same thickness as decking. Form to match contour of deck units and approximately 6" wide.
- C. Metal Closure Strips: Fabricate metal closure strips, cell closures, "Z" closures, column closures, pour stops, girder fillers and openings between decking and other construction, of not less than 0.045" min. (18 gage) sheet steel or as indicated on the drawings. Form to provide tight fitting closures at open ends of cells or flutes and sides of decking.
- D. Pour Stops: Minimum material thickness shall be 18 gage or as indicate on drawings.. Fabricate vertical leg to accommodate specified slab thickness. Fabricate horizontal leg to minimize field cuts. Provide welded attachment sufficient to resist forces during concrete placement.
- E. Roof Sump Pans: Fabricate from a single piece of 0.071" min. (14 gage) galvanized sheet steel with level bottoms and sloping sides to direct water flow to the drains, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3" wide. Recess pans not less than 1 1/2" below roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains will be cut in the field.
- F. Provide all pour stops and accessories necessary to contain concrete for poured concrete surfaces.

## PART 3 EXECUTION

### 3.01 INSTALLATION:

- A. Install deck units and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein.



- B. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before permanently fastened. Deck shall be in full contact with members parallel to ribs and attached as indicated. Do not stretch or contact side lap interlocks.
- C. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.
- D. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.
- E. Coordinate and cooperate with the structural steel erector in locating decking bundles to prevent overloading of structural members.
- F. Do not use decking units for storage or working platforms until permanently installed.

3.02 FASTENING:

- A. Roof Deck: Each deck is to be fastened with a minimum of 5/8" diameter puddle welds spaced in a 36/7 pattern (1.5B/BA deck) with a minimum of 2 welds per unit at each support if incomplete sheet is utilized. Where support is parallel to support, at edge of building, at brace lines, at edge of opening or deck discontinuity provide puddle welds at 6" o.c. Secure deck to each supporting member in ribs where sidelaps occur. Deck units shall bear over the ends of supports by a minimum of 1.5". Sidelaps: #10 Tek screws, 6 per span.
- B. Welding: Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
- C. Uplift loading: Floor deck units are not required to resist uplift loads. Decking units used at the roof level shall be designed for a net uplift of 15 psf.
- D. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking.
- E. Reinforcement at openings: Provide additional metal reinforcement and closures pieces as required for strength, continuity of decking and support of other work shown.
  - 1. Deck penetrations affecting no more than (1) deck rib need not be reinforced.
  - 2. For deck penetration affecting more than (1) deck rib, but less than 10", reinforce the opening with a 0.057" thick plate spanning between unaffected ribs, unless otherwise shown on the Design Drawings or supporting a piece of mechanical equipment (see item 3).
  - 3. Reinforce deck penetrations larger than 10" with the structural frame described in the Design Drawings.
- F. Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units.

- G. Roof Sump Pans: Place over openings provided in roof decking and weld to top decking surface. Space welds not more than 12" on center with at least 1 weld in each corner. Cut opening in roof sump bottom to accommodate drain size indicated.
- H. Closure Strips: Provide metal closure strips at open uncovered ends and edges of roof decking, and in voids between decking and other construction. Weld into position to provide a complete decking installation.
- I. Touch-Up Painting:
  - 1. Painted Deck: After decking installation, wire brush, clean and paint scarred areas, welds and rust spots on top and bottom surfaces of decking units and supporting steel members.
    - a. Touch up painted surfaces with same type paint used on adjacent surfaces.
    - b. In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.

### 3.03 QUALITY CONTROL:

- A. General: Contractor is responsible for maintaining quality control in the field and for providing a structure that is in strict compliance with the Contract Documents.
- B. Required inspection and testing services are intended to assist the Contractor in complying with the Contract Documents. These specified services, however, do not relieve the Contractor of his responsibility for compliance, nor are they intended to limit the Contractor's quality control efforts in the field.
- C. Testing: Owner shall engage an Independent Testing Agency to inspect all puddle welded connections, to perform tests and prepare reports of their findings. All connections must pass these inspections prior to the installation of subsequent work which they support.
- D. Deck Testing Requirements (to be performed by the Independent Testing Agency):
  - 1. Deck and accessory welding and/or attachments subject to inspection and testing. Work found to be defective will be removed and replaced at the Contractor's expense.
  - 2. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests. If re-certification of welders is required, re-testing will be the Contractor's responsibility.

END OF SECTION

## SECTION 05 40 00 – EXTERIOR COLD FORMED METAL FRAMING

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.
- B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

#### 1.02 DESCRIPTION OF THE WORK

- A. Work specified within this Section includes, but is not necessarily limited to, the following:
  - 1. Provide and install steel stud structural framing system at exterior walls as noted on the Drawings.
  - 2. Providing and installing miscellaneous fasteners, hat channels, stiffeners, bridging, expansion joints, and accessories necessary to complete the work.
- B. Related work specified elsewhere:
  - 1. Interior Partition Walls: Division 9
  - 2. Exterior Gypsum Sheathing: Division 9

#### 1.03 QUALITY ASSURANCE

- A. Materials and installation shall conform to recommendations of the following publications:
  - 1. American Iron and Steel Institute Cold-Formed Steel Design Manual, *"Specification for the Design of Cold-Formed Steel Structural Members"*.
  - 2. AWS D1.1 "Structural Welding Code" - Steel.
  - 3. AWS D1.3 "Structural Welding Code" - Sheet Steel.
  - 4. ASTM C 954, Standard specification for steel drill screws for the application of gypsum board or metal plaster bases to steel studs from 0.033 in. to 0.112 in. thickness.
  - 5. ASTM C 955, Standard Specification for Load-Bearing Steel Studs, Runners, and Bracing or Bridging, for Screw Application of Gypsum Board and Metal Plaster Bases.

6. ASTM C 1007 Standard Specification for installation of load bearing steel studs and related accessories.
  7. Standard Specification for installation of load bearing steel studs and related accessories.
  8. ASCE 7-10, "Minimum Design Loads for Building and Other Structures."
  9. International Building Code, 2015 Edition.
  10. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).
- B. Maximum Allowable Deflections: Deflection limitations, (either horizontal or vertical), include the effect of cold formed framing only, not sheathing or facing material. Spans are measured in inches between the attachments to structural steel or concrete.
1. Studs supporting Masonry or Brick Veneer:  $1/600$  of span or 0.3 inches
  2. Studs supporting Siding:  $1/360$  of span
  3. Roof overframing:  $1/240$  of span,  $2/240$  for cantilevered framing.
- C. Design wind pressures: Design wind pressures calculated in accordance with ASCE 7-10, for Components and Cladding, shall be used in the design of the exterior cold formed steel framing system. Utilize wind speed, importance factor and exposure indicated on the project General Notes.
- D. Design snow loads: Design snow loads as indicated on the Drawings.
- E. Slip Track Tolerances: Where non-bearing light gage framing abuts the structure, provide a slip joint capable of accommodating the vertical movement of the structure. Slip joint gaps shall allow for  $3/4$ " Live Load deflection of the supporting member. Minimum depth of slip track shall be 2". Minimum thickness shall be 14 gage. Slide clips are also acceptable where applicable.

#### 1.04 SUBMITTALS

- A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with this section and Division 1.
- B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.
- C. All submittals shall be reviewed and returned to the Architect within 10 working days.
- D. Incomplete submittals will not be reviewed.

- E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in Division 1 have been complied with.
- F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.
- G. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.
- H. Electronic Submittals:
  - 1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.
  - 2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
  - 3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Bluebeam version 12 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
  - 4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.
  - 5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.
- I. Product Data: Submit Manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications.
  - 1. Steel framing members
  - 2. Anchors and anchor bolts

3. Self drilling screws

J. Shop Drawings:

1. Shop Drawing Review: Electronic files of structural drawings **will not** be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings and/or Erection Drawings is prohibited. Shop drawings and/or Erection drawings created from reproduced Construction Documents will be returned without review.
  2. General: Submit shop drawings showing the following:
    - a. Stud and roof overframing gages and spacings.
    - b. Sizes, gages and fastenings for all built-up members including but not limited to headers and jambs.
    - c. Shop Coatings
    - d. Type, size, quantity, locations and spacings of all anchorages and self drilling screws.
    - e. Details of attachment to structure and adjacent work
    - f. Supplemental strapping, bracing, splices, bridging, hat channels and other accessories required for proper installation.
    - g. Critical installation procedures.
  3. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility.
  4. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided and shall include; erection and piece drawings. **Incomplete submittals will not be reviewed.**
- K. Design calculations shall be prepared by a Professional Engineer (Specialty Engineer) registered in the State of Maine, illustrating the design of exterior steel stud wall and roof overframing systems including all all necessary stiffeners and bracing connections and anchorage required for a complete structural system.
- L. The Specialty Engineer shall design the attachments of veneer and siding elements, such that pull out loads under wind or seismic loads will not be exceeded. Coordinate this design with other specification sections, including Unit Masonry and Precast Concrete.

M. Professional Engineer responsible for design of cold formed framing shall review the installation and submit a correspondence indicating compliance with the design. Review shall include all work. Any discrepancies noted shall be corrected and reviewed by the Engineer prior to the submittal of the correspondence.

N. Sustainability Documentation: Refer to paragraph 1.06 of this section and Division 1.

#### 1.05 DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials to site at such intervals to insure uninterrupted progress of work.
- B. Deliver anchorage devices, which are to be embedded in cast-in-place, in ample time to not delay work.
- C. Store materials to permit easy access for inspection and identification. Keep cold formed members off ground, using pallets, platforms, or other supports. Protect cold formed members and packaged materials from corrosion and deterioration.
- D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Materials shall be stored in a manner to avoid ponding of precipitation on members. Repair or replace damaged materials or structures as directed.

### PART 2 - PRODUCTS

#### 2.01 FRAMING MEMBERS

##### A. Steel Studs:

- 1. Acceptable manufacturers: Manufacturer shall be a member of the Steel Stud Manufacturers Association.
- 2. Minimum stud shall be 8", 18 gage with 1.625" flange.
- 3. Maximum Spacing: 16 inches, on-center.
- 4. Minimum studs indicated have not been engineered, but are provided as a general guideline. Engineering of studs is the responsibility of the Specialty Design Engineer referenced in the Submittals Section, and not the Engineer of Record nor the Architect of Record. Any exterior stud size, gage, spacing, bracing and connection information shown on the Contract Documents is schematic only. The Contractor shall provide the studs and built-up sections, engineered by the Specialty Engineer. If studs of a thicker gage or lesser spacing are required by the Specialty Engineer's design, the studs shall be provided at no additional cost to the Owner.
- 5. Provide channel-shaped load-bearing studs, channel-shaped joists, runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, stiffeners, fasteners, and other accessories recommended by manufacturer for complete framing system

6. Steel framing materials shall comply with ASTM A 446, A 570, or A 611, as applicable. Fabricate all components from structural quality sheet steel with the following minimum yield points:
    - a. 16 ga. and heavier 50,000 psi
    - b. 18 ga., 33,000 psi
    - c. 20 ga., 33,000 psi (permitted for bottom track only).
  7. Manufacture of studs, runners (track), and other framing members shall comply with ASTM C 955.
  8. Framing components shall be galvanized per ASTM A 525, minimum G-60 coating.
- B. Screws and other attachment devices:
1. Provide a protective cadmium or zinc plated coating and comply with ASTM A 165 type NS.
  2. Self-drilling screws shall comply with the Industrial Fastener Institute Standard for steel self-drilling and tapping screws (IFI-113).
  3. Penetration through jointed materials shall not be less than three (3) exposed threads.
- C. Standard Steel Shapes: Standard steel shapes, plates, etc. shall conform to material and finish specifications in Division 5 -Miscellaneous Metals.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Product Storage: Store studs, joists, track etc. on a flat plane. Material damaged (i.e. rusted, dented, bent or twisted) shall be discarded. Protect adhesives and sealants from freezing.
- B. Construction Methods: Construction may be either piece-by-piece (stick-built), or by fabrication into panels either on or off site.
- C. Material Fit up: All framing components shall be cut squarely or at an angle to fit squarely against abutting members. Members shall be held firmly in position until properly fastened. Prefabricated panels, if used, shall be square and braced against racking. Provide blocking and strapping within 12" of slip joint and at 8'-0" o.c., or as required for member bracing.
- D. Attachment: Components shall be joined by self-drilling screws, so that connection meets or exceeds required design loads. Wire tying of framing components will not be permitted. Field welding will be permitted only where shown on the drawings.



- E. Anchorage to Structure: Securely anchor studs and track to floor construction and overhead structure. Provide fasteners at a maximum of 16" on center. Provide slip joints where non-bearing vertical studs meet floor or roof structural steel, or as indicated on the drawings. Provide sill sealer beneath all floor tracks.
- F. Welding: Shop and field welds shall conform to applicable AWS and AISI standards, and may be fillet, plug, butt or seam type. Touch-up damage to galvanizing caused by welding with zinc-rich paint.
- G. Openings: Frame openings larger than 2 ft. square with double studs. Provide suitable reinforcements (double studs, headers, jack studs, cripples, bracing, etc.) at control joint intersections, corners, and other special conditions.
- H. Lintels: Lintels supporting masonry veneer shall be secured to studs by screws or power-driven anchors. Method of anchorage shall be sufficient to support veneer with a factor of safety of 3.0.
- I. Bridging/Bracing: Provide horizontal strap bracing for all walls. Minimum requirements are as follows: Horizontal bracing shall be continuous 20 gage x 1 1/2" wide steel straps on each face of the stud, located at 4'-0" maximum for the full height of the wall. Provide CR runner solid bridging at 8'-0" for the full height of the wall at each line of bracing. An additional row of bracing shall be provide within 12 inches of the slip joint.
- J. Tolerances: Finished installation shall be level and plumb within a tolerance of 1/8 inch in 10 feet horizontally and vertically. Maximum deviation from plan or section dimension shall not exceed 1/8 inch. Spacing of studs shall not be more than 1/8 inch from design spacing, providing that cumulative error does not exceed requirements of finishing materials.

**END OF SECTION**

**SECTION 06 10 00**  
**ROUGH CARPENTRY**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Rooftop equipment bases and support curbs.
  - 2. Wood blocking, furring and nailers.
  - 3. Plywood backing panels.
- B. Related Requirements:
  - 1. Section 06 16 00 - Sheathing for sheathing, subflooring, and underlayment.

**1.2 DEFINITIONS**

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated 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 fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
  - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

**1.4 DELIVERY, STORAGE, AND HANDLING**

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

## **PART 2 - PRODUCTS**

### **2.1 WOOD PRODUCTS, GENERAL**

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

### **2.2 WOOD-PRESERVATIVE-TREATED MATERIALS**

- C. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
  - 2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- D. 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.
- E. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- F. Application: Treat items indicated on Drawings.

### **2.2 MISCELLANEOUS LUMBER**

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Rooftop equipment bases and support curbs.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and the following species:
  - 1. Hem-fir (north); NLGA.
  - 2. Mixed southern pine; SPIB.
  - 3. Spruce-pine-fir; NLGA.

- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used if it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.
- F. Where plywood blocking is indicated, provide 5/8-inch-thick plywood.

### **2.3 PLYWOOD BACKING PANELS**

- A. Equipment Backing Panels: DOC PS 1, Exterior, C-C Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

### **2.4 FASTENERS**

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Screws for Fastening to Metal Framing: ASTM C 1002 or ASTM C 954, length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Chemical anchor or expansion anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
  - 1. Material for Interior Locations: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

### **2.5 ACCESSORIES**

- A. Membrane Strip Flashing: Refer to Section 07 27 00 – Air Barriers for flashing material.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking and similar supports to comply with requirements for attaching other construction.
- B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- C. Do not splice structural members between supports unless otherwise indicated.
- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- F. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- G. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
  - 2. ICC-ES evaluation report for fastener.
- H. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

### **3.2 WOOD BLOCKING AND NAILER INSTALLATION**

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Where wood-preservative-treated lumber is installed onto metal decking, install continuous membrane strip flashing separator between wood and metal decking.

- D. Where wood-preservative-treated lumber is installed onto concrete masonry units, install continuous membrane strip flashing separator between wood and concrete masonry units.

**END OF SECTION**

## **SECTION 06 16 00**

### **SHEATHING**

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

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Wall sheathing.
  - 2. Parapet sheathing.
- B. Related Requirements:
  - 1. Section 06 10 00 - Rough Carpentry for plywood backing panels.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

##### **1.3 INFORMATIONAL SUBMITTALS**

- A. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.

##### **1.4 DELIVERY, STORAGE, AND HANDLING**

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

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

##### **2.1 WOOD PANEL PRODUCTS**

- A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- B. Factory mark panels to indicate compliance with applicable standard.
- C. Adhesives: formaldehyde-free or phenol-formaldehyde.

##### **2.2 WALL SHEATHING**

- A. Plywood Sheathing (at fiber-cement siding assembly): APA rated, Exposure 1 sheathing.
  - 1. Span Rating: Not less than 32/16.
  - 2. Nominal Thickness: Not less than 1/2 inch.

## **2.3 PARAPET SHEATHING**

- A. Plywood Sheathing: APA rated, Exposure 1 sheathing.
  - 1. Span Rating: Not less than 32/16.
  - 2. Nominal Thickness: Not less than 1/2 inch.

## **2.4 FASTENERS**

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. For roof parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.
- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
  - 2. ICC-ES evaluation report for fastener.
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate parapet 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.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.



- G. 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 WOOD STRUCTURAL PANEL INSTALLATION**

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Wall and Parapet Sheathing:
    - a. Nail to wood framing.
    - b. Screw to cold-formed metal framing.
    - c. Space panels 1/8 inch apart at edges and ends.

**END OF SECTION**

## **SECTION 06 20 23**

### **INTERIOR FINISH CARPENTRY**

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

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Interior trim.
  - 2. Shelving.
- B. Related Requirements:
  - 1. Section 06 10 00 - Rough Carpentry for furring, blocking, and other carpentry work not exposed to view.
  - 2. Section 09 91 00 - Painting for priming and backpriming of interior finish carpentry.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
  - 1. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
- B. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

##### **1.3 INFORMATIONAL SUBMITTALS**

- A. Evaluation Reports: For fire-retardant-treated wood, from ICC-ES.
- B. Sample Warranty: For manufacturer's warranty.

##### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Stack lumber and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
- B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

## **1.5 FIELD CONDITIONS**

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
  - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS, GENERAL**

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's Board of Review. Grade lumber by an agency certified by the American Lumber Standard Committee's Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.
- B. Particleboard: ANSI A208.1, Grade M-2 or Grade M-2-Exterior Glue, where indicated.

### **2.2 INTERIOR TRIM**

- A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish) (WD-1):
  - 1. Species and Grade: Ash; Clear; NHLA.
  - 2. Finger Jointing: Not allowed.
  - 3. Gluing for Width: Use for lumber trim wider than 6 inches.
  - 4. Face Surface: Surfaced (smooth).
  - 5. Matching: Selected for compatible grain and color.

### **2.3 OPEN WALL SHELVING**

- A. Thermoset Decorative Overlay (melamine) shelves with 3 mm PVC edging, 3/4 inch thick unless noted otherwise.
- B. Wall Brackets: Knap & Vogt No. 182, twin slotted standards with No. 82 heavy-duty U- Brackets. Color as selected by Architect.

## **2.4 MISCELLANEOUS MATERIALS**

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
- B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
- C. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

## **2.5 FABRICATION**

- A. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## **3.2 PREPARATION**

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

## **3.3 INSTALLATION, GENERAL**

- A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
  - 1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
  - 2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

### **3.4 STANDING AND RUNNING TRIM INSTALLATION**

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full- surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
  1. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
  2. Install trim after gypsum-board joint finishing operations are completed.
  3. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

### **3.5 OPEN WALL SHELVING INSTALLATION**

- A. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners not more than 12 inches o.c.
- B. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on cleats, brackets, and supports.
  1. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.

### **3.6 ADJUSTING**

- A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

### **3.7 CLEANING**

- A. Clean interior finish carpentry on exposed and semiexposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes if any.

### **3.8 PROTECTION**

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
  1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

**END OF SECTION**

## **SECTION 06 40 23**

### **INTERIOR ARCHITECTURAL WOODWORK**

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

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Plastic-laminate countertops.
  - 2. Cabinet frame.
  - 3. Cabinet accessories and hardware.
  - 4. Shop finishing of interior woodwork.
- B. Related Sections include the following:
  - 1. Division 06 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

##### **1.2 DEFINITIONS**

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

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

- A. Product Data: For panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, cabinet hardware and accessories, 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.
  - 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 plumbing fixtures and other items installed in architectural woodwork.
  - 4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
- C. Samples for Initial Selection:
  - 1. Shop-applied transparent finishes.
  - 2. Plastic laminates.
  - 3. PVC edge material.

4. Thermoset decorative panels.

D. Samples for Verification:

1. Lumber with or for transparent finish, not less than 50 sq. in. or 5 inches wide by 24 inches long, for each species and cut, finished on 1 side and 1 edge.
2. Veneer-faced panel products with or for transparent finish, 8 by 10 inches, for each species and cut. Include at least one face-veneer seam and finish as specified.
3. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish.
4. Thermoset decorative-panels, 8 by 10 inches, for each type, color, pattern, and surface finish.
5. Exposed cabinet hardware and accessories, one unit for each type and finish.

#### **1.4 QUALITY ASSURANCE**

- A. 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. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.
- B. 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.

#### **1.5 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.

#### **1.6 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 and relative humidity at occupancy levels 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.

## **1.7 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 - 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: Maple, plain sawn or sliced.
- C. Wood Products: Comply with the following:
  1. Hardboard: AHA A135.4.
  2. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
  3. Particleboard: ANSI A208.1, Grade M-2.
- D. High-Pressure Decorative Laminate (PLAM): 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. Lamin-Art, Inc.
    - c. Nevamar Company, LLC; Decorative Products Div.
    - d. Panolam Industries International Incorporated. (Pionite)
    - e. Westinghouse Electric Corp.; Specialty Products Div.
    - f. Wilsonart International; Div. of Premark International, Inc.
  2. Colors:
    - a. PLAM-1: Formica, Silver Riftwood, 6413-NG.
    - b. PLAM-2: Formica, Mineral Spa, 6920-58.
- E. PVC Edging: Rehau; Match adjacent laminate colors.

## **2.2 CABINET HARDWARE AND ACCESSORIES**

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening, self-closing.
  - 1. Available Products:
    - a. Blum: BH75T1550.
    - b. Grass: GHA3703M.
    - c. MEPLA: CS04 (MH146304550015).
- C. Pulls: No. 305 by Richelieu; brushed nickel finish.
- D. Shelf Rests: BHMA A156.9, B04013; plastic, two-pin type with shelf hold-down clip.
  - 1. Plastic double pin shelf clip: Provide 1/4-inch diameter hole, clear or white color as selected by the Architect.
    - a. Available Products:
      - 1) Hardware Concepts, Inc.: Series 5033.
      - 2) AllenField: No. 55 Double Pin.
- E. Recessed Adjustable Shelf Standards and Supports:
  - 1. Available Products: Knappe & Vogt Mfg. Co.: No. 82 heavy-duty brackets, No. 182 Standards, color as selected by the Architect.
- F. Drawer Slides: BHMA A156.9, B05091; Heavy Duty (Grade 1HD-100 and Grade 1HD-200); Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
  - 1. Available Products:
    - a. Grass 6610.
    - b. Mepla-Alfit AL5300.
    - c. KV 8417.
    - d. Blum 430E Series.
- G. Counter Support Brackets: Provide the following where indicated:
  - 1. Heavy gage aluminum angle, MIG welded corners, 5/16-inch holes for mounting, and primed finish for field painting. Provide Rakks Counter Support, Model No. EH- 1818FM Inside Wall Flush Mount, by Ragine Corporation (800-826-6006) or approved substitution.
- H. Grommets on Access Panel: 3-inch OD, stainless steel grommets and matching caps.
- I. Wall Mount, Floating Support Bracket: Standard Plus Countertop Support Bracket by Centerline Steel, LLC.
- J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
  2. Satin Stainless Steel: BHMA 630.
- K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- L. Drawer and Door Locks: Provide Locks by Olympus Lock, Inc.; 100 DR door lock and 200 DW drawer lock. No substitutions.
1. Provide 6 master keys with all locks keyed alike.
  2. Provide locks where indicated on the drawings.
  3. Provide epoxy adhesive to retain lock attachments in place
- M. Backpack Coat Hooks: No. 51124 by Richelieu; stainless steel finish.

## **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. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- D. Adhesives, General: Do not use adhesives that contain urea formaldehyde.
- E. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
- F. Adhesive for Bonding Plastic Laminate: Contact cement.
1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

## **2.4 FABRICATION, GENERAL**

- A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.
- 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 Thick or Less: 1/16 inch.
  2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
  3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.
- 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. 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.
- F. Install glass to comply with applicable requirements in Division 08 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

## **2.5 PLASTIC-LAMINATE CABINETS**

- A. Grade: Custom, unless noted otherwise.
- B. AWI Type of Cabinet Construction: Flush overlay without face frame.
- C. Component Materials:
1. Body members - ends, bottom, divisions, rails and tops: .028" exterior laminate over 3/4 inch thick particleboard, interior Thermoset Decorative Overlay (melamine) with 3 mm PVC edging, all exposed and semi-exposed sides. Provide Type B or C flush joint for underside of wall cabinets as required by AWI 400-G-7.
  2. Shelves: Minimum 3/4 inch thick particleboard, Thermoset Decorative Overlay (melamine) each side with 3 mm PVC edging. Provide material and thickness required to meet AWI 400-G-8.
  3. Backs: 1/4 inch thick particleboard, Thermoset Decorative Overlay (melamine) each side.
  4. Drawer sides, backs and subfronts: 1/2" hardwood plywood or solid lumber.
  5. Drawer Bottoms: 1/4" hardwood plywood.
  6. Drawer Fronts: .028" exterior laminate over 3/4 inch thick particleboard, interior Thermoset Decorative Overlay (melamine) with 3 mm PVC edging.
  7. Cabinet Doors: .028" exterior laminate over 3/4 inch thick particleboard, interior Thermoset Decorative Overlay (melamine) with 3 mm PVC edging.

8. Edging: Band all exposed edges with 3 mm PVC.
  9. Base Toe Kick: Hardwood plywood.
- D. 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 laminate manufacturer's full range in the following categories:
    - a. Solid colors, matte finish.
    - b. Patterns, matte finish.

## **2.6 PLASTIC-LAMINATE COUNTERTOPS**

- A. Grade: Premium.
- B. High-Pressure Decorative Laminate Grade: HGS.
- 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 in the following categories:
    - a. Solid colors, matte finish.
    - b. Patterns, matte finish.
- D. Grain Direction: Parallel to cabinet fronts.
- E. Edge Treatment: As indicated.
- F. Core Material: Particleboard.
- G. Core Material at Sinks: Exterior-grade plywood.
- H. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

## **2.7 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. 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.
- D. Transparent Finish:
1. Grade: Custom.
  2. AWI Finish System TR-5: Catalyzed vinyl.
  3. Staining: None required.
  4. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
  5. Sheen: Satin, 30-50 gloss units.

### **PART 3 - 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.
- 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 for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

2. Maintain veneer sequence matching of cabinets with transparent finish.
  3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
1. Install countertops with no more than 1/8 inch in 96-inch 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 "Joint Sealants."
- H. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

### **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**

## **SECTION 071100**

### **DAMPPROOFING**

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

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Cold-applied, emulsified-asphalt dampproofing.
  - 2. Capillary breaks.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

##### **1.3 FIELD CONDITIONS**

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

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

##### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer.

##### **2.2 PERFORMANCE REQUIREMENTS**

- A. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise indicated.
- B. Capillary Break: Minimum 10 year warranty up to 10 PSI water resistance.

##### **2.3 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Degussa Building Systems; Sonneborn Brand Products.
  - 2. Karnak Corporation.
  - 3. W.R. Meadows, Inc.



- B. Trowel Coats: ASTM D 1227, Type II, Class 1 or Type IV.
  - 1. Available Products:
    - a. Sealmastic, Type 3; W. R. Meadows
    - b. Hydrocide 700; Sonneborn Building Products.
    - c. Karnak 920 AF; Karnac Chemical Corp.
- C. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1 or Type IV.
  - 1. Available Products:
    - a. Sealmastic, Type 2; W. R. Meadows
    - b. Hydrocide 700B; Sonneborn Building Products.
    - c. Karnak 220 AF; Karnac Chemical Corp.
- D. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.
  - 1. Available Products:
    - a. Sealmastic, Type 1; W. R. Meadows
    - b. Hydrocide 600; Sonneborn Building Products.
    - c. Karnak 100 AF; Karnac Chemical Corp.

## **2.4 CAPILLIARY BREAK MATERIALS**

- A. Water-based, waterproofing paint designed to provide a waterproof barrier on concrete or masonry surfaces.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Rust-Oleum-Zinsser; WaterTile Mold & Mildew-Proof Waterproofing Paint.
  - 2. Sealkrete; Damplock.
  - 3. UGL; Drylok Latex Masonry Waterproofer.
- C. Performance: Product shall provide a minimum of 10 years protection against 10 PSI water pressure.

## **2.5 AUXILIARY MATERIALS**

- A. Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
- C. Asphalt-Coated Glass Fabric: ASTM D 1668/D 1668M, Type I.
- D. Patching Compound: Epoxy or latex-modified repair mortar or Asbestos-free fibered mastic of type recommended in writing by dampproofing manufacturer.

## **2.6 INSULATION**

- A. Insulation, General: Comply with Section 07 21 00 - Thermal Insulation."

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for surface smoothness, maximum surface moisture content, and other conditions affecting performance of the Work.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for dampproofing and capillary break application.
- B. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- C. Clean substrates of projections and substances detrimental to dampproofing and capillary break work; fill voids, seal joints, and remove bond breakers if any.
- D. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections.

### **3.3 DAMPPROOFING APPLICATION, GENERAL**

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless otherwise indicated.
  - 1. Apply dampproofing to provide continuous plane of protection.
  - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.
  - 1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
  - 2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where indicated as "reinforced," by embedding an 8-inch-wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.

**3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING**

- A. On Concrete Foundations: Apply 2 brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat, 1 fibered brush or spray coat at not less than 3 gal./100 sq. ft., or 1 trowel coat at not less than 4 gal./100 sq. ft.

**3.5 CAPILLARY BREAK INSTALLATION**

- A. Apply in two coats in accordance with manufacturer's instructions.
- B. Apply to the top of concrete foundation walls and down the inside and outside 2 to 3 inches; and where indicated on the interior of above-grade foundation walls.

**3.6 PROTECTION**

- A. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where panels are subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- B. Correct dampproofing that does not comply with requirements; repair substrates, and reapply dampproofing.

**END OF SECTION**

## **SECTION 072100**

### **THERMAL INSULATION**

#### **Part 1 - GENERAL**

##### **1.1 SUMMARY**

A. Section Includes:

1. Extruded polystyrene foam-plastic board.
2. Mineral-wool blanket.
3. Sprayed Foam insulation.

B. Related Requirements:

1. Section 07 53 23 - Ethylene-Propylene-Diene-Monomer (EPDM) Roofing for insulation specified as part of roofing construction.
2. Section 09 29 00 - Gypsum Board for sound attenuation blanket used as acoustic insulation.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

##### **1.3 INFORMATIONAL SUBMITTALS**

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

##### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
- C. Do not expose to sunlight except to necessary extent for period of installation and concealment.
- D. Protect against ignition. Do not deliver foam-plastic board materials to Project site until just before installation time.
- E. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

## **Part 2 - PRODUCTS**

### **2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD**

- A. Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C 578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.
- B. Extruded Polystyrene Board, Type IV: ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Dow Chemical Company (The); Styrofoam Square Edge Insulation.
  - 2. Owens Corning; Foamular® 250.
  - 3. Pactiv Corporation; GreenGuard Type IV 25 PSI Insulation Board.
- D. R-Value: 5.0 per inch.
- E. Applications:
  - 1. Foundation and below slab insulation.
  - 2. Where indicated on the drawings for miscellaneous voids.

### **2.2 MINERAL-WOOL BLANKETS**

- A. Mineral-Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Industrial Insulation Group, LLC (IIG-LLC).
  - 2. Roxul Inc.
  - 3. Thermafiber Inc.; an Owens Corning company.
- C. R-Value: 4.2 per inch.
- D. Application: Loose fill around windows.

### **2.3 SPRAYED FOAM INSULATION**

- A. Sprayed Polyurethane Foam Sealant for Exterior Doors: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft. density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

- B. Products:
  - 1. Great Stuff Window & Door by Dow
  - 2. Froth-Pak by Insta-Foam Products, Inc.
  - 3. Zerodraft Insulating Air Sealant by Zerodraft.
- C. Closed-Cell Spray Polyurethane Foam: ASTM C 1029, Type II, minimum density of 1.5 lb/cu. ft..
- D. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Corbond® Performance Insulation System.
  - 2. Gaco Wallfoam 183M Closed Cell Spray Polyurethane Foam by Gaco Western.
  - 3. Henry Permax 1.8 Closed Cell Foam Insulation.
  - 4. Styrofoam™ SPF Insulation.
- E. Flame/Smoke Properties: 25/450 in accordance with ASTM E84.
- F. R-Value, Aged: 6.2 per inch.
- G. Application: Where indicated on the drawings.

### **Part 3 -EXECUTION**

#### **3.1 PREPARATION**

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

#### **3.2 INSTALLATION, GENERAL**

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

#### **3.3 INSTALLATION OF SLAB INSULATION**

- A. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

- B. If not otherwise indicated, extend insulation a minimum of 48 inches in from exterior walls.

### **3.4 INSTALLATION OF FOUNDATION WALL INSULATION**

- A. On vertical foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
- B. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
- C. Butt panels together for tight fit.

### **3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION**

- A. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
- B. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
- C. Sprayed Foam Insulation: Comply with insulation manufacturer's written instructions applicable to products and applications. Spray insulation to envelop entire area to be insulated and fill voids. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam. Install into cavities formed by framing members to achieve thickness indicated on Drawings.

### **3.6 PROTECTION**

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

**END OF SECTION**

## **SECTION 07 26 16**

### **BELOW-GRADE VAPOR RETARDERS**

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

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Vapor Retarders under slabs-on-grade.

##### **1.2 DEFINITIONS**

- A. Vapor Retarder: Material with a water vapor transmission rating of not over 0.04g per square foot per hour.
- B. Vapor Barrier: Material with a water vapor transmission rating of not over 0.015g per square foot per hour.

##### **1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: 12-inch square units for each type of material specified.

##### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Protect 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.

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

##### **2.1 MANUFACTURERS**

- A. Available Manufacturers and Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following products listed in Part 2 of this Section.

##### **2.2 VAPOR RETARDERS FOR UNDER SLABS**

- A. Vapor Retarder with extremely low permeance for critically sensitive, low permeance floor coverings such as rubber, vinyl, urethane, epoxy and methyl methacrylate, as well as linoleum and wood, having the following qualities:
  - 1. Minimum Permeance: ASTM E-96, not greater than 0.01 perms.
  - 2. Tensile Strength: ASTM E154 or D638, Class A – over 45 lbf/in.
  - 3. Puncture Resistance: ASTM E-154, Class B – over 1700 grams.



4. Water Vapor Barrier: ASTM E-1745, meets or exceeds Class B.
  5. Thickness of Barrier (Plastic) ACI 302.1R-96, not less than 15 mils.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Stego Wrap, 15 mil thick vapor retarder by Stego Industries LLC, (877) 464-7834.
  2. Griffolyn® 15 by Reef Industries.
  3. Sealtight Perminator 15 mil Underslab Vapor-Mat by W.R. Meadows, Inc.
  4. Viper VaporCheck II by Insulation Solutions, Inc.
- C. Vapor-Retarder Tape (for slabs): Stego Warp red polyethylene tape or tape as recommended by the manufacturer.
- D. Expansion Joint Filler: Installer may elect to use Deck-O-Foam Expansion Joint Filler by WR Meadows or equal. Foam expansion joint filler with pre-scored removable strip for installation of joint sealant.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 PREPARATION**

- A. Clean substrates of substances harmful to vapor retarders, including removing projections capable of puncturing vapor retarders, or of interfering with attachment.
- B. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

#### **3.3 INSTALLATION, GENERAL**

- A. Comply with manufacturer's written instructions applicable to products and application indicated.
- B. Extend retarders in thickness indicated to envelop entire area to be covered. Cut and fit tightly around obstructions. Remove projections that interfere with placement.

#### **3.4 INSTALLATION OF UNDER-SLAB VAPOR RETARDERS**

- A. Moisture vapor retarder system shall be installed at all interior floor slabs and as otherwise indicated in the drawings in strict accordance with the manufacturer's printed instructions and as follows:

- B. Roll out vapor retarder material, overlapping edge rolls and all seams by 3". Tape all seams with vapor retarder seaming tape.
- C. At perimeter foundation, wrap vapor retarder material over top of foundation under exterior wall plate.
- D. Seal all penetrations (including pipes) per manufacturer's instructions.
- E. All tears, punctures, etc. to be repaired and taped as required to maintain the watertight integrity of the vapor retarder system.

### **3.5 PROTECTION**

- A. Protect installed vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where vapor retarders are subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

**END OF SECTION**

## **SECTION 07 27 00**

### **AIR BARRIERS**

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

##### **1.1 SUMMARY**

A. Section Includes:

1. Vapor-impermeable, self-adhered air barrier membrane.

B. Related Sections:

1. Section 07 52 23 – EPDM Roofing, for connection and installion of Air Barrier with Roofing System.

##### **1.2 REFERENCES**

A. Definitions and Abbreviations:

1. ABAA: Air Barrier Association of America

B. Reference Standards

1. American Architectural Manufacturers Association (AAMA):
  - a. AAMA 711 - Voluntary Specification for Self-Adhering Flashing Used for Installation of Exterior Wall Fenestration Products.
2. American Association of Textile Chemists and Colorists (AATCC):
  - a. AATCC-127 - Water Resistance: Hydrostatic Pressure Test.
3. ASTM International (ASTM):
  - a. ASTM D882 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
  - b. ASTM D3330 - Standard Test Method for Peel Adhesion of Pressure-Sensitive Tape.
  - c. ASTM D3652 – Standard Test Method for Thickness of Pressure-Sensitive Tapes.
  - d. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
  - e. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
  - f. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
  - g. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials.
  - h. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

### **1.3 ADMINISTRATIVE REQUIREMENTS**

#### **A. Coordination**

1. Coordinate Work of this Section with the work of other Sections that have work or materials connected to or passing through the air barrier assembly.
  - a. Sequence of construction to ensure continuity of the barrier assembly at openings, transitions, and penetrations.
  - b. Coordinate with installation of materials which cover the air barrier assemblies, to ensure exposure period does not exceed 6 months.
  - c. Coordinate field observations and testing by specified parties.

### **1.4 SUBMITTALS**

#### **A. Submittals: in accordance with Section 01 33 00 – Submittal Procedures.**

#### **B. Product Data: Manufacturer's data sheets on each product to be used, including:**

1. Physical properties, performance criteria, compliance reports, material compatibility, product limitations, and recommendations.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.
5. Testing Report: manufacturer's independent Laboratory Report for the Air Barrier Systems testing on ASTM E2357 tested on a steel stud frame wall and the ABAA listing.

#### **C. Shop Drawings: Provide manufacturer's typical, scaled, shop drawings with actual product names on details of:**

1. Typical conditions.
2. Transitions to adjacent systems.
3. Mock-up, including plans and elevations.

#### **D. Manufacturer's Letter Indicating Compatibility: Submit letter or technical bulletin listing specific air barrier materials, including sealants, and typical adjacent system materials; that are compatible, both chemically and adhesively.**

#### **E. Qualifications:**

1. Submit manufacturer and installer qualifications.
2. Submit 5 project references within the last 5 years of similar-sized projects with self-adhered sheet membrane air barrier assembly installation by the proposed installing contractor.

#### **F. Warranty: Submit manufacturer's sample warranty.**

## **1.5 CLOSEOUT SUBMITTALS**

- A. Closeout Submittals: in accordance with Section 01 78 23 – Operations and Maintenance Data.
- B. Warranty Documentation: Provide manufacturer's and installer's warranty documentation for warranty specified below.

## **1.6 QUALITY ASSURANCE**

- A. Single Source Responsibility: Provide primary weather barrier materials from a single manufacturer. Secondary and accessory materials by other manufacturers shall be approved for compatibility by the primary manufacturer.
- B. Testing Laboratory Qualifications: Accredited by the International Accreditation Service (IAS), American Association for Laboratory Accreditation (A2LA).
- C. Manufacturer Qualifications: Minimum 10 years of experience manufacturing similar products.
- D. Installer Qualifications: Minimum 5 years of experience installing similar products and approved by the manufacturer.
- E. Manufacturer Review:
  - 1. Manufacturer's Representative: review the contract drawings and specifications and note modifications required to ensure the will perform as intended by the Architect.
  - 2. Suggested modifications will be reviewed during the preinstallation conference noted above.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Store in accordance with the manufacturer's instructions in clean, dry location protected from exposure to direct sunlight. Material that has been unwrapped shall be covered with opaque, light colored tarp or re-wrapped in manufacturer's packaging.
- C. Use air barrier materials within 24 months from date of manufacture.
- D. Handle materials to avoid damage.

## **1.8 SITE CONDITIONS**

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results.
  - 1. Install membrane in temperature range from 0 degrees F to 150 degrees F (-18 degrees C to 66 degrees C).

2. Install sealant in temperature range from 40 degrees F to 95 degrees F (5 degrees C to 35 degrees C). For application temperatures outside this range, please contact manufacturer's technical services.
- B. Install on substrates clear of dirt, debris, oils, other chemicals, snow, ice, frost, and moisture above the allowable limitations of the product.
- C. Maximum exposure time of the air barrier assembly without cover or cladding is 6 months.
- D. Provide weather protection at the top of walls and unfinished roofs at the end of each day.

## **1.9 WARRANTY**

- A. Manufacturer's Product Warranty: Provide manufacturer's product warranty for a minimum of 0 years from date of Substantial Completion with installation completed by a certified applicator.
- B. Installer's Workmanship Warranty: Provide workmanship warranty for a minimum of one year from date of Substantial Completion including all air barrier assembly materials and accessories, against failures including loss of air tight seal, loss of watertight seal, loss of attachment, loss of adhesion, and failure to cure properly.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE CRITERIA**

- A. Assembly Performance:
  1. Standards Compliance: ASTM E 2357.
  2. Air Leakage, per ASTM E 2357: Less than 0.004 cfm/ft<sup>2</sup> at 1.57 psf (0.03 L/s/m<sup>2</sup> at 75 Pa).
  3. Loads from imposed pressures: Withstands design wind, fan, and stack pressures, both positive and negative, without damage or displacement of the air barrier assembly or adjacent materials. Allows transfer of these loads to the structure.
  4. Movement: Allows for thermal, creep, and anticipated seismic and building movement within the air barrier assembly, each air barrier detail, and transitions to adjacent systems without breaching the air barrier system or negating specified air leakage performance.
  5. Continuity: Joins air barrier materials and adjacent compatible materials and systems preventing air leakage and maintaining specified air leakage performance at the following locations and as shown on the Drawings:
    - a. Transitions from roof air barrier to wall.
    - b. Transitions from window, curtain wall, storefront, louvers, and doors to wall.
    - c. Transitions from foundation waterproofing to wall.
    - d. Transitions from one type of exterior cladding to another.
    - e. Across construction, control, expansion, and seismic joints.

- f. Penetrations of utilities, pipes, conduit, and ducts.
  - g. Penetrations of ties, anchors, and channels for exterior finishes.
  - h. Pathways for potential air leakage into the building envelope.
6. Comply with assemblies tested with NFPA 285.

## **2.2 MATERIALS**

- A. Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01 25 00 – Substitution Procedures and 01 60 00 - Product Requirements
- B. Vapor-impermeable, self-adhered air barrier membrane:
  - 1. Acceptable Materials:
    - a. 3M Air and Vapor Barrier 3015
    - b. Perm-A-Barrier NSP by GCP Applied Technologies
    - c. SikaMembran-540 by Sika
  - 2. Required Properties:
    - a. Water Vapor Permeance, ASTM E96 Method A: not to exceed 1 perm
    - b. Water Resistance, AATCC 127: no leakage
    - c. Service Temperature: minimum -20F
    - d. Application Temperature: minimum acceptable range 0°F to 20F
    - e. Low Temperature Flexibility, ASTM C1305: pass
- C. Accessories:
  - 1. Provide associated flashing and thru-flashing tapes, sealants, trims, primers (if required for difficult substrates), and other accessories in order to complete the Work as required by the manufacturer.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. Substrate surfaces shall be free of grease, oil, unbonded paint, corrosion or other substances.
- C. Verify that substrate construction is complete, clean, dry, and ready to receive barrier system with no damaged or unsupported areas; or sharp protrusions or voids. Substrate must meet the following requirements:
  - 1. Exterior gypsum sheathing: Moisture content below 19 percent; no open joints or cracks wider than 1/4 inch (6 mm).

2. Plywood: Moisture content below 16 percent; no open joints or cracks wider than 1/4 inch (6 mm).
  3. Concrete surfaces: Cured minimum 7 days, fins and extrusions ground flush and void areas filled and cured.
  4. Masonry: Mortar joints struck flush.
  5. Metal: Wipe down to remove any release agents or coatings.
- D. If substrate preparation is the responsibility of another installer, notify Architect and General Contractor of unsatisfactory preparation before proceeding.

### **3.2 PREPARATION**

- A. Connection to difficult substrates and other systems:
1. Test adhesion by installing a 6 inch (152 mm) square test patch of barrier product over the difficult substrate or other system. Removal of the test patch should not be possible without permanent damage to either the test patch or substrate material.
  2. Consult the manufacturer for detailing connections that fail this test.
- B. Gaps or cracks in substrate exceeding 1/4 inch (6 mm) width: Fill gap or crack with sealant and tool surface flush and smooth.
- C. Penetrations of air barrier assembly: Fill gaps or cracks exceeding 1/4 inch (6 mm) width between the substrate and the penetration with sealant.
- D. Gaps or cracks in substrate exceeding 1/2 inch (12 mm) width: Fill gap or crack with closed-cell backer rod or spray foam. Once the spray foam is cured, shave flush to adjoining substrate.

### **3.3 INSTALLATION**

- A. Apply air barrier membrane and accessories according to air barrier manufacturer's current written instructions to achieve a continuous air barrier.
1. Connect and seal exterior wall air barrier membrane 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.
- B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.
- C. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- D. At end of each working day, seal top edge of strips and transition membrane to substrate with termination sealant.



- E. Apply joint sealants forming part of air barrier assembly within sealant manufacturer's recommended application temperature ranges. Consult sealant manufacturer when sealant cannot be applied within these temperature ranges.
  - 1. Wall Openings: If required, prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition membrane so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates. Roll firmly to enhance adhesion.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.
- G. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.
  - 1. Repair punctures, voids, and deficient lapped seams in strips and transition membrane. Slit and flatten fish-mouths and blisters. Patch with transition membrane extending 6 inches (150 mm) beyond repaired areas in strip direction.

### **3.4 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Inspections: Air barrier materials 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. Continuous structural support of air barrier system has been provided;
  - 3. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings;
  - 4. Site conditions for application temperature and dryness of substrates have been maintained;
  - 5. Maximum exposure time of materials to UV deterioration has not been exceeded;
  - 6. Surfaces have been primed, if applicable;
  - 7. Laps in strips and transition membrane have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fish-mouths;
  - 8. Termination sealant has been applied on cut edges;
  - 9. Strips and transition membrane have been firmly adhered to substrate;
  - 10. Compatible materials have been used;
  - 11. Transitions at changes in direction and structural support at gaps have been provided;

12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal; and,
  13. All penetrations have been sealed.
- C. Tests: Testing to be performed will be determined by Owner's testing agency from among the following tests:
1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E1186.
- D. Remove and replace deficient air barrier components and retest as specified above.

### **3.5 CLEANING AND PROTECTION**

- A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
- B. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace main air barrier material exposed for more than 12 months.
- C. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- D. Remove masking materials after installation.

**END OF SECTION**

## **SECTION 07 46 46**

### **FIBER-CEMENT SIDING**

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

##### **1.1 SUMMARY**

- A. Fiber cement cladding, trim, and accessories.

##### **1.2 COORDINATION**

- A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

##### **1.3 PREINSTALLATION MEETINGS**

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

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

- A. Product Data: Product Data: Submit manufacturer's product description, standard detail drawings relevant to the project, storage and handling requirements, and installation instructions.
- B. Shop Drawings: Submit project specific drawings, including plan, section, and elevation drawings, showing installation details that demonstrate product layout, dimensions, finish colors, edge/termination conditions/treatments, compression and control joints, openings, and penetrations. Show details of all metal flashing conditions.
- C. Samples for Initial Selection: For fiber-cement cladding and trim including related accessories.
- D. Samples for Verification:
  - 1. 12-inch long-by-actual-width Sample of cladding.
  - 2. 12-inch long-by-actual-width Samples of trim and accessories.

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

- A. Product Test Reports and Code Compliance: Documents demonstrating product compliance with local building code, such as test reports or Evaluation Reports from qualified, independent testing agencies.
- B. Sample Warranty: For special warranty.

##### **1.6 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

## **1.7 QUALITY ASSURANCE**

- A. Manufacturer Qualifications:
  - 1. All fiber cement panels specified in this section must be supplied by a manufacturer with a minimum of 10 years of experience in fabricating and supplying fiber cement cladding systems.
  - 2. Provide technical and design support as needed regarding installation requirements and warranty compliance provisions.
- B. Installer Qualifications: All products listed in this section are to be installed by a single installer trained by manufacturer or representative.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Fiber cement panels must be stored flat and kept dry, off the ground before installation. A waterproof cover over panels and accessories should always be used prior to installation.
- B. If panels are exposed to water or water vapor prior to installation, allow to completely dry before installing. Moisture saturation before installation can cause shrinkage and panel damage.
- C. Panels must be carried on edge. Do not carry or lift panels flat. Improper handling may cause cracking or panel damage.
- D. Do not stack product more than three pallets high.

## **1.9 WARRANTY**

- A. Provide manufacturer's 30-year limited warranty against manufactured defects in fiber cement panels.
- B. Warranty provides for the original purchaser and transfers to one subsequent owner. See warranty for detailed information on terms, conditions and limitations.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS:**

- A. Fiber Cement Cladding – Must comply with ASTM C-1186, Type A, Grade II requirements:
  - 1. Wet Flexural Strength, lower limit: 1015 psi.
  - 2. Water Tightness: No water droplets observed on any specimen.
  - 3. Freeze-thaw: No damage or defects observed.
  - 4. Warm Water: No evidence of cracking, delamination, swelling, or other defects observed.
  - 5. Heat-Rain: No crazing, cracking, or other deleterious effects, surface or joint changes observed in any specimen.
- B. Mean Coefficient of Linear Thermal Expansion (ASTM E-228): Max  $1.0 \times 10^{-5}$  in./in. F.

- C. Surface Burning (CAN-ULC S102/ASTM E-84): Flame Spread: 0, Smoke Developed: 5.
- D. Wind Load (ASTM E-330): Contact manufacturer for ultimate test pressure data corresponding to framing type, dimensions, fastener type, and attachment clips. Project engineer(s) must determine Zone 4 and 5 design pressures based on project specifics.
  - 1. Minimum lateral deflection:  $L/120$ .
- E. Water Penetration (ASTM E-331): No water leakage observed into wall cavity.
- F. Weather Resistant (ASTM G-23): No cracking, checking, crazing, erosion, or other detrimental effects observed.
- G. Steady-State Heat Flux and Thermal Transmission Properties Test (ASTM C-518): thermal resistance R Value of 1.23.
- H. Fire Resistant (ASTM E-119): The wall assembly must successfully endure 60-minute fire exposure without developing excessive unexposed surface temperature or allowing flaming on the unexposed side of the assembly.
- I. Ignition Resistance (NFPA 268): No sustained flaming of panels, assembly when subjected to a minimum radiant heat flux of  $12.5 \text{ kW/m}^2 \pm 5\%$  in the presence of a pilot ignition source for a 20-minute period.
- J. Fire Propagation (NFPA 285): Wall assembly of Nichiha AWP, Ultimate Clips and Starter Track, Tyvek Commercial Wrap, 1/2-inch Densglass Gold Sheathing, 16-inch o.c. 18-gauge steel studs, mineral wool in-cavity insulation, and interior 5/8" Type X gypsum met the acceptance criteria of NFPA 285.
- K. Drained and Back Ventilated Rainscreen (AAMA 509-09): System must pass all component tests.
- L. Florida Building Code - Test Protocol HVHZ (TAS 201, 202, 203): Passed.

## **2.2 MANUFACTURERS**

- A. Basis-of-Design Product: Nichi Illumination Series by Nichiha USA
  - 1. Profiles: AWP-3030 Panel: No score lines. Wider, soft-U chamfered edge at horizontal joints.
  - 2. Profile Color: Custom colors as selected by the Architect.
- B. Accessory/Component Options:
  - 1. Manufactured Corners with 3-1/2 inch returns for each profile size and color.
    - a. Do not use AWP-1818 Corners with AWP-3030 Panels.
  - 2. Aluminum trim to be painted per finish schedule: Outside corners (Corner Key, Open Outside Corner), vertical joints (H-Mold), terminations (J-Mold)
  - 3. Essential Flashing System: Starter, Compression Joint, Overhang.

C. Properties:

1. AWP-3030: 455mm (17-7/8") (h) x 3,030 mm (119-5/16") (l).
2. Panel Thickness: 16 mm (5/8").
3. Finish: Matte, smooth.
4. Weight: AWP-3030: 57.32 lbs. per panel.
5. Coverage: 14.81 sq. ft. per panel (3030).
6. Factory sealed on six (6) sides.

- D. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00 – Substitution Procedures.

## **2.3 MATERIALS**

- A. Fiber cement panels manufactured from a pressed, stamped, and autoclaved mix of Portland cement, fly ash, silica, recycled rejects, and wood fiber bundles.
- B. Panel surface pre-finished and machine applied.
- C. Factory-applied sealant gasket added to top and right panel edges.

## **2.4 INSTALLATION COMPONENTS**

- A. Panel Clips: JEL 777 "Ultimate Clip" (10mm rainscreen for 16mm AWP) – Zinc-Aluminum-Magnesium alloy coated steel.
- B. Single Flange Sealant Backer – FHK 1017 (10mm) – 6.5' (l) fluorine coated galvalume.
- C. Aluminum Trim: Provide the following Nichiha's Tamlyn trims:
  1. Corner Key.
  2. J-Mold.
- D. Fasteners: Use Stainless Steel fasteners. Panel manufacturer is not liable for corrosion resistance of fasteners. Do not use aluminum fasteners, staples or fasteners that are not rated or designed for intended use. See manufacturer's instructions for appropriate fasteners for construction method used.
- E. Flashing: Flash all areas specified in manufacturer's instructions. Do not use raw aluminum flashing. Flashing must be galvanized and painted with silicone polyester finish, color to match siding.
- F. Sealant: Sealant shall comply with ASTM C920.

## **2.5 FIELD-INSTALLED THERMAL INSULATION**

- A. Mineral-Wool Board, Unfaced: ASTM C 612, Type IVA or IVB; consisting of fibers; with maximum flame-spread and smoke-developed indexes of 0 and 0, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Roxul-Rockwool; CavityRock DD.
  - 2. Thermafiber Inc.; an Owens Corning company; RainBarrier HD.
  - 3. R-Value: 4.2 per inch.
- C. Mechanical pin fasteners in accordance with insulation manufacturer's written recommendations.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verification of Conditions:
  - 1. Fiber cement panels are to be installed over steel studs and sheathing.
  - 2. Allowable stud spacing: 16" o.c. maximum.
  - 3. A weather resistive barrier is required when installing fiber cement panels. Refer to Section 07 27 00 – Air Barriers.
  - 4. Appropriate metal flashing should be used to prevent moisture penetration around all doors, windows, wall bottoms, material transitions and penetrations.
- B. Examine site to ensure substrate conditions are within specification for proper installation.
- C. Do not begin installation until unacceptable conditions have been corrected.
- D. Do not install panels or components that appear to be damaged or defective. Do not install wet panels.

### **3.2 INSTALLATION**

- A. General: Install products in accordance with the latest installation guidelines of the manufacturer and all applicable building codes and other laws, rules, regulations and ordinances. Review all manufacturer installation, maintenance instructions, and other applicable documents before installation.
- B. Panel Cutting:
  - 1. Always cut fiber cement panels outside or in a well-ventilated area. Do not cut the products in an enclosed area.
  - 2. Always wear safety glasses and NIOSH/OSHA approved respirator whenever cutting, drilling, sawing, sanding or abrading the products. Refer to manufacturer SDS for more information.
  - 3. Use a dust-reducing circular saw with a diamond-tipped or carbide-tipped blade.
    - a. Recommended circular saw: Makita 7-1/4" Circular Saw with Dust Collector (#5057KB).
    - b. Recommended blade: Tenryu Board-Pro Plus PCD Blade (#BP-18505).

- c. Shears (electric or pneumatic) or jig saw can be used for complicated cuttings, such as service openings, curves, radii and scrollwork.
  4. Silica Dust Warning: Fiber cement products may contain some amounts of crystalline silica, a naturally occurring, potentially hazardous mineral when airborne in dust form. Consult product SDS or visit [www.osha.gov/SLTC/silicacrystalline/index.html](http://www.osha.gov/SLTC/silicacrystalline/index.html).
- C. Panel Installation:
1. Proceed by working from left to right.
  2. Cut ship-lapped edge from left edge of panel.
  3. Add 10 mm spacer to rainscreen support system and face fasten at 16 inches on center.
  4. At right side, install panel clip and fasten to rainscreen support system.
  5. Leave gap between brick veneer and panels.
  6. Begin second course of panels by installing horizontal joint flashing.
  7. Begin working from left to right, install the next panel with its ship-lapped edges intact. A rubber mallet or block may be used to seat panels firmly in place and tighten together. Do not hammer directly on panels.
- D. Face Fastening:
1. Fiber cement panels must be jointed on rainscreen support system.
  2. Fasteners must penetrate support system at least 1/2 inch.
  3. Fastener head must be flush to the board surface.
  4. Fasteners shall be placed a minimum of 3/8" from board edges.
  5. Fasten panels a maximum of 6" o.c. on all board horizontal and vertical edges and no more than 12" o.c. at intermediate framing.
  6. Pre-drill panels and fill counter-sunk holes as recommended by panel manufacturer.
- E. Joint Installation Using Caulk: Leave a 1/4-inch gap between each panel and fill with recommended sealant.
- F. Trim: Caulk panels when using trim.
- G. Horizontal Joints: Non-corrosive Z-flashing shall be used. Do not fill the gap between the bottom of the panel and the flashing with sealant.
- H. Trim Joints (corners and around windows and doors): For vertical joints, leave a 1/4-inch gap between panel edge and trim and fill with recommended sealant. For horizontal joints above windows and doors, use a metal flashing over the trim, leaving a 1/4-inch gap between panel and flashing. For horizontal joints underneath window sills or trim, leave a 1/4-inch gap and fill with recommended sealant.
- I. Field Cut Edges: All exposed field cut edges, such as outside edges, field cut butt joints, cuts around doors and windows, or bottom ends of corners and window trim, must be coated with primer such as DryLock, Kilz Premium or Kilz Max. Do not use touch-up paint.



- J. Install thermal insulation between rainscreen support system. Fasten per manufacturer's recommendations.

### **3.3 ADJUSTING AND CLEANING**

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

**END OF SECTION**

**Section 07 53 23**

**ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Adhered ethylene-propylene-diene-monomer (EPDM) roofing system.
  - 2. Air Barrier installation.
  - 3. Roof insulation.
  - 4. Walkway pads.
  - 5. Expansion joints.
- B. Section includes the installation of insulation strips in ribs of roof deck. Insulation strips are furnished under Section 05 31 00 - Steel Decking.
- C. Products installed, but not furnished, under this Section include the following:
  - 1. Roof drains furnished under Division 22 Section for Plumbing.
- D. Related Requirements:
  - 1. Section 05 31 00 - Steel Decking for furnishing acoustical deck rib insulation.
  - 2. Section 06 10 00 - Rough Carpentry for wood nailers, curbs, and blocking.
  - 3. Section 07 27 00 - Air Barriers.
  - 4. Section 07 92 00 - Joint Sealants for joint sealants, joint fillers, and joint preparation.

**1.2 DEFINITIONS**

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

**1.3 PREINSTALLATION MEETINGS**

- A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
  - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
  - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
  5. Review structural loading limitations of roof deck during and after roofing.
  6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
  7. Review governing regulations and requirements for insurance and certificates if applicable.
  8. Review temporary protection requirements for roofing system during and after installation.
  9. Review roof observation and repair procedures after roofing installation.
- B. Preinstallation Roofing Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
  2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
  3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
  5. Review structural loading limitations of roof deck during and after roofing.
  6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
  7. Review governing regulations and requirements for insurance and certificates if applicable.
  8. Review temporary protection requirements for roofing system during and after installation.
  9. Review roof observation and repair procedures after roofing installation.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Provide "Project Specific" shop drawings for roofing system. Include plans, elevations, sections, details, and attachments to other work, including:
1. Base flashings and membrane terminations.
  2. Tapered insulation, including slopes.
  3. Roof plan showing orientation of steel roof deck and orientation of roofing and fastening spacings and patterns for mechanically fastened roofing.
  4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
- C. Samples for Verification: For the following products:

1. Sheet roofing, of color required.
2. Roof paver in each color and texture required.
3. Walkway pads or rolls, of color required.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer's installation rating of the roofing contractor.
- C. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
  1. Submit evidence of complying with performance requirements.
- D. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.
- E. Research/Evaluation Reports: For components of roofing system, from ICC-ES.
- F. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.
- G. Sample Warranties: For manufacturer's special warranties.

## **1.6 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For roofing system to include in maintenance manuals.

## **1.7 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.
- B. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing roofing similar to that required for this Project and who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product. Contractor shall have installed a minimum of 500,000 square feet and have a manufacturer's installation rating of 9.0 or better.
  1. Work associated with single-ply membrane roofing, including (but not limited to) insulation, flashing, and membrane sheet joint sealers, shall be performed by Installer of this Work.
- C. Upon completion of the installation, an inspection shall be made by the system manufacturer to ascertain that the roofing system has been installed according to the applicable manufacturer's specifications and details. No "early bird" warranty will be accepted. The results of the warranty inspection shall be submitted in writing to Owner for their review and records.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
  - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

## **1.9 FIELD CONDITIONS**

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

## **1.10 WARRANTY**

- A. A manufacturer's sole source 20-year written Total Roofing System Warranty shall be provided. Warranty shall cover both labor and materials with no dollar limitation and shall state that the Total roofing System will remain in a watertight condition. The contractor shall provide as part of the shop drawing submittal process, certification indicating that the manufacturer has reviewed and has agreed to such wind coverage indicated.
  - 1. Total Roofing System is defined as the following materials and provided by the roof system manufacturer: membrane, flashings, counterflashings, adhesives, sealants, insulation, cover boards, fasteners, fastener plates, fastener bars, metal work.
  - 2. The warranty shall be for twenty (20) years starting after final acceptance of the total roofing system by the roof system manufacturer. Defective materials or installation shall be removed, properly disposed of, and replaced at the manufacturer's expense.
  - 3. The warranty shall provide that if within the warranty period the roofing system becomes non-watertight or if the elastomeric sheet splits, tears, or separates at the seams because of defective materials and/or materials and cost thereof shall be the responsibility of the manufacturer. Should the manufacturer or his approve applicator fail to perform repairs within 72 hours of notification, the warranty will not be voided because of work being performed by others to repair the roofing regardless of the manufacturer's warranty to the contrary.
  - 4. The total Roofing System shall be applied by a roofing Contractor approved by the system manufacturer. After inspection and acceptance of the installed roof system, the warranty will be issued.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. General Performance: Installed 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. Roofing and base flashings shall remain watertight.
  - 1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
  - 2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:
  - 1. Corner Uplift Pressure: 120 lbf/sq. ft..
  - 2. Perimeter Uplift Pressure: 90 lbf/sq. ft..
  - 3. Field-of-Roof Uplift Pressure: 60 lbf/sq. ft..
- D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

### **2.2 EPDM ROOFING**

- A. EPDM: ASTM D 4637, Type I, nonreinforced, uniform, flexible EPDM sheet.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Carlisle SynTec Incorporated.
    - b. Firestone Building Products.
    - c. Versico Incorporated.
  - 2. Thickness: 60 mils, nominal.
  - 3. Exposed Face Color: Black.

### **2.3 AUXILIARY ROOFING MATERIALS**

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
  - 1. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

- a. Plastic Foam Adhesives: 50 g/L.
  - b. Gypsum Board and Panel Adhesives: 50 g/L.
  - c. Multipurpose Construction Adhesives: 70 g/L.
  - d. Fiberglass Adhesives: 80 g/L.
  - e. Contact Adhesive: 80 g/L.
  - f. Other Adhesives: 250 g/L.
  - g. Single-Ply Roof Membrane Sealants: 250 g/L.
  - h. Nonmembrane Roof Sealants: 300 g/L.
  - i. Sealant Primers for Nonporous Substrates: 250 g/L.
  - j. Sealant Primers for Porous Substrates: 775 g/L.
- B. Sheet Flashing: 60-mil-thick EPDM, partially cured or cured, according to application.
- C. Protection Sheet: Epichlorohydrin or neoprene nonreinforced flexible sheet, 55- to 60-mil-thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.
- D. Bonding Adhesive: Manufacturer's standard, State of Maine VOC Compliant.
- E. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 6-inch-wide minimum, butyl splice tape with release film.
- F. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.
- G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- H. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- I. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.
- J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

## **2.4 AIR BARRIER**

- A. Self-Adhering-Sheet Air Barrier: Refer to Section 07 27 00 – Air Barriers.

## **2.5 ROOF INSULATION**

- A. General: Preformed roof insulation boards manufactured or approved by EPDM roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt facer on both major surfaces.
  - 1. Thickness: As indicated on the drawings.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

## **2.6 INSULATION ACCESSORIES**

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2-inch-thick, factory primed.
  - 1. Products: Subject to compliance with requirements, provide the following:
    - a. Georgia-Pacific Corporation; Dens Deck Prime.

## **2.7 WALKWAYS**

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16-inch-thick and acceptable to roofing system manufacturer.

## **2.8 FASCIA SYSTEM**

- A. Refer to Section 07 62 00 - Sheet Metal Flashing and Trim.

## **2.9 EXPANSION JOINTS**

- A. Deck-To-Deck Expansion Joints: Where indicated, provide manufacturers standard joint system consisting of expansion joint support or support sponge, anchor plates, and flashing.
- B. Deck-To-Wall or Deck-To-Deck Expansion Joints: Where indicated, provide Johns Manville Expand-O-Flash expansion joint cover style EJ complete with optional fiberglass batt insulation in poly sleeve and integral vapor barrier insulation support.
  - 1. Bellows Width: 4 inches (1"-2" gap).



## **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 roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
  - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
  - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00 - Steel Decking.
  - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
  - 5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
  - 6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Install insulation strips according to acoustical roof deck manufacturer's written instructions.

### **3.3 ROOFING INSTALLATION, GENERAL**

- A. Install roofing system according to roofing system manufacturer's written instructions.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

### **3.4 AIR BARRIER INSTALLATION**

- A. Self-Adhering-Sheet Air Barrier: Prime substrate if required by manufacturer. Install self-adhering-sheet air barrier over area to receive air barrier, side and end lapping each sheet a minimum of 3-1/2 inches and 6 inches, respectively. Seal laps by rolling.

### **3.5 INSULATION INSTALLATION AT METAL AND CONCRETE DECK**

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
  - 1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. 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.
- G. Loosely Laid Insulation: Loosely lay insulation units over substrate.
- H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck.
  - 1. Fasten cover boards according to requirements of manufacturer for specified warranty and performance.

### **3.6 ADHERED MEMBRANE ROOFING INSTALLATION**

- A. Adhere roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer and allow to partially dry before installing roofing. Do not apply to splice area of roofing.
- E. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeters.

- F. Apply roofing with side laps shingled with slope of roof deck where possible.
- G. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.
- H. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.
- I. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal membrane roofing in place with clamping ring.

### **3.7 BASE FLASHING INSTALLATION**

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings.

### **3.8 WALKWAY INSTALLATION**

- A. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

### **3.9 ROOF DRAIN INSTALLATION**

- A. Install roof drain and accessories in strict accordance with manufacturer's written instructions, providing a permanent weather tight installation.
  - 1. Inspect and determine substrate to be in satisfactory condition, with deck fully anchored and aligned at proper location and elevation. All surfaces shall be smooth, dry, clean, and free of sharp edges, and other irregularities.
  - 2. Attach deck flange securely to substrate.
  - 3. Assemble and flash gravel stop flange into roof system per roof system and roof drain manufacturer requirements.
  - 4. Securely attach strainer basket.

### **3.10 FIELD QUALITY CONTROL**

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
  - 1. Notify Architect or Owner 48 hours in advance of the date and time of inspection.
- B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

### **3.11 PROTECTING AND CLEANING**

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

**END OF SECTION**

## **SECTION 07 62 00**

### **SHEET METAL FLASHING AND TRIM**

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

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Formed low-slope roof sheet metal fabrications.
- B. Related Requirements:
  - 1. Section 06 10 00 - Rough Carpentry for wood nailers, curbs, and blocking.

##### **1.2 COORDINATION**

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

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

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: Provide "Project Specific" shop drawings for sheet metal flashing and trim.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
  - 3. Include identification of material, thickness, weight, and finish for each item and location in Project.
  - 4. Include details for forming, including profiles, shapes, seams, and dimensions.
  - 5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
  - 6. Include details of termination points and assemblies.
  - 7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
  - 8. Include details of roof-penetration flashing.
  - 9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.

10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish.

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.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For fabricator.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

#### **1.6 QUALITY ASSURANCE**

- A. Fabricator Qualifications: 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.

#### **1.7 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 extent necessary for period of sheet metal flashing and trim installation.

### **PART 2 - PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

- A. General: Sheet metal flashing and trim assemblies 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.
- B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

- C. 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. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

- 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## **2.2 SHEET METALS**

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying 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; with smooth, flat surface.

- 1. As-Milled Finish: Mill.

## **2.3 UNDERLAYMENT MATERIALS**

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils 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 D 1970; stable after testing at 240 deg F or higher.
  - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.

- B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

## **2.4 MISCELLANEOUS MATERIALS**

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as 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. Exposed Fasteners: Heads matching color of sheet metal 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 metal.
    - b. 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, 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 silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- I. Membrane Strip Flashing: Refer to Section 07 27 00 – Air Barriers for flashing material.

## **2.5 FABRICATION, GENERAL**

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
  - 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 to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
  - 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners 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 indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
  - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
  - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.



- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.
- G. Do not use graphite pencils to mark metal surfaces.

## **2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS**

- A. Metal Fascia, Break Metal Fascia, Metal Roof Edge and Metal Closure Panel: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long sections. Furnish with 6-inch-wide, joint cover plates. Shop fabricate interior and exterior corners.
  - 1. Joint Style: Butted with expansion space and 6-inch-wide, concealed backup plate.
  - 2. Fabricate from the Following Materials:
    - a. Aluminum: 0.040 inch thick.
- B. Where fascia exceeds 6 inches in width, provide fascia system in two equal height pieces with flat seam.
- C. Provide lap joint at roof/fascia expansion joints.

## **2.7 WALL SHEET METAL FABRICATIONS**

- A. Opening Flashings in Frame Construction: Fabricate louver sill flashings to extend the width of wall openings. Fabricate from the following materials:
  - 1. Aluminum: 0.040 inch thick.

## **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. Verify compliance with requirements for installation tolerances of substrates.
  - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 UNDERLAYMENT INSTALLATION**

- A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.
- B. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

### **3.3 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, 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, levels, and slopes. 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. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
  - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
  - 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 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 or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
  - 1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
  - 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
  - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
  - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

- 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. Seal joints as required for watertight construction.
  - 1. Use sealant-filled joints unless otherwise indicated. 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 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 Section 07 92 00 - Joint Sealants.
- G. Where indicated, install membrane strip flashing over two-piece metal counter flashing to tie to air barrier system.

### **3.4 ROOF FLASHING INSTALLATION**

- A. General: Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

### **3.5 WALL FLASHING INSTALLATION**

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

### **3.6 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 indicated on Drawings 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."

### **3.7 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 sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in 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**

## **SECTION 07 92 00**

### **JOINT SEALANTS**

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

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Silicone joint sealants.
  - 2. Mildew-resistant joint sealants.
  - 3. Latex joint sealants.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.

##### **1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- C. Sample Warranties: For special warranties.

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

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

## **1.5 FIELD 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: 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.

## **PART 2 - PRODUCTS**

### **2.1 JOINT SEALANTS, 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. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

### **2.2 SILICONE JOINT SEALANTS**

- A. Sealant Type 1: 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. Dow Corning Corporation; 790; 756 SMS for cold applications.
  - 2. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
  - 3. Pecora Corporation; 890.
  - 4. Sika Corporation, Construction Products Division; SikaSil-C990.
  - 5. Tremco Incorporated; Spectrem 1.
- B. Sealant Type 2: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
  - 1. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

2. Products: Subject to compliance with requirements, provide one of the following:
  - a. Dow Corning Corporation; 756 SMS (VOC 87).
  - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700 (VOC 27).
  - c. Pecora Corporation; 890NST (VOC 98).
- C. Sealant Type 3: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and 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. Pecora Corporation; 301 NS (VOC 50).
    - b. Tremco Incorporated; Spectrem 800 (VOC 1).
- D. Sealant Type 4: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant: ASTM C 920, Type S, Grade NS, Class 25, 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. Dow Corning Corporation; 786(VOC 33) (Food)
    - b. GE Advanced Materials - Silicones; Sanitary SCS1700.
    - c. Tremco Incorporated; Tremsil 200 Sanitary (VOC 1).

## **2.3 LATEX JOINT SEALANTS**

- A. Sealant Type 5: Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
  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; Sonolac (VOC 41).
    - b. Bostik, Inc.; Chem-Calk 600.
    - c. Pecora Corporation; AC-20 (VOC 31).
    - d. Sherwin-Williams 950A
    - e. Tremco Incorporated; Tremflex 834.

## **2.4 JOINT-SEALANT BACKING**

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and 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.

- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## **2.5 MISCELLANEOUS MATERIALS**

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- 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.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    - a. Metal.



- b. Glass.
  - c. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### **3.3 INSTALLATION OF JOINT SEALANTS**

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
  - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

### **3.4 CLEANING**

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### **3.5 PROTECTION**

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

### **3.6 JOINT-SEALANT SCHEDULE**

- A. Exterior Isolation and Contraction Joints in Cast-in-place Concrete Slabs.
  1. Silicone Joint Sealant: Sealant Type 3.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Exterior Control, Expansion, and Soft Joints in Fiber-Cement Siding Work and Adjacent Work.
  1. Silicone Joint Sealant: Sealant Type 2.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Under Exterior Door Thresholds.
  1. Silicone Joint Sealant: Sealant Type 1.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Exterior Joints for Which No Other Sealant Type is Indicated.
  1. Silicone Joint Sealant: Sealant Type 1.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Interior Isolation and Contraction Joints in Cast-In-Place Concrete Slabs.
  1. Silicone Joint Sealant: Sealant Type 3.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Concealed Interior Perimeter Joints of Exterior Openings.
  1. Silicone Joint Sealant: Sealant Type 1.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- G. Exposed Interior Perimeter Joints of Exterior Openings.
  1. Silicone Joint Sealant: Sealant Type 1.

2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- H. Perimeter Joints Between Interior Wall Surfaces and Frames of Interior Doors, Windows and Elevator Entrances.
  1. Latex Joint Sealant: Sealant Type 5.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- I. Joints between Plumbing Fixtures and Walls and Floors and Between Countertops and Walls.
  1. Silicone Joint Sealant: Sealant Type 4.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- J. Interior Joints for Which No Other Sealant is Indicated.
  1. Latex Joint Sealant: Sealant Type 5.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

**END OF SECTION**

## **SECTION 08 10 00**

### **DOORS AND FRAMES**

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

##### **1.1 SUMMARY**

- A. Section includes:
  - 1. Interior standard steel doors and frames.
  - 2. Exterior standard steel doors and frames.
  - 3. Solid-core doors with wood-veneer faces.
  - 4. Factory finishing flush wood doors.
  - 5. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Requirements:
  - 1. Section 08 71 00 - Door Hardware

##### **1.2 DEFINITIONS**

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

##### **1.3 COORDINATION**

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

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

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, core descriptions, and finishes.
- B. Hollow Metal Doors and Frames Shop Drawings, include the following:
  - 1. Elevations of each door type.
  - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
  - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  - 4. Locations of reinforcement and preparations for hardware.
  - 5. Details of each different wall opening condition.

6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
  7. Details of anchorages, joints, field splices, and connections.
  8. Details of accessories.
  9. Details of moldings, removable stops, and glazing.
- C. Flush Wood Doors Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
1. Dimensions and locations of blocking.
  2. Dimensions and locations of mortises and holes for hardware.
  3. Dimensions and locations of cutouts.
  4. Undercuts.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For door inspector.
1. Egress Door Inspector: Submit documentation of compliance with NFPA 101, section 7.2.1.15.4.
  2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.
- B. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

## **1.6 QUALITY ASSURANCE**

- A. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, section 7.2.1.15.4 and the following:
1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic for hollow metal doors and frames.
1. Provide additional protection to prevent damage to 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 doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.
- D. Mark each door on bottom rail with opening number used on Shop Drawings.

## **1.8 FIELD CONDITIONS**

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Standard Steel Doors and Frames:
    - a. Ceco Door Products; an Assa Abloy Group company.
    - b. Curries Company.
    - c. J/R Metal Frames Manufacturing, Inc.
    - d. Steelcraft; a division of Ingersoll-Rand.
  2. Flush Wood Doors:
    - a. Algoma Hardwoods Inc.
    - b. Eggers Industries.
    - c. Graham Wood Doors; an Assa Abloy Group company.
    - d. Marshfield Door Systems, Inc..
    - e. VT Industries Inc.
- B. Source Limitations: Obtain each type of door from single source from single manufacturer.

### **2.2 FLUSH WOOD DOORS, GENERAL**

- A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."
1. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- C. Particleboard-Core Doors:
1. Particleboard: ANSI A208.1, Grade LD-2.
  2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
  3. Grade: Premium, with Grade A faces.

4. Species: White ash.
5. Cut: Plain sliced (flat sliced).
6. Match between Veneer Leaves: Book match.
7. Assembly of Veneer Leaves on Door Faces: Balance match.
8. Exposed Vertical Edges: Same species as faces - edge Type A.
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.

## **2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES**

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
  1. Full hinge cut-outs for non-handed doors will not be acceptable.
- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3; SDI A250.4, Level A.
  1. Doors:
    - a. Type: As indicated in the Door and Frame Schedule.
    - b. Thickness: 1-3/4 inches.
    - c. Face: Uncoated steel sheet, minimum thickness of 0.053 inch.
    - d. Edge Construction: Model 2, Seamless.
    - e. Edge Bevel: Bevel lock edge 1/8 inch in 2 inches.
    - f. Core: Manufacturer's standard.
  2. Frames:
    - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
    - b. Construction: Face welded.
  3. Exposed Finish: Prime.

## **2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES**

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors: SDI A250.8, Level 3; SDI A250.4, Level A.
  1. Doors:
    - a. Type: As indicated in the Door and Frame Schedule.
    - b. Thickness: 1-3/4 inches.
    - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60coating.

- d. Edge Construction: Model 2, Seamless.
  - e. Edge Bevel: Bevel lock edge 1/8 inch in 2 inches.
  - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
  - g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
  - h. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
  - i. Core: Manufacturer's polyurethane core.
- C. Maximum-Duty Door Frames: SDI A250.8, Level 4; SDI A250.4, Level A.
- 1. Frames:
    - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A60 coating.
    - b. Construction: Face welded.
  - 2. Exposed Finish: Prime.

## **2.5 FRAME ANCHORS**

- A. Jamb Anchors:
- 1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
  - 2. Compression Type for Drywall Slip-on Frames: Not applicable.
  - 3. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
  - 4. Postinstalled Expansion Anchor (Where indicated for Exterior Doors): Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Material: ASTM A 879/A 879M, Commercial Steel (CS), 04Z 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.

## **2.6 HOLLOW METAL DOORS AND FRAMES, 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 A60 metallic coating.
  - 1. Wipe Coat Galvanneal materials will not be considered acceptable.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- G. Spray Foam Insulation: Refer to Section 07 21 00 -Thermal Insulation.
- H. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## **2.7 FABRICATION**

- A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
  - 1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
- B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
  - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
  - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- C. Wood Doors: Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  - 1. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA- 156.115-W, and hardware templates.

2. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

## **2.8 STEEL FINISHES**

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
  1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## **2.9 WOOD DOORS, 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 bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
  1. Grade: Premium.
  2. Finish: WDMA TR-4 conversion varnish or WDMA TR-6 catalyzed polyurethane.
  3. Effect: Open-grain finish.
  4. Sheen: Satin.

## **PART 3 - EXECUTION**

### **3.1 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. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
- C. Field apply bituminous coating to backs of frames that will be filled with grout or located in exterior walls.
- D. Apply spray foam insulation in exterior door frames prior to frame installation. Fill frame and cut off excess to allow for installation and final filling of voids with spray foam insulation as indicated below.

### **3.2 INSTALLATION**

- A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with reviewed Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with SDI A250.11.
  - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
    - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    - b. Install frames with removable stops located on secure side of opening.
- C. Floor Anchors: Secure with postinstalled expansion anchors.
  - 1. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
  - 2. Solidly pack mineral-fiber insulation inside interior frames.
  - 3. Exterior Hollow Metal Door Frames: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces. Prior to installing frames, pre-fill frames with spray foam insulation around frame as indicated on the drawings. Voids around installed frames to be foamed as specified in Section 07 21 00 - Thermal Insulation.
  - 4. Installation Tolerances: Adjust hollow-metal frames 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.
    - 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.
- D. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
  - 1. Non-Fire-Rated Steel Doors: Comply with SDI A250.8.
- E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

### **3.3 FIELD QUALITY CONTROL**

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

- B. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements according to NFPA 101, section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

### **3.4 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.

### **3.5 CLEANING AND TOUCHUP**

- A. 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.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

**END OF SECTION**

## **SECTION 08 32 13**

### **SLIDING ALUMINUM-FRAMED GLASS DOORS**

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

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Sliding aluminum-framed glass doors
  - 2. Factory glazing
  - 3. Operating hardware and accessories
- B. Related Sections:
  - 1. Section 08 44 13 – Aluminum-Framed Storefronts
  - 2. Section 08 71 00 – Door Hardware

##### **1.2 COORDINATION**

- A. Coordinate installation of the work of this section with Section 08 44 13 – Aluminum-Framed Storefronts and Section 08 71 00 – Door Hardware for keying requirements.

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

- A. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.

##### **1.4 INFORMATION SUBMITTALS**

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of sliding aluminum-framed glass door indicated.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type, class, grade, and size of sliding aluminum-framed glass doors. Test results based on use of downsized test units will not be accepted.

##### **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.
- B. Manufacturer Qualifications: A manufacturer capable of fabricating sliding aluminum-framed glass doors that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

- C. Source Limitations: Obtain sliding aluminum-framed glass door through one source from a single manufacturer.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of sliding aluminum-framed glass doors and are based on the specific system indicated. Do not modify size and dimensional requirements.
  - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

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

- A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle sliding door material and components to avoid damage. Protect sliding door material against damage from elements, construction activities, and other hazards before, during and after sliding door installation.

#### 1.7 **PROJECT CONDITIONS**

- A. Field Measurements: Verify actual dimensions of sliding aluminum-framed glass door openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

#### 1.8 **WARRANTY**

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
  - 1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

### **PART 2 - PRODUCTS**

#### 2.1 **PERFORMANCE REQUIREMENTS**

- A. General Performance: Sliding aluminum-framed glass door system shall withstand the effects of the following performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
  - 1. Failure also includes the following:
    - a. Thermal stresses transferring to building structure.
    - b. Glass breakage.
    - c. Noise or vibration created by wind and thermal and structural movements.
    - d. Loosening or weakening of fasteners, attachments, and other components.

- B. Sliding Aluminum-Framed Glass Door Performance Requirements:
  - 1. Performance Requirements: Provide sliding aluminum-framed glass doors of performance indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS).
    - a. Performance Class and Grade: AW-PG45-SD.
- C. Structural Loads:
  - 1. Wind Loads: As indicated on Drawings.
- B. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. The air infiltration rate shall not exceed 0.30 cfm/ft<sup>2</sup> (1.5 L/s•m<sup>2</sup>) at a static air pressure differential of 6.27 psf (300 Pa).
- D. Air Exfiltration: The test specimen shall be tested in accordance with ASTM E 283. The air exfiltration rate shall not exceed 0.10 cfm/ft<sup>2</sup> (0.5 L/s•m<sup>2</sup>) at a static air pressure differential of 1.57 psf (75 Pa).
- E. Water Resistance: The test specimen shall be tested in accordance with ASTM E 547 and ASTM E 331. There shall be no leakage as defined in the test method at a static air pressure differential of:
  - 1. 12 psf (580 Pa) with standard sill.
- F. Uniform Load: A static air design load of 45 psf (2160 Pa) or 65 psf (3120 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member at design load. At structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing member in excess of 0.2% of the clear spans shall occur.
  - 1. Forced Entry Resistance: Comply with Performance Grade 10 requirements when tested according to ASTM F 842.
  - 2. Operating Force: Tested according to and complying with ASTM E2068.
- G. Seismic Performance: withstand the effects of earthquake motions determined according to ASCE/SEI 7.

## 2.2 MANUFACTURERS

- A. Basis-of-Design: Series AA 3200IR-SUB Sash OXXO by Thermal Kawneer Company Inc.
- B. Substitutions: Refer to Division 01 for Substitution Procedures.

## 2.3 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by sliding aluminum-framed glass door manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.8 mm) wall thickness at any location for the main frame and sash members.
- B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with sliding aluminum-framed glass door members, trim hardware, anchors, and other components.

- C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- E. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
  - 1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
- F. Sealant: For sealants required within fabricated sliding door, provide sliding door manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

## 2.4 SLIDING DOOR

- A. Sliding Aluminum-Framed Glass Doors:
  - 1. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
  - 2. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposed shall be stainless steel.
  - 3. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

## 2.5 GLAZING

- A. Glass and Glazing Materials: Refer to Section 08 80 00 Glazing for glass units and glazing requirements applicable to glazed sliding aluminum-framed glass doors units.
- B. Glazing System: Glazing method shall be a wet/dry type in accordance with manufacturer's standards. Exterior glazing shall be silicone back bedding sealant. Interior glazing shall be snap-in type glazing beads with an interior gasket in accordance with AAMA 702 or ASTM C864.

## 2.6 HARDWARE

- A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock sliding aluminum-framed glass doors.
- B. Standard Hardware:
  - 1. One pair of stainless steel tandem rollers per sliding panel.
  - 2. Stainless steel roller track.
  - 3. Hookbolt lock: 2-point Hookbolt lock.



4. Pull handle exterior: Flush finger pull – Blank
5. Pull handle interior: “D” pull - with Lever.
  - a. Keying: Refer to Section 08 71 00 – Door Hardware.

## **2.7 FABRICATION**

- A. Fabricate sliding aluminum-framed glass doors in sizes indicated. Include a complete system for assembling components and anchoring doors.
- B. Fabricate sliding aluminum-framed glass doors that are re-glazable without dismantling perimeter framing.
  1. Master Frame: Joined together with butt type joints, neatly sealed and assembled by a minimum of 2 stainless steel fasteners per joint anchored into continuous integral screw raceways.
  2. Sliding Panels: Shall have coped butt type joinery secured with stainless steel fasteners. Sliding panels shall not be removable when in a locked position.
  3. Fixed Panels: Shall have coped butt type joinery secured with stainless steel fasteners.
- C. Weather Stripping: Provide weather stripping locked into extruded grooves in door panels or frames as indicated on manufacturer's drawings and details.
- D. Weep Holes: Provide weep holes and internal drainage passages to conduct infiltrating water to exterior as detailed.
- E. Factory-Glazed Fabrication: Glaze sliding aluminum-framed glass doors in the factory where practical and possible for applications indicated. Comply with requirements in Section 08 80 00 - Glazing and with AAMA/WDMA/CSA 101/I.S.2/A440.

## **2.8 ALUMINUM FINISHES**

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight sliding door installation.
  1. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Comply with Drawings, Shop Drawings, and manufacturer's current written instructions for installing sliding doors, hardware, accessories, and other components.
- B. Install sliding doors level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.
- D. Install sliding doors and components to drain condensation, water penetrating joints, and moisture migrating within sliding door to the exterior.
- E. Separate aluminum from dissimilar materials to prevent corrosion or electrolytic action at points of contact.

### **3.3 ADJUSTING, CLEANING, AND PROTECTION**

- A. Adjust operating door panels, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weather tight closure. Lubricate hardware and moving parts.
- B. Clean aluminum surfaces immediately after installing sliding doors. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Clean factory-glazed glass immediately after installing sliding doors. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- E. Protect sliding door surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor sliding door surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, mortar, alkaline deposits, stains, or other contaminants. If contaminating substances do contact sliding door surfaces, remove contaminants immediately according to manufacturer's written recommendations.

**END OF SECTION**

## **SECTION 08 41 13**

### **ALUMINUM-FRAMED STOREFRONTS**

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

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Exterior storefront framing.
- B. Related Sections:
  - 1. Section 08 32 13 – Sliding Aluminum-Framed Glass Doors
  - 2. Section 08 80 00 – Glazing

##### **1.2 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
  - 2. Review structural loading limitations.
  - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review tie-in to air barrier system.
  - 5. Review sill flashing details and components.

##### **1.3 COORDINATION**

- A. Coordinate installation of aluminum-framed storefronts with sliding aluminum-framed glass doors, refer to Section 08 32 13.

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

- A. Product Data:
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Provide "Project Specific" shop drawings for aluminum-framed storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
  - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
  - 2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed storefronts, showing the following:

- a. Joinery, including concealed welds.
    - b. Anchorage.
    - c. Expansion provisions.
    - d. Glazing.
    - e. Flashing and drainage.
  3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Delegated-Design Submittal: For aluminum-framed storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed storefront.
- B. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- C. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.
- D. Sample Warranties: For special warranties.

## **1.6 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For aluminum-framed storefronts 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.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. 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.
1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

## **1.8 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed storefronts 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:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Noise or vibration created by wind and thermal and structural movements.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - d. Water penetration through fixed glazing and framing areas.
    - e. Failure of operating components.
  - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM 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. Warranty Period: 10 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
  - 1. Aluminum-framed storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
  - 2. Failure also includes the following:
    - a. Thermal stresses transferring to building structure.
    - b. Glass breakage.
    - c. Noise or vibration created by wind and thermal and structural movements.
    - d. Loosening or weakening of fasteners, attachments, and other components.

- C. Structural Loads:
  - 1. Wind Loads: As indicated on Drawings.
- D. Deflection of Framing Members: At design wind pressure, as follows:
  - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, 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 to less than 1/8 inch.
- E. Structural: Test according to ASTM E 330 as follows:
  - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
  - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
  - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
  - 1. Fixed Framing and Glass Area:
    - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.
- G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
  - 1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- H. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:
  - 1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
  - 2. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.
- I. Seismic Performance: Aluminum-framed storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- J. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.36 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
  2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.40 as determined according to NFRC 200.
  3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 56 as determined according to NFRC 500.
- K. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## **2.2 MANUFACTURERS**

- A. Source Limitations: Obtain components of storefront system and accessories, from single manufacturer.
- B. Manufacturers: Subject to compliance with requirements, provide indicated products by one of the following:
1. EFCO: System 406 T.
  2. Kawneer: Trifab 601 T.
  3. Tubelite: T24650 Series.
  4. Oldcastle: 6000 Thermal MultiPlane.
  5. YKK AP: YES 60 TU.

## **2.3 STOREFRONT SYSTEMS**

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken
  2. Glazing System: Retained mechanically with gaskets on four sides.
  3. Glazing Plane: Center.
  4. Finish: Clear anodized aluminum finish.
  5. Fabrication Method: Field-fabricated stick system.
  6. Exterior Jambs and Head Framing: Provide manufacturer's standard extruded aluminum continuous thermal flat filler for use at jambs and head framing. This extrusion provides the necessary profile for sealing with the building air barrier system. Channel type jamb components will not be acceptable.
  7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
  8. Steel Reinforcement: As required by manufacturer.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

## **2.4 GLAZING**

- A. Glazing: Insulated Glass: Low-E-coated, clear insulating glass. Refer to Section 08 80 00 – Glazing.
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.
- D. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.
  - 1. Color: Match structural sealant.

## **2.5 MATERIALS**

- A. Sheet and Plate: ASTM B 209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
- C. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
- D. Structural Profiles: ASTM B 308/B 308M.
- E. Steel Reinforcement:
  - 1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
  - 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
  - 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.
  - 4. Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

## **2.6 ACCESSORIES**

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
  - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  - 2. Reinforce members as required to receive fastener threads.
  - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel.



- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
  - 1. 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 requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Membrane Strip Flashing: Refer to Section 072726 "Fluid-Applied Membrane Air Barriers" for flashing material.
- E. Metal Cap Flashing: Refer to Section 074213.13 "Formed Metal Wall Panels" for cap flashing.
- F. Exposed Flashing (Break Metal Flashing) at Jambs, Head and Sills: Shop formed 0.090-inch-thick aluminum with finish to match storefront system. Fabricate to details on the drawings.
- G. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.
- H. Subsills for Exterior Storefronts: Manufacturer's standard thermally broken extruded aluminum sill flashing, color to match framing.

## **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. 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. Physical and thermal isolation of glazing from framing members.
  - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  - 5. Provisions for field replacement of glazing from exterior.
  - 6. 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 framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.

- F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## **2.8 ALUMINUM FINISHES**

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

### **3.3 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 nonmovement joints.
  - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
  - 6. Seal perimeter and other joints watertight unless otherwise indicated.
- B. Metal Protection:
  - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
  - 2. Where aluminum is in contact with concrete, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00 - Joint Sealants to produce weathertight installation.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install glazing as specified in Section 08 80 00 - Glazing.

- F. Install weatherseal sealant according to Section 07 92 00 - Joint Sealants and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.
- G. Where indicated, install metal cap flashing, sealant and membrane strip flashing to tie to air barrier system.

### **3.4 ERECTION TOLERANCES**

- A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
  - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
  - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
  - 3. Alignment:
    - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2-inch-wide, limit offset from true alignment to 1/16 inch.
    - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
  - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

**END OF SECTION**

**SECTION 08 71 00**  
**DOOR HARDWARE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes commercial door hardware for the following:
  - 1. Swinging doors.
  - 2. Sliding doors.
- B. Door hardware includes, but is not necessarily limited to, the following:
  - 1. Mechanical door hardware.
  - 2. Electromechanical door hardware.
  - 3. Automatic operators.
  - 4. Cylinders specified for doors in other sections.
- C. Related Sections:
  - 1. Section 06 10 00 - Rough Carpentry
  - 2. Section 08 10 00 - Doors and Frames
  - 3. Section 08 32 13 - Sliding Aluminum-Framed Glass Doors
  - 4. Section 08 44 13 - Aluminum-Framed Storefronts
  - 5. Division 28 for Access Control
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 2. ICC/IBC - International Building Code.
  - 3. NFPA 70 - National Electrical Code.
  - 4. NFPA 80 - Fire Doors and Windows.
  - 5. NFPA 101 - Life Safety Code.
  - 6. NFPA 105 - Installation of Smoke Door Assemblies.
  - 7. UL/ULC and CSA C22.2 – Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
  - 8. State Building Codes, Local Amendments.
- E. Standards: hardware specified shall comply with the following industry standards:
  - 1. ANSI/BHMA Certified Product Standards - A156 Series

2. UL10C – Positive Pressure Fire Tests of Door Assemblies

**1.2 COORDINATION**

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

**1.3 SUBMITTALS**

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  - 3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
    - h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
    - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    - b. Complete (risers, point-to-point) access control system block wiring diagrams.
    - c. Wiring instructions for each electronic component scheduled herein.
  2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the Owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- E. Informational Submittals:
1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

#### **1.4 QUALITY ASSURANCE**

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware 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.

- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
  - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third-party source will not be accepted.
  - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- F. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service.

#### **1.6 WARRANTY**

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
  - 1. Structural failures including excessive deflection, cracking, or breakage.
  - 2. Faulty operation of the hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
  1. Ten years for mortise locks and latches.
  2. Five years for exit hardware.
  3. Twenty five years for manual surface door closer bodies.
  4. Five years for motorized electric latch retraction exit devices.
  5. Two years for electromechanical door hardware.

## **1.7 MAINTENANCE SERVICE**

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

## **PART 2 - PRODUCTS**

### **2.1 SCHEDULED DOOR HARDWARE**

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets, and as noted below.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
  1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

### **2.2 CYLINDERS AND KEYING**

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
  1. Manufacturers: Sargent Manufacturing (SA) - Signature Series



- C. Cylinders: Original manufacturer cylinders complying with the following:
  - 1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
  - 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  - 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
  - 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
  - 5. Keyway: Match Facility Standard.
- D. Security Cylinders: ANSI/BHMA A156.5, Grade 1, patterned security cylinders and keys able to be used together under the same facility master or grandmaster key system. Cylinders are to be factory keyed.
- E. Keying System: Each type of lock and cylinders to be factory keyed.
  - 1. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
  - 2. Existing System: Key locks to Owner's existing system.
- F. Key Quantity: Provide the following minimum number of keys:
  - 1. Change Keys per Cylinder: Three (3).
  - 2. Master Keys (per Master Key Level/Group): Five (5).
  - 3. Construction Keys (where required): Ten (10).
- G. Construction Keying: Provide construction master keyed cylinders.
- H. Key Registration List (Bitting List):
  - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
  - 2. Provide transcript list in writing or electronic file as directed by the Owner.

## **2.3 MECHANICAL LOCKS AND LATCHING DEVICES**

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
  - 1. Manufacturers:
    - a. Sargent Manufacturing (SA) – 8200 Series.

## **2.4 CONVENTIONAL EXIT DEVICES**

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
  2. Provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
  3. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
  4. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.
  5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
    - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
  6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
  7. Rail Sizing: Provide exit device rails factory sized for proper door width application.
  8. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:
    - a. Sargent Manufacturing (SA) - 80 Series.

## **2.5 ELECTROHYDRAULIC DOOR OPERATORS**

- A. General: Provide low energy operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.
- B. Standard: Certified ANSI/BHMA A156.19.
- C. Performance Requirements:
  1. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
  2. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.

- D. Configuration: Surface mounted or in-ground as required. Door operators to control single swinging and pair of swinging doors.
- E. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19. When not in automatic mode, door operator to function as manual door closer with fully adjustable opening and closing forces, with or without electrical power.
- F. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.
- G. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.
- H. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.
- I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Norton Door Controls (NO) - 6000 Series.

## **2.6 FABRICATION**

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## **2.7 FINISHES**

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

### **3.2 PREPARATION**

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

### **3.3 INSTALLATION**

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
  - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  - 4. Provide blocking in gypsum board partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### **3.4 FIELD QUALITY CONTROL**

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

### **3.5 ADJUSTING**

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

### **3.6 CLEANING AND PROTECTION**

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### **3.7 DEMONSTRATION**

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

### **3.8 DOOR HARDWARE SETS**

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. Manufacturer's Abbreviations:
  - 1. MK - McKinney
  - 2. PE - Pemko
  - 3. RO - Rockwood
  - 4. SA - Sargent
  - 5. SU - Securitron
  - 6. OT - OTHER

### **Hardware Sets**

#### **Set 1.0**

Door: 100.1

1 Cylinder	as required	US26D	SA
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Note: Balance of hardware including rollers, roller track, hookbolt, pulls, and lever by others, refer to Section 08 32 13.

#### **Set 2.0**

Door: 100.2

1 Continuous Hinge	MCK-25HD EPT	CL	MK
1 Rim Exit Device	10 16 21 43 56 8804	US32D	SA
1 Door Pull	BF157	US32D	RO
1 Door Closer	281 CPS X DROP PLATE AS REQUIRED	EN	SA
1 Threshold	to architect detail		PE
1 Gasketing	290APK x 2891APK		PE
1 Sweep	18061CNB		PE
1 ElectroLynx Harness - Frame	QC-C1500P		MK
1 ElectroLynx Harness - Door	QC-CXXX (Size as required)		MK
1 Electric Power Transfer	EL-CEPT		SU
1 Wiring Diagram	WD-SYSPK		SA
1 Card Reader	by Security System Supplier		OT
1 Power Supply	AQD6		SU
1 Door Operator	6060 / 6070	689	NO
1 Door Switch	501		NO

Notes: Door closed & locked at all times. Presenting valid credential outside allows for authorized entrance. Inside always operable allowing for egress at all times. With loss of power door remains locked.

#### **Set 3.0**

Door: 100.3

3 Hinge	TA2714	US26D	MK
1 Institutional Privacy Lock	10 21 50 8267 LNL	US26D	SA
1 Door Stop	400 / 441CU	US26D	RO
3 Silencer	608		RO

**Set 4.0**

Door: 100.5, 101.1

3	Hinge	TA2714	US26D	MK
1	Storeroom Lock	10 21 8204 LNL	US26D	SA
1	Door Stop	400 / 441CU	US26D	RO
3	Silencer	608		RO

**END OF SECTION**

## **SECTION 08 80 00**

### **GLAZING**

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

##### **1.1 SUMMARY**

- A. Section includes:
  - 1. Glass for storefront framing and sliding doors.
  - 2. Glazing sealants and accessories.
  - 3. Window film.

##### **1.2 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. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

##### **1.3 REFERENCE STANDARDS**

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
  - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

##### **1.4 COORDINATION**

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

##### **1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.



- C. 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.

## **1.6 INFORMATIONAL SUBMITTALS**

- A. Product Certificates: For glass.
- B. Product Test Reports: For security glass and insulating glass, for tests performed by a qualified testing agency.
- C. Preconstruction adhesion and compatibility test report.
- D. Sample Warranties: For special warranties.

## **1.7 QUALITY ASSURANCE**

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

## **1.8 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 instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

## **1.9 FIELD 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.
- B. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

## **1.10 WARRANTY**

- A. Manufacturer's Special Warranty for 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 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: Engage a qualified professional engineer, as defined in Division 01 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
1. Design Wind Pressures: As indicated on Drawings.
  2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
    - a. Wind Design Data: As indicated on Structural Drawings.
  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, whichever is less.
  4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. 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.
  3. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
  4. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

## **2.2 GLASS PRODUCTS, GENERAL**

- A. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IgCC.
- B. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
  - 1. Minimum Glass Thickness for Exterior Lites: 6 mm.
- C. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

## **2.3 GLASS PRODUCTS**

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
  - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Quality-Q3.
  - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

## **2.4 INSULATING GLASS**

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
  - 1. Sealing System: Dual seal, with silicone primary seal and butyl secondary seal.
  - 2. Spacer: Aluminum with mill or clear anodic finish.
  - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

## **2.5 GLAZING SEALANTS**

- A. General:
  - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation; 790.
    - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
    - c. May National Associates, Inc.; Bondaflex Sil 290.
    - d. Pecora Corporation; 890.
    - e. Sika Corporation, Construction Products Division; SikaSil-C990.
    - f. Tremco Incorporated; Spectrem 1.

## **2.6 WINDOW FILM**

- A. Decorative Film: Window film by SOLYXiQ, Style: Gradient.
  1. Obscuring polyester film intended to be bonded to existing window glass by clear distortion free adhesive. Film shall be scratch resistant and maintained with mild cleaning solutions.
  2. Dimensions (minimum): refer to Elevation Drawings.
  3. Adhesive, factory applied to polyester film, water activated, non-water reactivated.
  4. Color: Allow for Architect to select from standard manufacturer color selection.

## **2.7 GLAZING TAPES**

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
  1. AAMA 804.3 tape, where indicated.
  2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
  1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
  2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

## **2.8 MISCELLANEOUS GLAZING MATERIALS**

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

## **2.9 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.
  - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
  - 2. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## **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 leave visible marks in the completed Work.

### **3.3 GLAZING, GENERAL**

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, window films and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. 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.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
- G. 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.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. 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.
- K. 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 and butt joints with sealant recommended by gasket manufacturer.

### **3.4 TAPE GLAZING**

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

### **3.5 GASKET GLAZING (DRY)**

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

### **3.6 SEALANT GLAZING (WET)**

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### **3.7 CLEANING AND PROTECTION**

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. 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.
  - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces 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.

### **3.8 INSULATING GLASS SCHEDULE**

- A. Insulated Glass (G1): Low-E-coated, clear insulating glass.
  - 1. Basis-of-Design Product: PPG Solarban 90
  - 2. Overall Unit Thickness: 1 inch.
  - 3. Minimum Thickness of Each Glass Lite: 6 mm.
  - 4. Outdoor Lite: Annealed float glass.
    - a. Fully tempered where required by code.
  - 5. Interspace Content: Argon.
  - 6. Indoor Lite: Annealed float glass.
    - a. Fully tempered where required by code.
  - 7. Low-E Coating: Pyrolytic or sputtered on second and third surface.
  - 8. Winter Nighttime U-Factor: 0.26 maximum.
  - 9. Summer Daytime U-Factor: 0.26 maximum.
  - 10. Visible Light Transmittance: 51 percent minimum.
  - 11. Solar Heat Gain Coefficient: 0.23 maximum.
  - 12. Safety glazing where required.

**END OF SECTION**



## **SECTION 09 22 16**

### **NON-STRUCTURAL METAL FRAMING**

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

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Non-load-bearing steel framing systems for interior partitions.
  - 2. Suspension systems for interior ceilings and soffits.
  - 3. Grid suspension systems for gypsum board ceilings.
- B. Related Sections:
  - 1. Section 05 40 00 - Cold-Formed Metal Framing

##### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."

##### **1.3 INFORMATIONAL SUBMITTALS**

- A. Evaluation Reports: For embossed steel studs and runners from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

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

##### **2.1 FRAMING SYSTEMS**

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dietrich Metal Framing; a Worthington Industries Company.
    - b. EB Metal, U.S.
    - c. MarinoWare; a division of Ware Industries.
    - d. Super Stud Building Products, Inc.
    - e. The Steel Network, Inc.
  - 2. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.

3. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- B. Studs and Tracks: ASTM C 645. Use either, steel studs and tracks or embossed steel studs and tracks.
  1. Steel Studs and Tracks:
    - a. Minimum Base-Metal Thickness: 0.0179 inch (18 mils) for furring and framing for soffits, 0.0269 inch (27 mils) for wall framing and 0.0296 inch (30 mils) for fire fire-rated wall framing.
    - b. Depth: As indicated on Drawings.
  2. Embossed Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally equivalent to conventional ASTM C 645 steel studs and tracks.
    - a. Minimum Base-Metal Thickness: 0.0147 inch for equivalent to 18 mil and 0.0190 inch for equivalent to 27 mil.
    - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints for Non-Fire Rated Walls: Where indicated, provide one of the following:
  1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
  2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
  3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
      - 2) MBA Building Supplies; FlatSteel Deflection Track or Slotted Deflecto Track.
      - 3) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
      - 4) Superior Metal Trim; Superior Flex Track System (SFT).
      - 5) Telling Industries; Vertical Slip Track or Vertical Slip Track II.
- D. Flat Strap and Backing Plate (metal blocking, type 1): Steel sheet for blocking and bracing in length and width indicated.
  1. Minimum Base-Metal Thickness: 16 gage, unless noted otherwise.
- E. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.
  1. Depth: 1-1/2 inches.

2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  1. Minimum Base-Metal Thickness: 0.0179 inch.
  2. Depth: As indicated on Drawings.
- G. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
  1. Configuration: Asymmetrical.
- H. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
  1. Depth: 3/4 inch.
  2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
  3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

## **2.2 SUSPENSION SYSTEMS**

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.
  1. Depth: 1-1/2 inches.
- E. Furring Channels (Furring Members):
  1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
  2. Steel Studs and Runners: ASTM C 645.
    - a. Minimum Base-Metal Thickness: 0.0179 inch (18 mils).
    - b. Depth: As indicated on Drawings.
  3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
  4. Minimum Base-Metal Thickness: 0.0179 inch.
  5. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.
    - a. Configuration: Asymmetrical.

- F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
    - b. Chicago Metallic Corporation; Drywall Grid System.
    - c. USG Corporation; Drywall Suspension System.

## **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 of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
  - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Insulation Materials:
  - 1. Before sprayed insulation materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed insulation materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
  - 2. After sprayed insulation materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of insulation materials below that are required for thermal ratings indicated. Protect adjacent insulation materials from damage.

### **3.3 INSTALLATION, GENERAL**

- A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- 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. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
  1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
  2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
  3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (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 that penetrate partitions above ceiling.
  1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two 0.0296 inch (30 mils) studs at each jamb, unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

### **3.5 INSTALLING SUSPENSION SYSTEMS**

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
  - 1. Hangers: 48 inches o.c.
  - 2. Carrying Channels (Main Runners): 48 inches o.c.
  - 3. Furring Channels (Furring Members): 16 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
  - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
  - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 5. Do not attach hangers to steel roof deck.
  - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

**END OF SECTION**

## **SECTION 09 29 00**

### **GYPSUM BOARD**

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

##### **1.1 SUMMARY**

A. Section Includes:

1. Interior gypsum board.

B. Related Requirements:

1. Section 06 16 00 - Sheathing for gypsum sheathing for exterior walls.
2. Section 09 22 16 - Non-Structural Metal Framing for non-structural steel framing and suspension systems that support gypsum board panels.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

##### **1.3 DELIVERY, STORAGE AND HANDLING**

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

##### **1.4 FIELD CONDITIONS**

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

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

##### **2.1 GYPSUM BOARD, GENERAL**

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.



## **2.2 INTERIOR GYPSUM BOARD**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Gypsum.
  - 2. CertainTeed Corp.
  - 3. Georgia-Pacific Gypsum LLC.
  - 4. Lafarge North America Inc.
  - 5. National Gypsum Company.
  - 6. PABCO Gypsum.
  - 7. Temple-Inland.
  - 8. USG Corporation.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
  - 1. Thickness: 5/8 inch.
  - 2. Long Edges: Tapered.
- C. Moisture-Resistant Gypsum Board: ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Georgia-Pacific Building Products; DensArmor Plus Fireguard.
    - b. National Gypsum Company; Gold Bond® Brand eXP Fire-Shield Interior Extreme Gypsum Panel.
  - 2. Core: 5/8 inch, Type X.
  - 3. Long Edges: Tapered.
  - 4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## **2.3 TRIM ACCESSORIES**

- A. Interior Trim: ASTM C 1047.
  - 1. Material:
    - a. Galvanized or aluminum-coated steel sheet or rolled zinc.
    - b. Trim-Tex, Super Seal Tear Away™ L Bead where abutting exterior metal doors and windows.
  - 2. Shapes:
    - a. Cornerbead.
    - b. Bullnose bead.
    - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - d. L-Bead: L-shaped; exposed long flange receives joint compound.
    - e. Expansion (control) joint.

- B. Mudded Edge Molding: Provide F Control Joint by Vinyl Corp. or equal.

## **2.4 JOINT TREATMENT MATERIALS**

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  - 1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.
    - a. Use setting-type taping with mold-resistant gypsum wallboard.
    - b. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
  - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
  - 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

## **2.5 AUXILIARY MATERIALS**

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. 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.
- D. Acoustical Batt Insulation: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  - 1. Where indicated, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Roxul-Rockwool; AFB.
    - b. Thermafiber; SAFB.
- E. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Pecora Corporation; AC-20 FTR or AIS-919.
  - b. USG Corporation; SHEETROCK Acoustical Sealant.
- F. Thermal Insulation: As specified in Section 07 21 00 - Thermal Insulation.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 APPLYING AND FINISHING PANELS, GENERAL**

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  2. Fit gypsum panels around ducts, pipes, and conduits.
  3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### **3.3 APPLYING INTERIOR GYPSUM BOARD**

- A. Install interior gypsum board in the following locations:
  - 1. Type X: Vertical and horizontal surfaces unless otherwise indicated.
  - 2. Moisture Resistant Type: at horizontal surfaces at the following locations:
    - a. West elevation in water closet (T102).
- 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 metal framing) and horizontally (perpendicular to wood 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 stairwells and other 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.
- C. Multilayer Application:
  - 1. On ceilings, apply gypsum board indicated for base layers before applying face layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
  - 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

### **3.4 INSTALLING TRIM ACCESSORIES**

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on approved Shop 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 unless otherwise indicated.
  2. LC-Bead: Use at exposed panel edges.

### **3.5 FINISHING GYPSUM BOARD**

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish interior panels to levels indicated below and according to ASTM C 840:
  1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  2. Level 2: not used.
  3. Level 3: not used.
  4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
  5. Level 5: not used.
- B. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

### **3.6 PROTECTION**

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

**END OF SECTION**

## **SECTION 09 51 13**

### **ACOUSTIC CEILING SYSTEMS**

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

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Materials and application of acoustical units for application and installation within a suspended ceiling.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

##### **1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For testing agency.
- B. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

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

- A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

##### **1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
- C. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

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

- A. Deliver acoustical panels, suspension-system components, and accessories to project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

## **1.7 SITE REQUIREMENTS**

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

## **1.8 EXTRA MATERIALS**

- A. Provide extra materials of acoustic units in accordance with Section 01 11 00 – Summary of Works.
- B. Provide acoustical units amounting to 2% of gross ceiling area for each pattern and type required for project.
- C. Ensure extra materials are from same production run as installed materials.
- D. Clearly identify each type of acoustic unit, including colour and texture.
- E. Deliver to Owner, upon completion of the work of this section.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- C. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
- D. Smoke-Developed Index: 50 or less.
- E. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

### **2.2 ACOUSTICAL PANELS, GENERAL**

- A. Source Limitations:
  - 1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
  - 2. Suspension System: Obtain each type from single source from single manufacturer.
- B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- C. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.



- D. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance unless otherwise indicated.
- E. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- F. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
  - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

## **2.3 MATERIALS**

- A. Basis-of-Design, (C-1): Armstrong; Yukon 8771.
- B. Properties:
  - 1. Composition: Mineral fiber.
  - 2. Color: White.
  - 3. LR: Not less than 0.82.
  - 4. NRC: Not less than 0.75.
  - 5. CAC: Not less than 28.
- C. Edge/Joint Detail: Square beveled.
  - 1. Modular Size: 24 by 24 inches.
  - 2. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.

## **2.4 ACOUSTICAL SUSPENSION SYSTEM**

- A. Intermediate duty system to ASTM C635.
  - 1. Acceptable Material: Prelude XL 15/16" Grid by Armstrong.
- B. Basic materials for suspension system: commercial quality cold rolled steel, zinc coated.
- C. Suspension system: non-fire rated, two directional exposed tee bar grid with width as appropriate for materials specified.
  - 1. Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

2. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- D. Exposed tee bar grid components: shop painted satin sheen, white colour. Components die cut. Main tee with double web, rectangular bulb and 1 inch rolled cap on exposed face. Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection.
- E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.
- F. Hanger inserts: purpose made.
- G. Accessories: seismic stabilizer bars, struts, splices, clips, wire ties, retainers and wall moulding flush, to complement suspension system components, as recommended by system manufacturer.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Do not install acoustical tiles until work above ceiling has been inspected by Consultant.
- B. General: Do not begin installation until materials sufficient to complete an entire room are received and prepared for installation.
- C. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders.
- D. Symmetrically locate grid layout in each space. Coordinate work with other trades so that lighting fixtures, grilles and other ceiling fixtures work with grid layout.
- E. Do not use universal splices or other splices that would obstruct passage of recessed lighting fixtures through grid openings or limit fixture relocation upon flanges of ceiling grids.
- F. Support suspension system from structure above, not from ductwork, metal deck, equipment or piping.
- G. Space hangers not more than 6 inches (152 mm) from ends and not more than 4 feet (1219 mm) on centers on runners.
- H. Install wall mouldings at the perimeter of each acoustical ceiling area and at locations where edge of units would otherwise be exposed.

1. Secure mouldings to supporting construction by fastening with screw anchors into the substrate, through holes drilled in vertical leg. Space holes not more than 3 inches (76 mm) from each end and not more than 16 inches (406 mm) on center along each moulding.
  2. Level mouldings with ceiling suspension system, to a level tolerance of 1/8 inch (3.2 mm) in 12 feet (3658 mm).
  3. Miter corners of mouldings accurately to provide hairline joints, securely connected to prevent dislocation. Cope exposed flanges of intersecting suspension system members, so that flange faces will be flush.
  4. Furnish additional tees for supporting grilles, diffusers and light fixtures. Refer to reflected ceiling, HVAC and electrical plans for locations.
- I. Field paint cut edges to match surface color and sheen.
  - J. Arrange acoustical units and orient directionally patterned units, if any, in manner shown on reflected ceiling plans.

### **3.2 APPLICATION**

- A. Refer to reflected ceiling plan.
- B. Scribe acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.

### **3.3 INTERFACE WITH OTHER WORK**

- A. Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

**END OF SECTION**

## **SECTION 09 65 16**

### **RESILIENT SHEET FLOORING**

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

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Linoleum sheet flooring with backing.
  - 2. Rubber base.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of resilient sheet flooring.
  - 1. Include sheet flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
  - 2. Show details of special patterns.

##### **1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer.

##### **1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

##### **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.
- B. Resilient Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

##### **1.6 QUALITY ASSURANCE**

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.
  - 1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store rolls upright.

## **1.8 FIELD CONDITIONS**

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than
- B. 70 deg F or more than 85 deg F, in spaces to receive resilient sheet flooring during the following periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- C. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- D. Close spaces to traffic during resilient sheet flooring installation.
- E. Close spaces to traffic for 48 hours after resilient sheet flooring installation.
- F. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

## **PART 2 - PRODUCTS**

### **2.1 LINOLEUM SHEET FLOORING WITH BACKING**

- A. Manufacturers: Marmoleum by Forbo: MCS Sheet.
- B. Composition: Linseed oil, wood flour, rosin binders and dry pigments.
- C. Overall Thickness: 2.0 mm.
- D. Backing: Jute.
- E. Wearing Surface: Embossed.
- F. Sheet Width: As standard with manufacturer.
- G. Seamless-Installation Method: Heat welded.
- H. Colors and Patterns: Sparrow-MCS-3252.

## **2.2 THERMOSET-RUBBER BASE**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Burke Mercer Flooring Products, Division of Burke Industries Inc.
  - 2. Flexco.
  - 3. Roppe Corporation, USA.
  - 4. Johnsonite.
- B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
- C. Style and Location:
  - 1. Style A, Straight: Provide in areas at sealed concrete.
  - 2. Style B, Cove: Provide in areas with resilient floor coverings.
- D. Thickness: 0.125 inch.
- E. Height: 4 inches.
- F. Lengths: Coils in manufacturer's standard length.
- G. Outside Corners: Job formed or preformed.
- H. Inside Corners: Job formed or preformed.
- I. Colors: Confirm color selection with Architect.

## **2.3 INSTALLATION MATERIALS**

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.
  - 1. Where transitioning between 2.5 mm and 2.0 mm sheet products, feather by using mesh sheet rock seam tape on the floor in front of the 2.0mm material, then skimming off the tape with a Portland patch.
- B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and 90% RH substrate conditions.
  - 1. Use Forbo 1299 adhesive with Forbo products.
- C. Seamless-Installation Accessories:
  - 1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
  - 2. Colors: Match flooring.
- D. Integral-Flash-Cove-Base Accessories:
  - 1. Provide FlashCove Prefabricated Base with stainless steel Chiklet cove cap.

2. Size: 4 by 3-inch, pre-fabricated base component to heat weld to flooring sheet.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 SUBSTRATE TESTING**

- A. General: Conduct testing using an independent agency with a minimum of five years' experience in moisture emission testing or as pre-approved by the manufacturer of the flooring material.
- B. Moisture Emission Testing: Conduct moisture emission testing of concrete slabs-on-grade and elevated slabs to receive floor coverings or coatings by the calcium chloride test method. Perform tests in accordance with ASTM F-1869.
  1. Conduct a minimum of three tests for the first 1,000 sq. ft. and one additional test for each additional 1,000 sq. ft.
  2. Ambient test environment shall conform to ASTM-1869 and be reflective of the building's normal operational environment.
  3. Conduct tests on bare concrete, free of surface contaminants, adhesives, curing compounds or sealers.
  4. Locate test locations a minimum of five feet from exterior walls or interior walls that penetrate the floor. Do not conduct tests over random cracks or within five feet of control or construction joints.
  5. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lbs. of water/1000 sq. ft. in 24 hours.
- C. Internal Relative Humidity Testing: Conduct internal relative humidity testing of concrete slabs- on-grade and elevated slabs to receive floor coverings or coatings in accordance with ASTM F- 2170.
  1. Proceed with installation only after substrates have a maximum 90 percent relative humidity level measurement.
- D. Surface Alkalinity Testing: Conduct alkalinity testing of the concrete surface at all moisture emission test locations in accordance with ASTM F710 5.3.1.
- E. Submit all test results to the Architect, flooring installer and manufacturer of the flooring materials before installation of the flooring materials.

#### **3.3 PREPARATION**

- A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring to flooring surface and gypsum wall board.
- 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 resilient sheet flooring manufacturer. Do not use solvents.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient sheet flooring until materials are the same temperature as space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

### **3.4 INSTALLATION, GENERAL**

- A. Comply with manufacturer's current written instructions for installing resilient sheet flooring, at floor surfaces and wall surfaces, and resilient base.

### **3.5 RESILIENT SHEET FLOORING INSTALLATION, FLOOR**

- A. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.
- B. Lay out resilient sheet flooring as follows:
  - 1. Maintain uniformity of flooring direction.
  - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
  - 3. Match edges of flooring for color shading at seams.
  - 4. Avoid cross seams.
- C. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- D. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.
- E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.



- F. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.
- G. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- H. Seamless Installation:
  - 1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.
  - 2. Chemically Bonded Seams: Bond seams with chemical-bonding compound to fuse sections permanently into a seamless flooring installation. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on flooring surfaces.
- I. Integral-Flash-Cove Base: Cove resilient sheet flooring 6 inches up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.
  - 1. Install metal corners at inside and outside corners.

### **3.6 RESILIENT SHEET FLOORING INSTALLATION, WALL**

- A. Cut pieces of flooring material to the required length and width, adding 1" – 2" in each direction to allow for final trimming.
- B. Install all flooring on wall in the same direction. Immediately roll the material in all directions using a three-section wall roller to ensure proper adhesive transfer.
  - 1. Additional rolling is required during adhesive setup to ensure that the material is flat and fully adhered.
- C. Installation Techniques:
  - 1. Scribe, cut, fit to butt tightly to vertical surfaces, permanent fixtures and built-in furniture, including pipes, outlets, edgings, thresholds, nosings, and cabinets.
  - 2. Adhere material to substrate without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed installation.
  - 3. Use adhesive applied to the substrate in compliance with the manufacturer's recommendations, including those for proper spreading of the adhesive, adhesive missing and adhesive open and working times.

### **3.7 RESILIENT BASE INSTALLATION**

- A. 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.

- B. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- C. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch resilient base during installation.
- E. Preformed Corners: Install preformed corners before installing straight pieces.
- F. Job-Formed Corners:
  - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Form without producing discoloration (whitening) at bends.
  - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Miter or cope corners to minimize open joints.

### **3.8 CLEANING AND PROTECTION**

- A. Comply with manufacturer's written instructions for cleaning and protecting installed flooring and base.
- B. Perform the following operations immediately after completing resilient product installation:
  - 1. Remove adhesive and other blemishes from surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect products marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover flooring and base until Substantial Completion.

### **END OF SECTION**

**SECTION 09 91 23**  
**INTERIOR PAINTING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
  - 1. Concrete.
  - 2. Steel.
  - 3. Galvanized metal.
  - 4. Wood.
  - 5. Gypsum board.
  - 6. Cotton or canvas insulation covering.
  - 7. ASJ insulation covering.
- B. Section includes surface preparation and the application of paint systems on the following exterior substrates:
  - 1. Steel.
  - 2. Galvanized metal
- C. Related Requirements:
  - 1. Section 05 12 00 - Structural Steel Framing for shop priming structural steel.
  - 2. Section 08 10 00 - Doors and Frames

**1.2 DEFINITIONS**

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Indicate VOC content.
- B. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- A. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

### **1.5 QUALITY ASSURANCE**

- A. Applicator Qualifications: Engage an experienced Applicator who has completed painting system applications similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

### **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.

### **1.7 FIELD CONDITIONS**

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- 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.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.
  2. California Paints.
  3. PPG Architectural Finishes, Inc. (Pittsburgh Paints, Glidden Professional, Flood Stains)
  4. Samuel Cabot, Inc. (Cabot).
  5. Sherwin-Williams Company (The).
  6. Tnemec Company, Inc. (Tnemec).
- B. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the paint category indicated.

## **2.2 PAINT, GENERAL**

- A. Material Compatibility:
1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. Colors: As selected by Architect from manufacturer's full range.
1. Allow for up to 5 different color selections.

## **2.3 PRIMERS/SEALERS**

- A. Low-VOC Latex Primer/Sealer:
1. Cal: Envirotech Zero VOC Interior Latex Primer/Sealer, 64600.
  2. Moore: Ultra Spec 500 Interior Latex Primer, No. N534. (0 g/L)
  3. Glidden Professional: 9116-1200 LifeMaster No VOC Interior Primer. (0 g/L)
  4. PPG: Pure Performance Interior Latex Primer, 9-900 Series. (0 g/L)
  5. SW: ProMar 200 Zero VOC Interior Latex Primer B28W02600 Series. (0 g/L)]
- B. High-Build Primer/Sealer:
1. Cal: Hide-A-Spray, 91-20. (VOC 76 g/L)
  2. Glidden Professional: 1040-1200, High Build Surfacer Interior Primer Sealer. (100g/L)
  3. PPG: 6-1 Speedhide Interior MaxBuild High Build Surfacer. (<50 g/L)
  4. SW: PrepRite High Build Interior Latex Primer/Surfacer B28W601 (VOC 74 g/L).
  5. Moore: Super Spec Satin-Fil 172 (VOC 31g/L)

## **2.4 METAL PRIMERS**

- A. Rust-Inhibitive Primer (Water Based):
1. Cal: Rust Stop DTM 100% Acrylic Semi-Gloss, 10XX.

2. Devoe Coatings: 4020-1000 Devflex 4020PF DTM Primer & Flat Finish. (91 g/L)
3. Moore: IMC Acrylic Metal Primer M04. (51 g/L)
4. Pittsburgh Paints; 90-712 Pitt-Tech One Pack Interior/Exterior Primer Finish DTM Industrial Enamel. (123 g/L)
5. S-W: IMC Pro-Cryl Universal Primer, B66-310 Series. (100 g/L)

## **2.5 WOOD PRIMERS**

### **A. Latex-Based Wood Primer:**

1. 1. Cal: ASAP "30" 50300.
2. Glidden Professional: 3210-1200 Gripper Interior/Exterior Primer Sealer. (100 g/L)
3. Moore: Super Spec Latex Enamel Undercoater & Primer Sealer #253.
4. PPG: Seal Grip Interior Primer/Finish, 17-951. (45 g/L)
5. S-W: PrepRite Classic Latex Primer B28W101 Series.

### **B. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.**

## **2.6 LATEX PAINTS**

### **A. Interior Low-VOC Latex (Flat):**

1. California Paints: Envirotech Zero VOC 100% Acrylic Flat, 633XX.
2. Glidden Professional: 1209-XXXXN Ultra-hide No VOC Interior Flat Paint (0 g/L)
3. Moore: Ultra Spec 500 Interior Flat Finish, No. N536. (0 g/L)
4. PPG: 6-4110XI Series, Speedhide zero Interior Zero VOC Interior Flat Latex. (0 g/L)
5. SW: ProMar 200 Zero VOC Interior Latex Flat B30-2600 Series. (0 g/L)]

### **B. Interior Low-VOC Latex (Low Luster):**

1. California Paints: Envirotech Zero VOC 100% Acrylic Eggshell, 631XX.
2. Glidden Professional: 1411-XXXX Ultra-hide No VOC Interior Eggshell Paint (0 g/L)
3. Moore: Ultra Spec 500 Interior Eggshell Finish, No. N538. (0 g/L)
4. PPG: 6-4310XI Series, Speedhide zero Interior Zero VOC Latex Eggshell Interior. (0 g/L)
5. SW: ProMar 200 Zero VOC Interior Latex Eg-Shell B20-2600 Series. (0 g/L)]

### **C. Interior Low-VOC Latex (Semi-gloss):**

1. California Paints: Envirotech Zero VOC 100% Acrylic Semi-Gloss, 663XX.
2. Glidden Professional: 1415-XXXXN Ultra-hide No VOC Interior Semi-Gloss Paint (0 g/L)
3. Moore: Ultra Spec 500 Interior Semi-Gloss Finish, No. N539. (0 g/L)
4. PPG: 6-4510XI Series, Speedhide zero Interior Zero VOC Latex Semi-Gloss. (0 g/L)
5. SW: ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-2600 Series. (0 g/L)

- D. Exterior Semi-Gloss Acrylic Enamel: Factory-formulated semi-gloss acrylic enamel for exterior application.
1. Benjamin Moore; DTM Acrylic Semi-Gloss Enamel M29: Applied at a dry film thickness of not less than 2.0 mils.
  2. California Paints: Rust Stop DTM 100% Acrylic Semi-Gloss, 10XX.
  3. Devoe Coatings; 4216-XXXX, High Performance Waterborne Acrylic Semi-Gloss Enamel.
  4. Pittsburgh Paints: 6-900XI Speedhide Exterior Semi-Gloss Latex: Applied at a dry film thickness of not less than 1.5 mils.
  5. Sherwin-Williams; IMC DTM Acrylic Coating Semi-Gloss (Waterborne) B66W200 Series. (250 g/L)

## **2.7 DRY FOG/FALL COATINGS**

- A. Interior Acrylic Dry Fog/Fall:
1. Tnemec: Uni-Bond DF, Series 115. No substitutions.

## **2.8 DECORATIVE COATINGS**

- A. Interior Metallic Paint:
1. Scuffmaster: EnviroMetal.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
  2. Masonry (Clay and CMUs): 12 percent.
  3. Wood: 15 percent.
  4. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

### **3.2 PREPARATION**

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.
- G. Existing Painted Surfaces: Remove any loose paint by scraping or sanding. Sand any rough or "orange peel" or crazing areas.

### **3.3 APPLICATION**

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tinting: Tint primer of colors such as reds, yellows, and oranges with a gray basecoat system designed to help provide color coverage.



- C. Do not tint prime or base coat for multi-colored finishes.
- D. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces. When using colors such as red, yellow or orange, an extra coat of finish may be necessary. Notify Architect when additional coats do not fix the problem.
- E. 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.
- F. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  - 1. Paint the following work where exposed in equipment rooms: Not applicable.
  - 2. Paint the following work where exposed in occupied spaces:
    - a. Equipment, including panelboards.
    - b. Uninsulated metal piping.
    - c. Uninsulated plastic piping.
    - d. Pipe hangers and supports.
    - e. Metal conduit.
    - f. Plastic conduit.
    - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    - h. Other items as directed by Architect.
  - 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

### **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 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.

### 3.5 INTERIOR PAINTING SCHEDULE

- A. Steel Substrates: Including, but not limited to, decking, structure, hollow metal doors and frames, metal glass lite frames in wood doors, stairs and railings, exposed steel column covers, exposed steel columns, access doors and frames.
  - 1. Low-Odor/VOC Latex System:
    - a. Prime Coat: Primer, rust inhibitive, water based.
    - b. Intermediate Coat: Latex, interior, low odor/VOC, matching topcoat.
    - c. Topcoat: Latex, interior, low odor/VOC, semi-gloss (MPI Gloss Level 5).
- B. Galvanized-Metal Substrates: Including, but not limited to, hollow metal doors and frames.
  - 1. Low-Odor/VOC Latex System:
    - a. Prime Coat: Primer, rust inhibitive, water based.
    - b. Intermediate Coat: Latex, interior, low odor/VOC, matching topcoat.
    - c. Topcoat: Latex, interior, low odor/VOC, semi-gloss (MPI Gloss Level 5).
- C. Exposed Steel Ceiling Substrates: Including, but not limited to, structural support framing, metal deck, mechanical and electric piping, and ductwork.
  - 1. DryFog/Fall System: Single coat application in accordance with manufacturer's instructions.
- D. Gypsum Board Substrates:
  - 1. Low-Odor/VOC Latex System:
    - a. Prime Coat: Primer sealer, interior, low odor/VOC.
    - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
    - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1) for ceilings.
    - d. Topcoat: Latex, interior, institutional low odor/VOC eggshell (MPI Gloss Level 3) for walls.
- E. Fiberglass-Faced Gypsum Board Substrates:
  - 1. Low-Odor/VOC Latex System:
    - a. Prime Coat: High-Build Primer/Sealer.
    - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
    - c. Topcoat: Latex, interior, institutional low odor/VOC eggshell (MPI Gloss Level 3).
- F. Cotton or Canvas and ASJ Insulation-Covering Substrates: Including pipe and duct coverings.
  - 1. Low-Odor/VOC Latex System:
    - a. Prime Coat: Primer sealer, interior, low odor/VOC.
    - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
    - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1).

### **3.6 EXTERIOR PAINTING SCHEDULE**

- A. Steel and Galvanized-Metal Substrates: Hollow metal doors and frames, exposed steel lintels and exposed structural steel.
  - 1. Acrylic Enamel Coating System:
    - a. Prime Coat: Primer, rust inhibitive, water based. Apply over shop primer.
    - b. Intermediate Coat: Acrylic enamel, matching topcoat.
    - c. Topcoat: Acrylic enamel, semi-gloss (MPI Gloss Level 5).

**END OF SECTION**

## **SECTION 10 11 16**

### **WHITEBOARDS**

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

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Whiteboards.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for whiteboards.
  - 2. Include electrical characteristics for motorized units.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, details, and attachment to other work.
  - 2. Show locations of panel joints. Show locations of field-assembled joints for factory-fabricated units too large to ship in one piece.
  - 3. Include sections of typical trim members.

##### **1.3 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For whiteboards to include in maintenance manuals.
- B. Warranty as specified below.

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

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

##### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver factory-fabricated whiteboards completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

##### **1.6 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not deliver or install whiteboards 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 whiteboards by field measurements before fabrication.
  - 1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

## **1.7 WARRANTY**

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Surfaces lose original writing and erasing qualities.
    - b. Surfaces exhibit crazing, cracking, or flaking.
  - 2. Warranty Period: 50 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 450 or less.

### **2.3 VISUAL DISPLAY BOARD ASSEMBLY**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AARCO Products, Inc.
  - 2. ADP Lemco.
  - 3. Claridge Products and Equipment, Inc.
  - 4. Ghent Manufacturing, Inc.
  - 5. Nelson Adams Company NACO.
  - 6. AJW Architectural Products.
- B. Assembly: Factory fabricated.
  - 1. Assembly: Markerboard
  - 2. Corners: Square.

3. Width: As indicated on Drawings.
  4. Height: As indicated on Drawings.
  5. Mounting Method: Direct to wall.
- C. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet with low-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.
1. Face Sheet Thickness: 0.021 inch uncoated base metal thickness.
  2. Particleboard Core: 3/8 inch thick; with 0.005-inch-thick, aluminum foil backing.
  3. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.
  4. Color: White.
- D. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch-thick, extruded aluminum; standard size and shape.
1. Aluminum Finish: Clear anodic finish.
- E. Joints: 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.
- F. Chalktray: Manufacturer's standard; continuous.
1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.
- G. Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork insert, end stops, designed to hold accessories.
1. Size: 1 inch high by full length of visual display unit.
  2. Map Hooks: Two map hooks for every 48 inches of display rail or fraction thereof.
  3. Flag Holder: One for each room.
  4. Tackboard Insert Color: As selected by Architect from full range of industry colors.
  5. Aluminum Color: Match finish of visual display assembly trim.

## **2.4 MATERIALS**

- A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.
- B. Particleboard: ANSI A208.1, Grade M-1.
- C. Fiberboard: ASTM C 208 cellulosic fiber insulating board.
- D. Extruded Aluminum: ASTM B 221, Alloy 6063.
- E. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

## **2.5 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 unacceptable. 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.

## **2.6 ALUMINUM FINISHES**

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

# **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 whiteboards.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## **3.2 PREPARATION**

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.
- 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 whiteboards and wall surfaces.
- D. Verify that wall surfaces are primed where indicated to receive whiteboards and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.

## **3.3 INSTALLATION**

- 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. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.

### **3.4 CLEANING AND PROTECTION**

- A. Clean whiteboards according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect whiteboards after installation and cleaning.

**END OF SECTION**



## **SECTION 101400**

### **SIGNAGE**

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

##### **1.1 SUMMARY**

- A. This Section includes the following types of signs:

1. Panel signs.
2. Dimensional letters and numbers.

##### **1.2 DEFINITIONS**

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

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

- A. Product Data: For each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Shop Drawings: Show fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components.
1. Provide message list for each sign required, including large-scale details of wording and lettering layout.
  2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
  3. Templates: Furnish full-size spacing templates for individually mounted dimensional letters and numbers.
- C. Samples for Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available.

##### **1.4 INFORMATION SUBMITTALS**

- A. Warranty: Special warranty specified in this Section.

##### **1.5 CLOSEOUT SUBMITTALS**

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

## **1.6 QUALITY ASSURANCE**

- A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.
- B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.
- C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.
- D. Design Concept: The Drawings indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

## **1.7 PROJECT CONDITIONS**

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

## **1.8 COORDINATION**

- A. Coordinate placement of anchorage devices with templates for installing signs.

## **1.9 WARRANTY**

- A. Warranty: Manufacturer's standard form in which 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 metal and polymer finishes beyond normal weathering.
    - b. Deterioration of embedded graphic image colors and sign lamination.
  - 2. Warranty Period: Five years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
- B. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing, suitable for exterior applications.
- C. Aluminum Castings: Provide aluminum castings of alloy and temper recommended by the sign manufacturer for the casting process used and for the use and finish indicated.

- D. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.
- E. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

## **2.2 PANEL SIGNS (TYPES 1 AND 3)**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  - 1. Rowmark.
  - 2. Welch Architectural Signage.
- B. Substrate: Fabricate signs from 1/8-inch-thick matte clear acrylic with edges mechanically and smoothly finished to eliminate cut marks. Background color to be subsurface.
  - 1. Background Color: As selected by the Architect from manufacturer's standard colors.
  - 2. Edge Condition: Straight.
  - 3. Corner Condition: Rounded to 3/8-inch radius.
  - 4. Size: As indicated on the drawings.
- C. Copy: Complying with ADA Accessibility Guidelines.
- D. Letterform: Route copy into face of substrate 1/32 inch deep. Chemically weld (inlay) computer precision cut tactile copy into routed letter openings so that tactile copy is embedded in substrate and remains at least 1/32" above surface of substrate.
  - 1. Height: 5/8 inch minimum letter height.
- E. Braille: Use engrave process for all Braille areas. Engrave Braille dots into surface of clear material.
- F. Symbols of Accessibility:
  - 1. Accessible elements: Provide international symbol of accessibility.
    - a. Provide male and female symbols as required for toilets.
- G. Provide characters complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille.

## **2.3 DIMENSIONAL LETTERS AND NUMBERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  - 1. A.R.K. Ramos Manufacturing Company, Inc.
  - 2. ASI Sign Systems, Inc.

3. Gemini, Inc.
  4. Metal Arts.
  5. Spanjer Brothers, Inc.
  6. Vomar Products, Inc.
- B. Plastic Letters (Type 7): Produce characters with smooth, flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, or other defects. Comply with requirements indicated for finish, style, and size.
1. Plastic Sheet: Not less than 0.080 inch thick. (3/4 inch thick for Alternate)
  2. Letter Height: As indicated on the drawings.
  3. Letter Style: As selected by the Architect.

## **2.4 FINISHES**

- A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.
- B. Metal Finishes: Comply with NAAMM "Metal Finishes Manual" for finish designations and applications recommendations.
- C. Aluminum Finishes: Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
1. Class II Clear Anodized Fine Satin Finish: AA-M31C21A31 (Mechanical Finish: Fine satin directional textured; Chemical Finish: Fine matte etched finish; Anodic Coating: Class II Architectural, clear film thicker than 0.4 mil).

## **2.5 ACRYLIC SHEET FINISHES**

- A. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

## **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 work.
- B. Verify that items are sized and located to accommodate signs.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
  2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
  2. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.
- C. Dimensional Letters and Numbers: Mount letters and numbers using standard fastening methods recommended by the manufacturer for letter form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish letter spacing and to locate holes for fasteners.
1. Projected Mounting: Mount aluminum letters and numbers at the projection distance from the wall surface indicated.

### 3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

### 3.4 PANEL SIGN SCHEDULE

- A. Signage Type:
1. Type 1 - Room Number & Room Name
  2. Type 3 - Room Name with Pictogram
  3. Type 7 - Window ID #S

Room Number	Room Name	Sign Type	Quantity	Remarks
100	Discovery Classroom			
101	Storage	1		
101A	Utility	1		
T102	Water Closet	3	1	

**END OF SECTION**

**SECTION 10 28 13**  
**TOILET ACCESSORIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Public-use washroom accessories.

**1.2 COORDINATION**

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
  - 1. Identify locations using room designations indicated.
  - 2. Identify accessories using designations indicated.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Sample Warranty: For manufacturer's special warranty.

**1.5 CLOSEOUT SUBMITTALS**

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

**1.6 WARRANTY**

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, visible silver spoilage defects.

2. Warranty Period: 15 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 OWNER-FURNISHED MATERIALS**

- A. Owner-Furnished Materials: The following accessories will be furnished by the Owner and installed by the Contractor:
  1. Toilet Paper Dispenser.
  2. Paper Towel Dispenser.
  3. Soap Dispenser.

### **2.2 PUBLIC-USE WASHROOM ACCESSORIES**

- A. Toilet Tissue (Roll) Dispenser: Furnished by the Owner and installed by the Contractor.
- B. Paper Towel (Folded) Dispenser: Furnished by the Owner and installed by the Contractor.
- C. Liquid-Soap Dispenser: Furnished by the Owner and installed by the Contractor.
- D. Grab Bar:
  1. Basis-of-Design Product: Bobrick No. B-5806 Series.
  2. Mounting: Flanges with concealed fasteners.
  3. Material: Stainless steel, 0.05 inch thick.
  4. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
  5. Outside Diameter: 1-1/4 inches.
  6. Configuration and Length: As indicated on Drawings.
- E. Mirror Units:
  1. Basis-of-Design Product: ASI No. 20650.
  2. Frame: Stainless-steel channel.
  3. Corners: Mitered.
  4. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
  5. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
  6. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
  7. Size: 24 by 36 inches.



## **2.3 MATERIALS**

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- F. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

## **2.4 FABRICATION**

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

# **PART 3 - EXECUTION**

## **3.1 INSTALLATION**

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

## **3.2 ADJUSTING AND CLEANING**

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

**END OF SECTION**

## **SECTION 11 41 00**

### **FOODSERVICE STORAGE EQUIPMENT**

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

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Foodservice storage equipment: refrigerator and freezer.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Product Schedule: For appliances. Use same designations indicated on Drawings.

##### **1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of appliance.
- C. Sample Warranties: For manufacturers' special warranties.

##### **1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For each appliance to include in operation and maintenance manuals.

##### **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.

##### **1.6 WARRANTY**

- A. Special Warranties: Manufacturer agrees to repair or replace appliances or components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: One year from date of Substantial Completion for parts and labor and five year warranty on the compressor from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS AND PRODUCTS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
  - 1. Amana; a division of Whirlpool Corporation.
  - 2. BOSCH Home Appliances.
  - 3. Electrolux Home Products (Frigidaire).
  - 4. General Electric Company (GE).
  - 5. KitchenAid; a division of Whirlpool Corporation.
  - 6. LG Appliances.
  - 7. Maytag; a division of Whirlpool Corporation.
  - 8. Sears Brands LLC (Kenmore).
  - 9. Whirlpool Corporation.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

### **2.3 FOODSERVICE STORAGE EQUIPMENT**

- A. Reach-In Refrigerator: Two-door refrigerator and complying with AHAM HRF-1.
  - 1. Basis-of-Design Product: GRRF-2D, Solid Door Reach-In Refrigerator by Admiral Craft Equipment Corp.
  - 2. Type: Freestanding.
  - 3. Dimensions:
    - a. Width: 54 inches.
    - b. Depth: 32 inches.
    - c. Height: 82 inches.
  - 4. Storage Capacity:
    - a. Refrigeration Compartment Volume: 48 cu. ft.
    - b. Shelves: 3 epoxy coated corrosion resistant shelves with 90 lb. capacity each.
  - 5. Appliance Color/Finish: Type 430 Stainless steel.
- B. Reach-In Freezer: Single-door freezer and complying with AHAM HRF-1.
  - 1. Basis-of-Design Product: GRFZ-1D, Solid Door Reach-In Freezer by Admiral Craft Equipment Corp.

2. Type: Freestanding.
3. Dimensions:
  - a. Width: 29 inches.
  - b. Depth: 32 inches.
  - c. Height: 82 inches.
4. Storage Capacity:
  - d. Freezer Volume: 23 cu. ft.
  - e. Shelves: 3 epoxy coated corrosion resistant shelves with 90 lb. capacity each.
5. Appliance Color/Finish: Type 430 Stainless steel.

## **2.4 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.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of appliances.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Install appliances according to manufacturer's written instructions.
- B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

### **3.3 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
  2. Operational Test: After installation, start units to confirm proper operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.
- B. An appliance will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

**3.4 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

**END OF SECTION**

## SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to design, install and test a pressurized, fully supervised, wet pipe fire protection system for full building protection in accordance with NFPA13, IBC, local fire department requirements and the Owner's insurance underwriter.

#### 1.2 RELATED DOCUMENTS

- A. The drawings and the specifications including SECTION 23 05 00 "Common Work Results for HVAC" are hereby made a part of the work of this section.

#### 1.3 QUALIFICATIONS

- A. The Fire Protection Work shall be performed by a qualified Contractor primarily engaged in the design and installation of Fire Protection Systems. The fire protection system design shall be performed under the direction of, and sealed by, a professional engineer registered in the State of Maine or with NICET Level III (minimum) Certification.
- B. Welding qualifications of individuals installing welded piping shall be certified by the National Certified Welding Bureau for the type(s) of weld(s) proposed for use in piping assembly.

#### 1.4 SUBMITTALS

- A. Items for which the submittal requirements of section 23 05 00 "Common Work Results for HVAC", apply are as Follows:
  - 1. Hydrant flow test.
  - 2. System components.
  - 3. Hydraulic calculations.
  - 4. Piping layout, details and control diagram.
  - 5. Flushing and testing records.
  - 6. Certificate of installation.
  - 7. Copy of Fire Protection Contractors License.
  - 8. Welding certificates of individual welding technicians.
  - 9. Zone flow switches, piping and valves.
  - 10. Sprinkler heads.
  - 11. Alarm valve(s).
  - 12. Fire department connection(s).
  - 13. Firestopping materials and methods.

Submit hydrant flow test, equipment descriptive data, hydraulic calculations and system layout for review by the Owner's Insurance Underwriter. Submit the system layout to the Architect, State Fire Marshal and Local Fire Department for review. The Architect's review will be limited to checking for conformance with the design concept of the project and

general compliance with the contract documents and will in no way assume liability for review for compliance with codes, standards and laws.

## 1.5 SPRINKLER COVERAGE

- A. Sprinkler head coverage shall conform with NFPA requirements for the use of the building (Light Hazard, 0.10 GPM/SF density for the hydraulically most remote 1500 S.F.). Coverage in other areas shall be increased accordingly where required by the Authority having jurisdiction.
- B. If the requirements of the inspection agency or the Owner's insuring agent are more rigorous than those stated herein, then the more rigorous requirements shall govern.
- C. Exterior canopies and concealed spaces of combustible construction shall be protected with a dry or wet pipe system as required for freeze protection.

## PART 2 - PRODUCTS

### 2.1 SYSTEM COMPONENTS AND HARDWARE

- A. Pipe, Fittings, Joints, Hangers, Valves, Fire Department Connections, Alarms: Conform to NFPA-13, Installation of Sprinkler Systems.
- B. Sprinkler Heads:
  - 1. Interior Heated Spaces: Conform to NFPA-13, commercial quick response type. Provide semi-recessed type with white finish for acoustical tile ceilings. Sprinkler heads in GWB and corridor / lobby ceilings shall be concealed type with white finish. Dry pendent or sidewall heads, where required, may be standard response type.
  - 2. Provide a spare head cabinet with wrenches and six (6) heads of each orifice size, finish, temperature classification, pattern and length furnished in the project.
  - 3. Provide sprinkler head guards where required.
  - 4. Sprinkler heads in unheated / minimally heated areas including all entrance vestibules shall be dry pendent or sidewall type, or be served by a separate dry-pipe system.
  - 5. Temperature ratings for sprinkler heads shall be suitable for the space. Heads in boiler rooms, kiln rooms and similar locations with concentrated heat sources shall have heads with the appropriate temperature rating.
  - 6. Sprinkler heads shall be located in the center of tiles for acoustical tile ceilings.
- C. Fire Department Connection: Provide a 4" Storz connection or siamese connection (as verified with the local fire department) at a location coordinated with the local fire department and the Architect.

2.2 WATER SUPPLIES

- A. Conform to the requirements of NFPA-13, Installation of Sprinkler Systems.

2.3 DEVICES

- A. Detection devices and associated wiring both within the fire protection system and connected to the building Fire Alarm System shall be the responsibility of the Sprinkler Contractor.

2.4 BACKFLOW PREVENTER

- A. Ames 2000 or equal.

2.5 PIPING SYSTEM IDENTIFICATION

- A. Piping system and valve identification and color coding shall be in accordance with ANSI.

2.6 SPRINKLER SYSTEM ZONING

- A. The building shall be a single zone.

2.7 CEILING CAVITIES

- A. Ceiling cavities above all suspended acoustical tile ceilings in corridor areas and certain other areas contain bundled electrical cables and individual wires and shall be sprinklered. Coordinate sprinkler requirements with the Electrical Drawings

PART 3 - EXECUTION

3.1 PIPING LAYOUT AND DESIGN

- A. System requirements, installation requirements, design, plans, and calculations: Conform to NFPA-13, Installation of Sprinkler Systems.
- B. Sprinkler piping shall be run concealed above ceilings in occupied areas. Piping in other areas may be run exposed. Piping shall not be exposed in occupied spaces unless indicated on the drawings.
- C. Pipe penetrations through walls and floors, including pipe sleeves shall be in accordance with Section 23 05 00 – General Mechanical. Traverse points of piping shall be escutcheoned with split chrome floor and ceiling plates and spring anchors, where visible to occupancy.
- D. Coordinate design and layout with building structure and building systems. The work shown in the contract documents has precedence for space requirements. Work of other trades may be modified or moved only with permission of the trade involved. Costs associated with modifications or relocations shall be the same as for "Substitutions" Section 23 05 00. Sprinkler system piping may need to be located within the structural system in certain locations.



- E. The Architect shall review proposed system layout and reserve the right to relocate heads, substitute head system and in general review final layout for components visible in occupied spaces.
- F. Sprinkler heads shall be centered in acoustical ceiling tiles.

### 3.2 SYSTEM ACCEPTANCE

- A. Approval, flushing, hydrostatic testing, instructions, and certificates of installation: Conform to NFPA-13, Installation of Sprinkler Systems.
- B. Disinfect the water piping in accordance with AWWA C601. Fill the piping systems with solution containing a minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Repeat disinfection if chlorine residual is less than 10 parts per million after 24 hours. Flush the solution from the systems with clean water until maximum residual chlorine contents is not greater than 0.2 parts per million.
- C. Closing in Work:
  - 1. General: Cover up or enclose work after it has been properly and completely reviewed.
  - 2. No additional cost to the Owner will be allowed for uncovering and recovering, work that is covered or enclosed prior to required review and acceptance.
- D. Cleanup and Corrosion Prevention:
  - 1. Upon completion of the work thoroughly clean and flush piping systems to the sewer with water.
  - 2. Piping and equipment shall be thoroughly cleaned. Dirt, dust, and debris shall be removed and the premises left in a clean and neat condition.
  - 3. Before uncovered piping is permitted to be concealed, corrosion and rust shall be wire brushed and cleaned and in the case of iron products, a coat of approved protective paint applied to these surfaces. When corrosion is from the effects of hot solder paste, the areas shall be cleaned and polished and a wash of bicarbonate of soda and water used to neutralize the acid condition.
- E. Instructions: On completion of the project, provide a technician familiar with the system to thoroughly instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. The time of instruction shall be arranged with the Owner.
- F. Warranty: For a period of one (1) year after completion of the installation repair or replace any defective materials or workmanship. Upon completion of the installation, the system shall be turned over to the Owner fully inspected and tested, and in operational condition.

3.3 FIRESTOPPING

- A. Firestopping shall be performed in accordance with Specification Section 07 84 13 "Penetration Firestopping". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

\* END OF SECTION \*

## SECTION 22 00 00 - PLUMBING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. The drawings and the specifications including Section 23 05 00 "Common Work Results for HVAC" are hereby made a part of the work of this section.
- B. Section 01 91 33 - GENERAL COMMISSIONING REQUIREMENTS.

#### 1.2 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections, and incidentals and the performing of operations required to provide a complete and functional plumbing system.
- B. Work shall be in accordance with the current edition of the Maine Internal Plumbing Rules and applicable local ordinances.

#### 1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section shall be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 23 05 00 "Common Work Results for HVAC", apply are as follows:
  - 1. Piping materials.
  - 2. Grooved joint couplings and fittings.
  - 3. Valves.
  - 4. Pipe hangers.
  - 5. Fixtures and trim.
  - 6. Miscellaneous equipment.
  - 7. Water heating equipment.
  - 8. Piping, valves and equipment identification.
  - 9. Backflow preventers.
  - 10. Floor drains, roof drains and cleanouts.
  - 11. Firestopping materials and methods.
  - 12. Insulation kits for ADA-compliant sinks.
  - 13. Gas pressure regulators.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- A. Soil and Waste (Sanitary), Condensate Drains, Vent and Roof Drainage Piping: Schedule 40 PVC, solvent-welded, or service weight cast iron with push-on joints below grade. Above grade, vent piping may be Schedule 40 PVC or service weight cast iron "no Hub" above grade. Above grade sanitary and waste and roof drain piping shall be service weight cast-iron, "No-Hub". "Vents thru roof" shall be service weight cast iron.

- B. Domestic Water Piping: Type L hard copper tubing and cast bronze or wrought copper solder fittings, lead-free solder. Underslab water piping including trap primer connections shall be  $\frac{5}{8}$ " PEX, without joints.
- C. Exposed Water and Waste Piping at Fixtures: I.P.S. copper with cast brass fittings chrome plated finish, with deep one piece escutcheon plates at traverse points.
- D. Solder: Lead-free (ONLY), Englehard Silvabrite 100, 440°F melting point, ASTM B32.
- E. Aboveground Gas piping: Schedule 40 carbon steel with malleable threaded fittings. Exterior gas piping shall be painted with two (2) coats of rust-inhibiting enamel. Exposed interior gas piping shall be painted with two (2) coats of rust-inhibiting enamel (black).
- J. Piping located in masonry (CMU) construction: Piping shall be protected from contact with concrete (masonry) by use of pipe sleeves or other methods approved by the local plumbing inspector.
- K. Domestic / Sprinkler service piping: From 8'-0" outside the building to the meter and sprinkler service location, and temporary water services, cement-lined ductile iron per NFPA13.

- 1. Class 53 pipe with mechanical joints.

## 2.2 NO HUB COUPLINGS

- A. For abovegrade DWV piping, couplings shall be Clamp-All HI-TORQ125, shall maintain 15 PSI hydrostatic seal, constructed with a 304SS housing and ASTM C-564 neoprene gasket. Couplings shall meet FM 1680, IBC and local codes and requirements.

## 2.3 VALVES AND ACCESSORIES

- A. General Service Ball Valves: Apollo Model 77-100 (threaded) or 77-200 (solder), Watts, Red-White, bronze full port, or Nibco, copper alloy with stationary seat ring and chromium plated or stainless steel floating ball per Federal Specification WW-V-35B. Blowout proof stem, reinforced PTFE seal. Sizes 2" and larger shall have threaded ends. Provide lever or tee handle with stem extension as required to allow operation without interfering with pipe insulation. Gas Service: Apollo 80-100 series, bronze gas valve, UL-listed.
- B. Check Valves: Horizontal Swing, MSS SP-80, Type 3, Class 125.
- D. Drain Valves: Provide ball valves with  $\frac{3}{4}$ " hose connection and brass cap and chain.
- E. Fixture Service Stop Valves: Angle Loose Key Stop, ASME A112.18M.
  - 1. Each plumbing fixture and item of equipment shall have individual stop valves in the hot and cold supplies.

2. Service stop valves exposed in finished areas shall be McGuire, or equal, chrome-plated brass ball valves; in non-finished areas, bronze ball valves shall be used in lieu of chromed supplies.
- F. Temperature and Pressure Relief Valves: Bronze body, tested under ANSI Z21.22, AGA and ASME rated, 125 psig/210°F relief settings.
- I. Automatic Trap Primers: Zurn Model Z-1022-XL, Josam or Smith, "Sani-Guard" Trap Primer, all-bronze body with integral vacuum breaker, union connection and supply manifold as required to serve floor drain traps. Trap primers shall comply with ANSI/ASSE Standard 1018. Connect to each floor drain and indirect waste trap unless otherwise served by an Electronic Trap Primer (**ETP**).
- M. Provide gas pressure regulators at each gas appliance. Pressure regulators shall be Maxitrol, Iltron or Pietro-Fiorentini with vent limiting device or vent to atmosphere per Code.

## 2.4 PIPE HANGERS

- A. Adjustable Swivel Hangers:
  1. Pipe sizes 2" and less: Carpenter and Paterson Fig. 800, oversize for insulated piping systems.
  2. Pipe sizes larger than 2": Carpenter and Paterson Fig. 100, oversize for insulated piping systems.
- B. Riser Clamp: Carpenter and Paterson Fig. 126 CT copper plated for copper piping, Fig. 126 for iron and PVC piping.
- C. Insulation Shields: 18 ga. galvanized steel, 180° wrap, Carpenter and Paterson Fig. 265P, Type H.

## 2.6 FIXTURES AND TRIM

- A. (**P-1**) Water Closet: Floor-mounted, flush-valve type, siphon jet, American-Standard "Madera" 3451.528.020, Kohler, Toto, Zurn, or equal, high efficiency elongated bowl, white vitreous china, low consumption (1.28 GPF), and shall flush with 30 psi water pressure at the valve. The water closet shall be 14"H, top spud.
  1. Flush Valve: TOTO Model TET1LN32#CP "Eco Powered", Zurn Model ZTR6200-EV-LL, American-Standard or Sloan "Solis" Model 8111-1.28, sensor-type, battery-operated and self-powered electronic with manual override button. Furnish with bumper stop, vacuum breaker and stop valve. Furnish with 6VDC lithium batteries and install per the manufacturers recommendations. Flush valves for small single user toilet rooms in Classroom areas shall have manual flush valves.
  2. Seat: Church, Zurn Z5955SS-EL-AMFR-STS, or equal, heavy weight solid plastic, open front, external check hinges, white color.

- B. **(P-2)** Lavatory, Wall Hung: Zurn Model Z-5341-PED, 20"x18", Toto LT307#01, Kohler "Brenham", Zurn, or approved equal, white vitreous china, with vitreous china shroud / half pedestal, single hole, front edge shall extend a minimum of 17" from rear finished wall, ADA compliant.
1. Drain: perforated grid strainer with bright metal finish.
  2. Hanger/Carrier: Concealed arms or as furnished by the manufacturer. Mounting heights shall be as indicated on the Architectural Drawings.
  3. Trap: Chrome-plated, cast copper alloy, 1-1/4" P-trap with cleanout plug. Adjustable with connected elbow and nipple to wall. Zurn Z8743-PC or Z8746-PC with Z8701-9B-PC.
  4. ADA lavatories shall be installed at 34" or 31" above finished floor per the Architectural Drawings. Final installation of lavatory and accessories shall meet ADA guidelines and ANSI A117.1.
  5. Faucet: TOTO TEL105-D10ET#CP "Eco Powered", Sloan "Optima Solis." Model EAF-275-ISM, Symmons "Ultra-Sense", Bradley, Zurn Z6950-XL-IM-S-F or Chicago-Faucets, chrome-plated brass, automatic electronic or infrared sensing dual temperature mixing type, battery-operated or self-powered and vandal-resistant, low battery indicator, ADA-compliant with a .5 GPM aerator and integral strainer. Supplies shall be chrome-plated with key stop. Furnish with strainer(s), solenoid valve, batteries and hot/cold back checks. Installation shall be in accordance with the manufacturers recommendations.
  6. Provide a Leonard Model 170A, Zurn ZW3870XLT, "Point-of-Use" temperature limiting valve (TLV), or equal, ASSE 1070 compliant at each faucet.
- C. **(P-6)** Classroom Sinks: Just or Elkay "Lustertone" Model DRKAD-2517, ADA-compliant, 25"x17"x5-1/2" deep, double-ledge, 18 gauge Type 302 stainless steel with "perfect drain grid", LK-1141-A "Flexi-Guard" bubbler and Chicago Faucets Model 2302 or Zurn Z824BO-XL-17M separate mixing faucet and 10" high swing spout and aerator with lever handle and E3 aerator at 2.0 GPM. The drain outlet shall be offset to the rear of the bowl, as required for ADA-compliance. Provide faucet / bubbler holes and ledges, as required. Coordinate sink configurations with the Architectural Drawings. Provide "Truebro" Model 102 insulation kits for supplies and drain unless a barrier is provided with the casework. Furnish with Zurn Z8808-XL-LR-LK-PC, or equal, key-operated stops on hot and cold supplies and chrome-plated P-trap. Provide Zurn Model Z-1180 solids interceptors at each sink.
1. Model LK-35 or Zurn Z8741-SS strainer, LK-1141-A "Flexi-Guard" bubbler and Chicago Faucets Model 2302 side mixing faucet with swing spout and Model E35JKCP, 1.5 gpm, low-flow aerator with lever handle. The drain outlet shall be offset, as required. Provide "Truebro" Model 102, Zurn Z8946-3-NT, Oatey Safety Series Tubular covers, Brocar, or McGuire insulation kits for supplies and drain. Furnish with key-operated stops on hot and cold supplies and chrome-plated P-trap.
- D. Acceptable fixture / trim / brass manufacturers are as follows: Zurn, Sloan, Toto, American-Standard, Eljer, Just, Elkay, Kohler, and Moen (Commercial). Provide

McGuire, or equal, chrome-plated brass key-operated stops on the hot / cold supplies to each fixture.

## 2.7 MISCELLANEOUS EQUIPMENT

- A. Floor Drains (**FD**) and Roof Drains (**RD**): Floor drains (FD) shall be Zurn Z-415-EZ1, Josam, or Smith, cast iron body with 2" or 3" bottom or side outlet, as indicated, combination invertible membrane clamp and adjustable collar. Floor drains shall have "deep seal" traps and trap primer connection. All floor drains shall be connected to a trap primer.

1. Strainer: 6" Zurn, polished nickel-bronze.
2. For floor drains receiving indirect wastes, provide a funnel receptor.

Roof Drains (**RD**) shall be Zurn Model Z-100ERC, or equal, with sump, extension, underdeck clamp and dome strainer. Furnish with Zurn Model Z-190 vertical expansion joint or flexible elastomeric boot for expansion compensation. See Architectural and Mechanical Drawings for quantities, types, sizes and locations. Unless otherwise indicated, roof drains shall be 4". **RD-2** shall include 2" inlet extension for overflow duty.

- B. Floor Cleanout (**FCO**): Zurn Z-1400, Josam, or Smith, adjustable floor cleanout, cast iron body, with gas and watertight ABS tapered thread plug. Provide size equal to piping served with maximum size of 4".

1. Concrete floor finishes: Scoriated round nickel bronze top.
2. Sheet tile finishes: Scoriated square nickel bronze top recessed to receive tile.
1. Carpeted finishes: Scoriated round nickel bronze top and carpet marker.
2. Ceramic tile finishes (Main Street): Square cover, nickel bronze finish.

- C. Water Hammer Arrestors (Shock Absorbers): Plumbing and Drainage Institute listed, Zurn Z1700 series, or Josam. Provide properly sized water hammer arrestors at all fast closing valves, e.g. flush valves and dishwashers, per Code.

Schedule:

"A" - Size #100 PDI - 0-11 Fixture Units

"B" - Size #200 PDI - 12-32 Fixture Units

"C" - Size #300 PDI - 33-60 Fixture Units

- F. Vacuum Breaker: Watts Model N36, 3/4" size, 20 CFM capacity.
- G. Strainer: Watts Series 777, or Wilkins SXL series, MIL-S-16293, epoxy-coated or lead-free bronze body wye-type, 200 WOG rating, screwed end connections, 20 mesh stainless steel, monel, or bronze screen.
- H. Backflow Preventers (**BFP**): Conforming to AWWA C506, FCCHR-USC Manual Section 10, and UL listed. Types, sizes and capacities scheduled. Manufacturers shall be Apollo, Zurn, or Watts.

1. Reduced Pressure Zone (RPZ): Reduced pressure principle type; bronze body with stainless steel internals. Provide bronze body ball valves or NRS gate valves, test cocks, strainer and air gap fittings.
  2. Double Check (DC): Double check backflow assembly with test ports, bronze body with stainless steel springs, corrosion resistant internals, strainer, stop and waste ball valves.
  3. Atmospheric Double Check (DCA): Double check continuous pressure type with atmospheric port for low hazard applications, 250°F maximum water temperature, bronze body, strainer, stainless steel internals with rubber seals and integral strainer.
- K. Thermometers: Weiss Instruments Model DVU35, solar-operated, Tel-Tru, Terice or Ashcroft, adjustable angle, plastic or Type 304 stainless steel case. The digital display shall include 3/8" high (minimum) LCD digits. The thermometer display shall be in °F. Accuracy shall be +/- 1% of the displayed value or 1°, whichever is greater. Furnish with brass thermowells and provide with heat transfer fluid to fill the sealed interstitial space between bulb and well. Evidence of the transfer fluid leaking shall be cause for refilling and sealing the well.
1. Thermowell: Provide with brass thermometer wells projecting a minimum of 2" into the pipe with extension to face of insulation. Provide with heat transfer fluid to fill interstitial space between bulb and well.
  2. Range: 30°F to 240°F for domestic hot water systems.
- L. Pressure Gauges: Tel-Tru or Ashcroft Type 1005, Grade B, 3-1/2" dial, ANSI B40.1, drawn steel case, white background dial with black figures, clear glass window, brass movement, beryllium copper bourdon tube, 0 to 100 PSI range, accuracy shall be within 2% over middle half of scale and 3% over the remainder. Provide with shut off petcock and restrictor.

## 2.8 PIPING, VALVE, AND EQUIPMENT IDENTIFICATION

- A. Piping identification: Provide plastic "wrap-around" identification markers indicating flow and fluid flowing for the following:
1. Domestic Hot Water
  2. Domestic Cold Water
  3. Vent Piping
  4. Roof Drain Piping
  5. Gas Piping
- B. Markers shall be placed 30-50 ft. apart for piping in accessible areas.
- C. Markers shall be placed outside the pipe insulation and in the most obvious location for viewing.
- D. Valve Tags:



1. Attach to each valve a 1-1/2" round or octagonal brass tag with 1/2" indented numerals filled with a durable black compound. In addition to the valve numbers, each tag shall identify the system it controls. Service stop valves exposed in finished areas need not be tagged.
  2. Tags shall be securely attached to stems of valves with copper or brass "S" hooks, or chains.
  3. Valve charts shall be provided for each piping system and shall consist of schematic drawings of piping layouts, showing and identifying each valve and describing its function. Upon completion of the work, one (1) copy of each chart, sealed to rigid backboard with clear lacquer placed under glass and framed, shall be hung where directed. Two (2) additional unmounted copies shall be delivered to the Architect.
  4. Tags and charts shall be coordinated with Section 23 00 00 HVAC and when completed this work shall have been done sequentially.
- E. Equipment Identification: Provide laminated plastic nameplates for equipment, pumps, mixing valves, backflow preventers, and balancing valves. Nameplates shall be laminated 0.125-inch thick melamine plastic conforming to Fed. Spec. L-P-387, black with white center core. Surface shall be a matte finish, corners shall be square. Accurately align lettering and engrave into the white core. Minimum size of nameplates shall be 1.0 inch by 2.5 inches. Lettering shall be minimum of 0.25-inch high normal block lettering.

## 2.7 WATER HEATING EQUIPMENT

- A. Electric Water Heater (EWH): A.O. Smith, model indicated, UL 732 and ASHRAE 90A (2013 requirements) compliant, Glass lined tank with replaceable anode rods and plastic jacket, factory installed ASME rated temperature and pressure relief valve, and adjustable range thermostat. Set to provide 120°F water temperature.

## PART 3 - EXECUTION

### 3.1 SURFACE CONDITIONS

- A. Inspection:
1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
  2. Verify that plumbing may be installed in strict accordance with pertinent codes and regulations and the reviewed Shop Drawings.

### 3.2 INSTALLATION OF PIPING

- A. Provide and erect in accordance with the best practice of the trade piping shown on the drawings and as required to complete the intended installation. Make offsets as shown or required to place piping in proper position to avoid other work and to allow the application of insulation and finish painting to the satisfaction of the Architect.

- B. The size and general arrangements, as well as the methods of connecting piping, valves, and equipment, shall be as indicated, or so as to meet the requirements of the Architect.
- C. Piping shall be erected so as to provide for the easy and noiseless passage of fluids under working conditions.
- D. Install unions to facilitate removal of equipment.
  - 1. Unions are not required in installations using grooved mechanical joint couplings. (The couplings shall serve as unions and disconnect points.)
- E. Copper pipe shall be reamed to remove burrs.
- F. Connections between copper and steel piping shall be made with brass fittings.
- G. Solder joints shall be made with lead free solder. Clean surfaces to be soldered and use a paste flux. Wash joints with sodium bicarbonate and water to remove corrosive effects of heated solder paste. Caution: Lead-bearing solder is not permitted.
- H. Pipe penetrations through walls, floors and ceilings shall have pipe sleeves and shall be in accordance with Section 23 05 00 "Common Work Results for HVAC". Traverse points of piping shall be escutcheoned with split chrome floor and ceiling plates and spring anchors, where visible to occupancy.
- K. Provide a cleanout in the vertical position at the base of each sanitary and storm (roof) drain riser. Locate "Vent-thru-Roof" terminations a minimum distance of thirty (30) feet from outside air intakes.
- L. Sanitary and vent piping shall be sized and installed at 1/4" per foot slope or as indicated and in no case less than 1/8" per foot.
- M. Vent thru roof terminations (VTR) shall be installed a minimum of thirty (30) feet from outside air intakes.

### 3.3 PIPE HANGERS

- A. Impact driven studs are prohibited.
- B. Copper Tubing: supported at intervals with rod sizes as follows, double nuts on hangers and on beam clips.

Copper Size	Hanger Intervals	Rod Sizes
1/2"	5'	3/8"
3/4"	6'	3/8"
1"	6'	3/8"
1-1/4"	8'	3/8"
1-1/2"	8'	3/8"
2"	10'	3/8"
3"	10'	1/2"

- C. Cast Iron Pipe: Supported at intervals with rod sizes as follows, double nuts on hangers and on beam clips.

Cast Iron Size	Hanger Intervals	Rod Sizes
1-1/2"	5'	3/8"
2"	5'	3/8"
2-1/2"	5'	1/2"
3"	6'	1/2"
4"	7'	5/8"

- D. PVC Pipe: Supported at 4-foot intervals.
- E. Verticals: Supported by use of clamp hangers at every story height, and at not more than 6 feet intervals for copper piping 1-1/4" and smaller size.

### 3.4 CLOSING IN UNINSPECTED WORK

- A. General: Cover up or enclose work after it has been properly and completely reviewed.
- B. If any of the work is covered or enclosed prior to required inspections and review, uncover the work as required for the test and review. After review, tests and acceptance, repairs and replacements shall be made by the appropriate trades with such materials as necessary for the acceptance by the Architect and at no additional cost to the Owner.

### 3.5 CLEANUP AND CORROSION PREVENTION

- A. Upon completion of the work thoroughly clean and flush piping systems to the sewer with water.
- B. Fixtures, piping and equipment shall be thoroughly cleaned. Dirt, dust, and debris shall be removed and the premises left in a clean and neat condition.
- C. Caulk around fixtures at floor and wall.
- D. Before covering is applied to piping systems, clips, rods, clevises and other hanger attachments, and before uncovered piping is permitted to be concealed, corrosion and rust shall be wire brushed and cleaned and in the case of iron products, a coat of approved protective paint applied to these surfaces. When corrosion is from the effects of hot solder paste, the areas shall be cleaned and polished and a wash of bicarbonate of soda and water used to neutralize the acid condition.

### 3.6 DISINFECTING

- A. After the entire potable water system is completed, cleaned and tested, and just before the building is ready to be occupied, disinfect the system as follows: After flushing the mains, introduce a water and chlorine solution for a period of not less than three hours before final flushing of the system.

### 3.7 TESTS

- A. Sanitary soil, waste and vent piping: Fill with water to top of vents, and test as required by Code.

- B. Water piping shall be tested to a pressure of 100 lbs. per square inch for at least 30 minutes. Pressure drop in this period shall not exceed two pounds per square inch. Leaks shall be repaired and system retested. Notify Architect 24 hours before test is to be performed.

3.8 INSTRUCTIONS

- A. On completion of the project, provide a competent technician to thoroughly instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. The time of instruction shall be arranged with the Owner.

3.9 FIRESTOPPING

- A. Firestopping shall be performed in accordance with Specification Section 07 84 13 "Penetration Firestopping". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

\* END OF SECTION \*

## SECTION 23 00 00 - HEATING, VENTILATING AND AIR CONDITIONING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to install the heating, ventilating and air conditioning systems indicated.

#### 1.2 RELATED DOCUMENTS

- A. The drawings and the specifications including SECTION 23 05 00 "Common Work Results for HVAC" are hereby made a part of the work of this section.
- B. Section 01 91 33 - GENERAL COMMISSIONING REQUIREMENTS.

#### 1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section should be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 23 05 00 "Common Work Results for HVAC", apply are as follows:
  - 1. Equipment identification.
  - 2. Electric wall heaters.
  - 3. Air handling equipment.
  - 4. Fans.

### PART 2 PRODUCTS

#### 2.1 EQUIPMENT IDENTIFICATION

- A. Equipment Identification:
  - 1. Provide laminated plastic nameplates for boilers, pumps, and air handling units. Laminated plastic shall be 0.125-inch thick melamine plastic conforming to Fed. Spec. L-P-387, black with white center core. Surface shall be a matte finish, corners shall be square. Accurately align lettering and engrave into the white core. Minimum size of nameplates shall be 1.0 inch by 2.5 inches. Lettering shall be minimum of 0.25-inch high normal block lettering.

#### 2.2 PACKAGED ROOFTOP AIR CONDITIONING EQUIPMENT

- A. Provide high efficiency packaged gas-electric air conditioning units and coils of manufacturer, model and performance indicated, McQuay, York, Carrier, or approved equal.

- B. The air conditioning units shall consist of a fan section, two stage gas burners, gas valves, coil sections, coils, and filter/mixing box section with economizer dampers with fully modulating dual enthalpy economizer and barometric relief, hot-gas reheat and humidity control. Performance shall be ARI 430 certified. Provide access doors in each section. Furnish with 14" insulated, downflow roof curb, full base rail, low leakage dampers, stainless steel heat exchanger, packaged controls and high static pressure drive. Provide with through the base electrical connections. Furnish with unit-mounted disconnect and supply and return duct smoke detectors for each unit.
- C. Cabinet Construction: Insulated, steel reinforced and braced with steel angle framework, factory-assembled, sectionalized fan and coil sections, removable access panels to internal parts. Metal parts galvanized steel or chemically cleaned, phosphatized, primed and finished with enamel topcoat. No fiberglass insulation shall be exposed to the air stream.
- D. Fans: Shall be as scheduled, multi-blade centrifugal type, statically and dynamically balanced and tested. Bearings shall be self-aligning, grease lubricated ball type. Fan motor shall be 1800 RPM, open drip-proof or TEFC type, with greasable ball bearings, variable pitch sheave and mounted on an adjustable base. Provide extended grease lines. The fan drive shall have a 1.5 service factor for the maximum rated horsepower. Motors shall be premium high efficiency with minimum motor efficiency conforming to Section 23 05 00 "Electric Motors and Motor Controls". Submit certificate of conformance for motor efficiency.
- E. Coils: Capacities and pressure drops shall be rated in accordance with ARI 410. Coils shall be pressure tested at 300 psig and shall be suitable for 150 psig service.
  - 1. Coils: Copper tubes, aluminum fins and copper headers. Casings shall be 16 gage galvanized steel.
- F. Mixing box section: Outside air and return air dampers shall be "low leak" type. Blade seals shall be neoprene and jamb seals shall be compressible aluminum or stainless steel.
- G. Filters: Provide MERV13 pleated media, Multi-Pleat Green 13 by Koch Filter Corporation, Glasfloss Z-line Series MR-13, Airguard "DP-Green", or approved equal, 80-85% efficient. Furnish with one (1) initial and two (2) spare sets. Efficiencies shall be as tested in accordance with ASHRAE Standard 52-76.
- H. Submit fan curves for each fan with the design operating point clearly marked.
- I. The compressors shall be direct-drive, scroll or reciprocating hermetic type. Units with two (2) compressors shall have two (2) independent refrigeration circuits (R410A). Provide condensing units with a five (5) year warranty for parts and labor. Motors shall be suction gas cooled with crankcase heater, low pressure switches, internal temperature and current sensitive motor overloads. Provide with an anti-recycle timer.
- J. The air-cooled condenser shall be of a copper tube and aluminum finned heat exchanger and direct-drive, R410A, dynamically and statically balanced fans with permanently lubricated motors and built-in thermal overload protection.

## 2.3 FANS

- A. Shall be model and performance scheduled. Fan manufacturers shall be Panasonic, Greenheck or equal. The fans shall include housing, fan wheel, shaft, bearings, inlet shroud,

motor, mounting support and mounting frame as a factory-assembled unit. Provide gravity-operated, gasketed automatic gravity backdraft dampers for all exhaust fans (except kitchen hood fans).

- B. Bearings shall be precision, flange-mounted self-aligning ball bearings at inlet and discharge. Minimum average L50 design life shall be 200,000 hours at maximum catalogued operating conditions. Grease lines shall extend to the exterior of the fan housing.
- C. Submit sound power data for inlet and discharge sound.
- D. Submit fan curves for each fan with the design operating point clearly marked.

## 2.4 ELECTRIC WALL HEATER

- A. Electric wall heaters shall be manufactured by the Berko Electric or approved equal, UL listed. Unit configuration shall be wall-mounted, inverted flow. Cabinet shall be 16 gauge cold rolled steel with hinged front access door for access to control panel and access panel for access to all other internal components. Heating element shall be warranted for five years and shall be a non-glowing design constructed of a steel sheath with steel fins and shall include a thermal cutout to directly interrupt power to the element in the case of overheating without the use of relays. Power and performance as scheduled. Provide with remote mounted thermostat.

## PART 3 EXECUTION

### 3.1 SURFACE CONDITIONS

- A. Inspection:
  - 1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
  - 2. Verify that the heating system may be installed in accordance with pertinent codes and regulations and the reviewed Submittals.

### 3.2 CLOSING IN WORK

- A. Cover up or enclose work after it has been properly and completely tested and reviewed.
- B. No additional cost to the Owner will be allowed for uncovering or recovering any work that is covered or enclosed prior to required test and review.

### 3.3 TEST AND ADJUST

- A. After the installation is complete and ready for operation, test the system under normal operating conditions in the presence of the Architect and demonstrate that the system functions as designed.
- B. Correct defects which develop in operational testing, conduct additional testing until defect free operation is achieved.

3.4 CLEANUP AND CORROSION PREVENTION

- A. Equipment shall be thoroughly cleaned. Dirt, dust, and debris shall be removed and the premises left in a clean and neat condition.

3.5 INSTRUCTIONS

- A. On completion of the project, instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not be less than two (2) hours. The time of instruction shall be arranged with the Owner. In addition to the prime HVAC Subcontractor, the control system subcontractor, Balancing subcontractor, and Owner's representative shall be present and participate in the Owner's instruction.

3.6 FIRESTOPPING

- A. Firestopping shall be performed in accordance with Specification Section 07 84 13 "Penetration Firestopping". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

\* END OF SECTION \*



## SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. The General Conditions, Supplemental General Conditions and Instructions to Bidders shall apply to this work. Read these to be familiar with conditions related to the installation of the work.
- B. Section 01 91 33 – HVAC SYSTEM COMMISSIONING.

#### 1.2 WORK SHOWN ON DRAWINGS

- A. The drawings accompanying this specification, as a part thereof, are working drawings indicating the location and arrangement of the increments of the systems of this section of work. Material deviation from this arrangement, process or means of application, shall bear the Engineer's review stamp before the change is made on the job or materials are ordered. Changes made without such review shall be ordered removed and items installed as specified shall be provided at no additional expense to the Owner.
- B. The drawings are not intended to show in minute detail minor items of installation or materials such as specific fittings or findings.

#### 1.3 MATERIALS AND LABOR

- A. Furnish materials and labor necessary to deliver to the Owner a complete and operable system installed in accordance with the contract documents.
- B. Materials shall be of the best quality. Workmanship shall be of highest grade and construction shall be done according to best practices of the trade.
- C. Provide, when required, labeled samples of material or equipment specified herein or proposed to be used in this work.
- D. Where words "furnish", "provide", or "install" are mentioned, either singly or in combination, these words are hereby interpreted to mean "furnish and install" or "provide and install", including materials complete with connections, supplemental devices, accessories and appurtenances, unless specifically otherwise noted. These words are likewise hereby interpreted as being prefixed to materials, equipment, and apparatus hereinafter mentioned, either in abbreviated or scheduled information or in the technical sections of the specifications.

#### 1.4 EQUIPMENT INSTALLATION IN HEATING SEASON

- A. The system shall be installed provided that the construction area will have sufficient heat to maintain temperature above 40°F throughout the construction period.

1.5 COOPERATION BETWEEN TRADES

- A. Provide information sufficiently in advance of this work, so that work by the other trades may be coordinated and installed without delays. Furnish and locate sleeves, supports, anchors and necessary access panels.
- B. Where work is concealed, assure it does not project beyond finished lines of floors, ceilings, or walls.
- C. Equipment or piping requiring access found to be located above sheetrock ceilings shall be brought immediately to the attention of the Architect for resolution.

1.6 VISITING THE PREMISES

- A. Visit the premises and review the existing conditions, as applicable.

1.7 ORDINANCES, AUTHORITIES, PERMITS, AND FEES

- A. Obtain necessary permits and licenses, give notices and comply with laws, ordinances, rules, regulations or orders affecting the work, and pay fees and charges in connection therewith.
- B. The "authority having jurisdiction" is the organization, office, or individual responsible for "approving" equipment, an installation, or a procedure.

1.8 PROTECTION OF WORK AND MATERIALS

- A. Protect and care for materials delivered and work performed until the completion of the work. Defective equipment or equipment damaged in the course of storage, installation or test shall be replaced or repaired to the satisfaction of the Engineer at no additional cost to the Owner.

1.9 INSURANCE

- A. Purchase and maintain Public Liability and Property Insurance during the progress of the work and until completion and acceptance of the entire project by the Owner in the amounts as specified in the General Conditions.

1.10 APPLICABLE CODES

- A. Work and materials shall conform to the latest rules and regulations listed below and these rules and regulations hereby are made part of this specification. They include, but are not necessarily limited to the following:

2015 International Energy Conservation Code  
American Society for Testing and Materials (ASTM)  
Underwriters' Laboratories, Inc. (UL)  
Air Moving and Conditioning Assoc. (AMCA)  
American Society of Heating, Refrigerating, and Air  
Conditioning Engineers (ASHRAE)  
American Society of Mechanical Engineers (ASME)  
National Electrical Manufacturers Association (NEMA)  
Institute of Electrical and Electronics Engineers (IEEE)

American National Standards Institute (ANSI)  
National Fire Protection Association (NFPA)  
American Water Works Association (AWWA)  
Local Fire Code  
Local Plumbing Codes  
American Welding Society

#### 1.11 SHOP DRAWINGS

- A. Submit shop drawings, manufacturers' data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, eight (8) copies, to be submitted to the Architect. Shop drawings will be returned "No Exceptions Taken", "Make Corrections Noted", "Amend and Resubmit", "Submit Specified Item", or "Rejected" less two (2) copies. Work shall progress in accordance with "Reviewed" shop drawings (ONLY).
- B. Groups of similar shop drawings shall be submitted as individual bound documents with covers and indexes. Typical similar items would be "Diffusers and Registers", "Valves and Controls". Rejection of individual items shall not be cause for rejection of the entire document.
- C. Clearly indicate item(s) to be reviewed on each submission by highlighting or underlining intended item(s). Submissions not clearly marked shall be returned "Amend and Resubmit".
- D. Shop drawings must bear the Engineer's review stamp. In the event that the Engineer returns shop drawings "Amend and Resubmit" or "Rejected", the shop drawing must be revised and resubmitted for review.
- E. Furnishing of the specified item must still produce the results and performance, dependability and quality reasonably to be expected within the spirit of the specifications, drawings, and the standard of good mechanical performance normal to the trade.

#### 1.12 SUBSTITUTIONS

- A. Refer to Specification Section 01 60 00 / 22. Where the specifications allow the substitution of a product, still this product is subject to review by the Engineer in accordance with the paragraph entitled "Shop Drawings". Review of a substitute item is an indication only that the substitute item is compatible with the specified item as a claim of the manufacturer. Insure dimensional propriety, performance, and quality of the substitute item.
- B. Reference in the specifications or on the drawings to any product, material, fixture, form or type of construction, by proprietary name, manufacturer, make or catalog number, establishes a standard of quality or design and is not meant to limit competition. Use any equivalent substitute provided favorable written review by the Engineer is first obtained. The (ONLY) notation in the specification is an exception to this and leaves no option.
- C. For materials or equipment which are supplied with integral or factory applied finish, the colors will be considered in evaluating substitutions.
- D. For the purpose of avoiding conflicts with other trades, contracts, and adjoining work where more than one (1) article, device, material, fixture, form or proprietary name, manufacturer, make or catalog number, the first named shall be used as the basis of design and details. The

cost of any changes because of substituted item shall be borne by the Contractor requesting such change.

#### 1.13 COMMISSIONING

- A. Mechanical systems in this project will be commissioned by an independent commissioning agent, hired by the Owner. All division 23 contractors and subcontractors will be responsible for carrying out the commissioning requirements specified in Section 019133 - General Commissioning Requirements, and other sections referenced in 019133, at no additional cost to the Owner.

### PART 3 - EXECUTION

#### 3.1 GRADES AND ELEVATIONS

- A. Establish and maintain grades and elevations in connection with this work.

#### 3.2 EQUIPMENT SUPPORTS

- A. Furnish and install equipment supports for mechanical equipment as required. Supports shall be subject to review by the Engineer. All equipment shall be installed level and per the manufacturers recommendations.

#### 3.3 SLEEVES AND PREPARED OPENINGS

- A. Coordinate core-drilling, cutting, patching and setting of sleeves, frames, framing and lintels for openings with other trades. Sleeves shall be furnished by the Contractor. Pipe sleeves shall be provided at all floor and wall penetrations. Sleeves shall be Schedule 40 steel pipe for iron pipe, Type "L" copper for copper pipe and Schedule 40 PVC for plastic pipe. Sleeves shall be firestopped, as specified. Piping penetrations thru floors above grade shall have watertight pipe sleeves (LinkSeal, or approved equal).
- B. Failure to give timely notice of and to locate openings and furnish sleeves shall cause no additional expense to the Owner.

#### 3.4 CONNECTION TO EQUIPMENT

- A. Provide piping connections, supports, brackets, compensators or flexible connections to prevent application of excessive stresses to equipment.
- B. Equipment shall be installed with flanges or unions in such a manner as to permit disconnecting for removal of tubes, coils, elements and other equipment for inspection, service and repairs.

#### 3.5 ACCESS TO EQUIPMENT

- A. The installation of work performed shall provide reasonable accessibility for operation, inspection, and maintenance of equipment and accessories. The Engineer shall determine the adequacy of such accessibility.

3.6 ACCESS PANELS / DOORS

- A. Access panels shall be provided where indicated on the drawings and as required for access to valves and other serviceable components. Access doors shall be Milcor, Zurn or approved equal hinged with primed finish and with allen wrench operated latch.
- B. Access panels installed in fire-rated assemblies shall have the same fire rating as the assembly.
- C. Access panels / doors shall be provided as required for mechanical components requiring access, such as radiant floor manifolds and valves. Access panels / door shall be Acudor, Milcor, or equal, size as noted or required, 16"x16" minimum, 18 gauge steel door and frame, stainless steel allen wrench operated cam latch, 1" wide flange, concealed pin hinge, 5 stage iron phosphate preparation with prime coat of white alkyd baked-on primer.

3.7 PAINTING OF EQUIPMENT

- A. Exposed ironwork, including steel supports and hangers in unfinished spaces, e.g. boiler rooms, mechanical rooms, pits, and trenches shall be properly cleaned, prepared and painted with two (2) coats of black asphaltum varnish.

3.8 GUARDS

- A. Exposed moving and rotating elements of mechanical equipment items shall be protected with suitable guards for personnel protection. Guards shall be of rigid construction, firmly positioned. Holes shall be provided in guards at shaft centers to facilitate tachometer readings.

3.9 LUBRICATION

- A. Furnish and install grease fittings for points requiring lubrication. Furnish extension type fittings as required to provide easy access for maintenance lubrication.
- B. Furnish initial charges of lubricants for equipment. Lubricants shall be in conformance with the manufacturer's requirements and recommendations.

3.10 ELECTRIC MOTORS AND MOTOR CONTROLS

- A. Unless otherwise noted, motors, motor starters and other electrical accessories which are specified under Mechanical specifications shall be selected with characteristics as follows:  
  
1/2 Horsepower and less - 120 volt, 1 phase, 60 Hz.  
3/4 Horsepower and larger – 460 or 208 volt, 3 phase, 60 Hz., as indicated.
- B. Motors shall be built in accordance with the latest applicable NEMA Premium Efficiency, IEEE and ANSI Standards. Motors shall be manufactured by Baldor, Magnetek or Toshiba, of the latest type and quality specified under individual items of equipment. Motor efficiencies shall be premium high efficiency type per the Consortium for Energy Efficiency Standard and/or be "Energy Star" compliant per the EISA.
- C. Magnetic motor starters for mechanical items of equipment shall be furnished under Division 26 unless the starter is an integral part of a factory packaged item of equipment.

Each starter furnished as an integral item of equipment shall be provided with overload heater elements. Starters shall be combination type with "Hand-Off-Auto" switches and shall have single phase protection or shall have relays installed to provide this feature. Starters shall be equipped with suitable step-down transformers to provide required control voltage.

- D. Motors shall have a minimum continuous duty service factor of 1.15. Minimum motor efficiency shall be:

MOTOR HORSEPOWER	PERCENTAGE EFFICIENCY		
	(1200RPM)	(1800 RPM)	(3600 RPM)
1-3	----	86.5	85.5
5	89.5	89.5	86.5
7.5	90.2	91.0	88.5
10	91.7	91.7	89.5
15	91.7	93.0	90.2

### 3.11 CLEANING OF SYSTEMS

- A. Piping and duct systems shall be thoroughly cleaned and flushed prior to initial operation.
- B. Thoroughly clean exposed portions of the mechanical installation, removing labels and foreign substance.
- C. Furnish detergents, solvents, cleaning compounds, and tools required for cleaning operations.
- D. Keep the premises free from accumulation of waste material or rubbish and at the completion of the work, remove from the job site tools, scaffolding, surplus materials, and rubbish, leaving the work areas "broom" clean.

### 3.12 STARTING OF EQUIPMENT

- A. Testing or starting of equipment shall be done in collaboration with trades concerned to insure safe and proper operation of the equipment.
- B. Prior to starting equipment, provide lubrication at required points. Before starting any electrical or electric motor driven equipment, a check must be made to insure that proper heater coils are installed in the starters and that the equipment is rotating in the proper direction.

### 3.13 OPERATIONAL TESTING

- A. Operate systems until successful operation is demonstrated to the Engineer. This initial operation shall be in addition to the testing of the system and shall be done after the system is cleaned and finished.

### 3.14 RECORD DRAWINGS

- A. During construction, keep an accurate record of deviations to the installation of the work as indicated on the drawings. Upon completion of the work, furnish a copy of this record to the Engineer. **Submit record drawings before requesting final payment.**

3.15 MANUFACTURER'S REPRESENTATIVE

- A. As indicated in the Technical Sections of this specification or as directed by the Engineer, provide the services of a factory trained Engineer or Technician to inspect, adjust, and place in proper operating condition the equipment or item involved. No additional compensation will be allowed for such service.

3.16 MANUFACTURER'S INSTRUCTIONS, OPERATION AND MAINTENANCE DATA

- A. Provide for each item of equipment or apparatus furnished, a complete set of printed instructions obtained from the manufacturer covering proper operation, maintenance, lubrication, cleaning, servicing, adjustment, and safety instructions.
- B. Manufacturer's data shall include performance data (curves are preferred where applicable) complete parts lists, recommended spare parts lists, piping, and wiring diagrams.
- C. Arrange data in complete sets, properly indexed and marked.
- D. Data shall include a complete set of shop drawings.
- E. Material shall first be submitted in preliminary form for review by the Engineer. After review, submit two (2) copies in bound volumes to the Engineer for distribution.

3.17 GUARANTEES

- A. An item becomes "defective" when it ceases to conform to the Contract Documents. Guarantees begin on the date of issuance of a certificate authorizing final payment or certificate of substantial completion with the Owner taking occupancy or beneficial use thereafter.
- B. Upon completion of the work and before applying for final payment, furnish a written guarantee, stating that the work complies with the provisions of codes listed herein and the local enforcing authorities, and that it will be free from defects of material and workmanship for not less than one (1) year. Guarantee shall further state that the Contractor will, at his own expense, repair or replace any of his material and work which may become defective during the time of guarantee, together with other work damaged as a consequence of such defects.
- C. Where special guarantees, covering installation, operation or performance of any systems, or equipment furnished under are indicated, the full responsibility for the fulfillment of such guarantees must be assumed by the Contractor who shall obtain written guarantees in triplicate, two (2) copies of which shall be filed with the Engineer before final acceptance.
- D. Repeated malfunctioning or failure in service of any item or work of the system is sufficient cause for the Engineer to order the removal of the item, and its replacement with new item at the expense of the Contractor.

3.18 EXISTING UTILITIES AND EQUIPMENT

- A. The Contractor shall be responsible for correcting any damage to existing systems, components or utilities that are to remain in service.

- B. The Contractor shall visit the premises to become familiar with the existing conditions prior to submitting a bid. No additional compensation will be allowed for existing conditions that are readily apparent during a site visit.

3.19 FIRESTOPPING

- A. Firestopping shall be performed in accordance with Specification Section 07 84 13 "Penetration Firestopping". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified. Coordinate size, location and type of pipe and duct sleeves as required by firestopping systems.

3.20 HAZARDOUS MATERIALS

- A. Recognized hazardous materials such as lead, mercury or asbestos shall be prohibited from the project. Submit MSDS sheets to the Owner for review.

\* END OF SECTION \*



## SECTION 23 0 593 - TESTING, ADJUSTING AND BALANCING FOR HVAC

### PART 1 - GENERAL

- 1.1 DESCRIPTION: The work covered by this section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required for testing and balancing the air systems.
- 1.2 RELATED DOCUMENTS
  - A. The General Conditions, Supplemental General Conditions and Instructions to Bidders shall apply to this work. Read these to be familiar with conditions related to the installation of the work.
  - B. Section 01 91 33 – HVAC SYSTEM COMMISSIONING.
- 1.3 DEFINITIONS
  - A. Adjust: To regulate the specified flow rate and air patterns at the terminal equipment, (e.g., reduce fan speed, throttling).
  - B. Balance: To proportion flows within the distribution system (submains, branches and terminals) in accordance with specified design quantities.
  - C. Procedure: Standardize approach and execution of sequence of work operations to yield reproducible results.
  - D. Report Forms: Test data sheets arranged for collection of test data in logical order to submission and review. This data should also form the permanent record which shall be used as the basis for any future testing, adjusting, and balancing required.
  - E. Test: To determine quantitative performance of equipment.
- 1.4 SUBMITTALS: Submit the following:
  - A. Standards Compliance:
    - Testing Agency
    - Testing Agency Personnel
    - Professional Engineers
    - Instrument Calibration
- 1.5 TESTING AND BALANCING AGENCY
  - A. Air Systems Testing and Balancing: Upon completion of the installation and field testing, performance test and adjust the supply, return, make-up, and exhaust air systems, and heating water systems to provide the air volume and water flow quantities indicated. Accomplish work in accordance with the agenda and procedures specified and AABC 71679 and standards of the NEBB. Correct air and water system performance deficiencies disclosed by the test before balancing the systems.

- B. Agency Qualifications: Obtain the services of a qualified testing organization to perform the testing and balancing work as herein specified. Prior to commencing work under this section of the specifications, the testing organization shall have been reviewed by the Architect. The criteria for determining qualifications shall be membership in the AABC, or certification by the NEBB, or the testing organization shall have submitted proof to satisfy the Architect that the organization meets or exceeds the technical standards for membership of the AABC as published in the AABC 71679. The testing organization shall be independent of both the installing contractors and equipment suppliers for this project.

1.6 AGENDA

- A. Preliminary Report: Review drawings and specifications prior to installation of any of the affected system. Submit a written report to the Architect indicating any deficiencies in the system that would preclude the proper adjusting, balancing, and testing of the systems.

1.7 PROCEDURES, GENERAL

- A. Requirements: Adjust systems and components thereof that perform as required by drawings and specifications.
- B. Test Duration: Operating tests of heating and cooling coils, fans and other equipment shall be of not less than 4 hours duration, after stabilized operating conditions have been established. Capacities shall be based on temperatures and air and water quantities measured during such tests.
- C. Instrumentation: Method of application of instrumentation shall be in accordance with the manufacturer's instructions. Furnish personnel, instruments, and equipment for tests specified herein.
- D. Accuracy of Instruments: Instruments used for measurements shall be accurate. Provide calibration histories for each instrument for examination. Calibrate each test instrument by an reviewed laboratory or by the manufacturer. The Architect has the right to request instrument recalibration, or the use of other instruments and test methodology, where accuracy of readings is questionable.
- E. Accuracy of Thermometers: Plus or minus one graduation at the temperatures to be measured. Graduations shall conform with the following schedule:

Medium	Design Temperature Differential (°F)	Maximum Graduation (°F)
Air	10 or less	1/2
Air	over 10	1

- F. Flow Rate Tolerance: Values are based on discussion in ASHRAE "HVAC Applications", Chapter 34. Air filter resistance during tests, artificially imposed if necessary, shall be 80 percent of final values.
1. Air Handling Unit CFM: Minus 0 percent to plus 10 percent.
  2. Other Fans: Minus 0 percent to plus 10 percent.
  3. Air Terminal Units (VAV Boxes): Minus 5 percent to plus 10 percent.

4. Minimum Outside Air (for manually set dampers): Minus 0 percent to plus 10 percent.
5. Individual Room Air Outlets and Inlets, and Air Flow Rates Not mentioned Above: Minus 10 percent to plus 10 percent.

## 1.8 COMMISSIONING

- A. Mechanical systems in this project will be commissioned by an independent commissioning agent, hired by the owner. All division 23 contractors and subcontractors will be responsible for carrying out the commissioning requirements specified in Section 019131 - General Commissioning Requirements, and other sections referenced in 019131, at no additional cost to the owner.

## PART 2 - PRODUCTS

NOT USED

## PART 3 - EXECUTION

### 3.1 AIR SYSTEM PROCEDURES

- A. Adjustments: Adjust air handling systems to provide the required design air quantity to, or through, each component. Conduct adjusting and balancing of systems during periods of the year approximating maximum seasonal operation.
- B. Balance: Use flow adjusting (volume control) devices to balance air quantities only; i.e., proportion flow between various terminals comprising system, and only to the extent that their adjustments do not create objectionable air motion or sound, i.e., in excess of specified limits.
- C. Balancing Between Runs (submains, branch mains, and branches): Use flow regulating devices at, or in, the divided - flow fitting. Minimize restriction imposed by flow regulating devices in or at terminals.
- D. Final Measurements of Air Quantity: Make final measurements of air quantity, after the air terminal has been adjusted to provide the optimum air patterns of diffusion.
- E. Fan Adjustment: Total air system quantities, generally, shall be varied by adjustment of fan speeds, or axial-flow fan wheel blade pitch. For systems with direct-connected fans (without adjustable pitch blades), damper restrictions of a system's total flow or variable speed rheostats shall be adjusted as appropriate.
- F. Air Measurement:
  1. Pitot Tube: Except as specifically indicated herein, make pitot tube traverses of each duct to measure air flow therein. Pitot tubes, associated instruments, traverses, and techniques shall conform with the ASHRAE Handbook Fundamentals.
  2. Pitot Tube Traverse: Pitot-tube traverse may be omitted if the duct serves only a single room or space and its design volume is less than 2000 cfm. In lieu of Pitot-tube

traverse, determine air flow in the duct by totalling volume of individual terminals served, measured as described herein.

3. Measurements of Air Quantity: Where duct's design velocity and air quantity are both less than 1000 (fpm/cfm), air quantity may be determined by measurements at terminals served.
- G. Air Terminal Balancing: Measurement of flow rates by means of velocity meters applied to individual terminals, with or without cones or other adapters, shall be used only for balancing.

### 3.2 CERTIFIED REPORTS

- A. Submittal: Submit three copies of the reports described herein, covering air and water system performance, air motion (fpm), to the Architect prior to final tests and inspection.
- B. Instrument Records: Include types, serial numbers, and dates calibration of instruments.
- C. Reports: Reports shall identify conspicuously items not conforming to contract requirements, or obvious maloperation and deficiencies.
- D. Certification: The reports shall be certified by an independent Registered Professional Engineer who is versed in the field of air and water balancing and who is not affiliated with any firm involved in the design or construction phases of the project.

### 3.3 AIR SYSTEM DATA

- A. Report: The certified report shall include for each air-handling system the data listed below:
  1. Equipment (fan or factory fabricated station unit):
    - a. Installation Data:
      - 1) Manufacturer and Model
      - 2) Size
      - 3) Arrangement, Discharge, and Class
      - 4) Motor H.P., Voltage, Phase, Cycles, and Full Load Amps.
      - 5) Location and Local Identification Data
    - b. Design Data: Data listed in schedules on drawings and specifications.
    - c. Fan Recorded (Test) Data
      - 1) C.F.M.
      - 2) Static Pressure
      - 3) R.P.M.
      - 4) Motor Operating Amps.
      - 5) Motor Operating B.H.P.
  2. Duct Systems:

- a. Duct Air Quantities (Maximum and Minimum) - Main, Submains, Branches, Outdoor (Outside) Air, Total-Air, and Exhaust
  - 1) Duct size(s)
  - 2) Number of Pitot-tube (Pressure) Measurements
  - 3) Sum of Velocity Measurement, excluding pressure measurements
  - 4) Average Velocity
  - 5) Recorded (Test) C.F.M.
  - 6) Design C.F.M.
- b. Individual Air Terminals:
  - 1) Terminal Identification (Supply or Exhaust, Location and Number Designation)
  - 2) Type Size, Manufacturer, and Catalog Identification
  - 3) Design and Recorded Quantities - C.F.M.
  - 4) Deflector Vane or Diffusion Cone Settings
  - 5) Applicable Factor for Application, Velocity, Area
  - 6) Design and Recorded Velocities - F.P.M. (State "core" "inlet," as applicable)

### 3.4 FINAL TESTS, REVIEW, AND ACCEPTANCE

- A. Capacity and Performance Tests: Make tests to demonstrate that capacities and general performance of air and water systems comply with contract requirements.
- B. Final Inspection: At the time of final review, recheck, in the presence of the Engineer, random selections of data water and air quantities and air motion recorded in the certified report.
- C. Points and Areas for Recheck: As selected by the Architect.
- D. Measurement and Test Procedures: As reviewed for work forming basis of certified report.
- E. Selections for Recheck (specific plus random): In general, selections for recheck will not exceed 25 percent of the total number tabulated in the report.
- F. Retests: If random tests elicit a measured flow deviation of ten percent or more from, at ten percent or more of the rechecked selections, the report shall be automatically rejected. In the event the report is rejected, systems shall be readjusted and tested, new data recorded, new certified reports submitted, and new inspection tests made.
- G. Marking of Settings: Following final acceptance of certified reports by the Architect, the settings of valves, dampers, and other adjustment devices shall be permanently marked, so that adjustment can be restored if disturbed at any time. Do not mark devices until after final review.

### 3.7 DUCT LEAK TESTING

- A. Medium pressure ductwork systems shall be leak-tested in accordance with SMACNA and as follows:

1. Medium pressure ductwork and associated components shall be tested at a minimum static pressure of 3.0" w.g. or 1.5 times the actual operating pressure (whichever pressure is greater) and maximum allowable leakage shall not exceed SMACNA Class 3 or 3.0 CFM/100 sf (@ a static pressure of 1.0" w.g.) of duct surface area. Total maximum leakage shall not exceed 2% of total system design airflow. Leak testing equipment shall be United-McGill "Leak Detective", or approved equal.
- B. The leakage testing shall be witnessed by a representative of the Owner and the results shall be submitted to the Engineer for review.
- C. Ductwork upstream of Variable Air Volume boxes shall be considered medium pressure construction and shall be leak-tested as specified.

\* END OF SECTION \*

## SECTION 23 07 00 - HVAC INSULATION

### PART 1 GENERAL

#### 1.1 RELATED DOCUMENTS

- A. The drawings and the specifications including the project manual are hereby made a part of the work of this section.
- B. Section 01 23 00 – ALTERNATES.
- C. Section 01 91 33 – HVAC SYSTEM COMMISSIONING.

#### 1.2 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to insulate the heating, ventilating, air conditioning, and plumbing systems.

#### 1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section shall be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 23 05 00, Common Work Results for HVAC, apply are as follows:
  - 1. Piping insulation.
  - 2. Duct insulation.
  - 3. Equipment and component insulation.
  - 4. Insulation application schedule.

#### 1.4 DEFINITIONS

- A. Finished Spaces: Spaces other than furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels, unless specifically listed below as an unfinished space.
- B. Unfinished Spaces: Mechanical rooms and Elevator machine rooms.
- C. Unconditioned Spaces: Spaces exposed to near outside ambient temperatures, such as unheated attic spaces or non-air conditioned areas.
- D. Outside: Areas beyond the exterior side of walls or above the roof, unexcavated spaces, and crawl spaces.
- E. Concealed: Not visible in finished or unfinished spaces. For example, above ceilings, below floors, between double walls, furred-in areas, pipe and duct shafts, and similar spaces.

- F. Exposed: Visible from a finished or unfinished space.

## 1.5 MANUFACTURER'S STAMP OR LABEL

- A. Packages or standard containers of insulation, jackets, cements, adhesives, and coatings delivered to the project site for use must have the manufacturer's stamp or label attached giving name of manufacturer, brand, and description of material. Insulation shall be asbestos-free.

## 1.6 FLAME SPREAD AND SMOKE DEVELOPED RATINGS

- A. Materials shall have a flame-spread rating of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with NFPA 255, ASTM E84, or UL 723.
- B. Provide materials with flame resistant treatments not subject to deterioration due to aging, moisture, high humidity, oxygen, ozone, or heat.
- C. Materials Exempt From Fire-Resistant Rating: Nylon anchors for securing insulation to ducts or equipment.

## PART 2 PRODUCTS

### 2.1 PIPING INSULATION

- A. Fiberglass: Heavy density preformed fiberglass with thermal conductivity of 0.29 Btu-in/hr-ft<sup>2</sup>-°F at 150°F mean temperature, Johns Manville Micro-Lok HP, or approved equal. Insulation shall conform to ASTM C547 Class I and shall be suitable for 850°F service. Fitting insulation shall be of same material used for pipe. The flame spread / smoke developed rating shall be 25 / 50.
  - 1. Insulation Jacket: All service (ASJ) type conforming to Fed. Spec. HH-B-100B Type I. Jacket permeability shall not exceed 0.02 perms (ASTM E96). Pipe fitting jacket shall be factory premolded, one-piece, PVC covers with pressure sensitive taped joints. Jackets in exposed locations shall have a white surface suitable for field painting. Provide vapor barrier as required by service.
  - 2. Aluminum Jackets: ASTM B 209M (ASTM B 209), Temper H14, minimum thickness of 27 gage (0.016 inch), with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide smooth surface jackets for jacket outside diameters less than 8 inches. Provide corrugated surface jackets for jacket outside diameters 8 inches and larger. Provide 1/2" wide stainless steel bands. Provide factory prefabricated aluminum covers for insulation on fittings, valves, and flanges.
  - 3. PVC Jacket: Glossy white finish, ASTM 1784, minimum thickness 0.030", over insulation and vapor barrier with solvent-welded joints. Jacket shall be overlapped 2" minimum on down side.  
***Provide jacketing over insulation in finished areas where exposed to view.*** See the Reflected Ceiling Plans for additional information. Provide jacketing on insulated exterior piping.
- B. Flexible Unicellular: Flexible unicellular with thermal conductivity of 0.27 Btu-in/hr-ft<sup>2</sup>-°F at 75°F mean temperature. Insulation shall conform to ASTM C534, Type I, Tubular and



shall be suitable for 200°F service. Fitting insulation shall be of same material used for pipe. Permeability shall not exceed 0.10 perms (ASTM E96). Insulation adhesive shall conform to Mil. Spec. MIL-A-24179A, Type II, Class 1.

- C. Fittings, Flanges, Hydronic Components and Accessories, Pump Casings and Valves: Provide insulation for fittings, flanges, and valves premolded, precut, or job fabricated of the same thickness and conductivity as used on adjacent piping.
- D. Insulation Kit: Insulate exposed supply and waste piping at handicapped accessible sinks with fully molded insulation kit. McGuire Products ProWrap, 3/16" thick closed vinyl with anti-microbial additive, 1.02 Btu-in/hr-F<sup>2</sup>-°F thermal conductivity, white color.

## 2.2 DUCT INSULATION

- A. Fiberglass (Ductwrap): Fiberglass duct wrap with foil-scrim-kraft facing/vapor barrier, 1.0 lb/cu.ft. density (0.75 lb/cu.ft. for 3" thickness only), 0.29 Btu-in/hr-ft<sup>2</sup>-°F conductivity at 75°F mean temperature, 0.05 permeance rating. Insulation shall meet the requirements of NFPA 90A & B and shall be UL rated. Provide foil-scrim-kraft (FSK) tape.
- B. Fiberglass (Ductboard): Fiberglass insulation board with foil-scrim-kraft facing/vapor barrier, 3.0 lb./CF density, 0.25 Btu-in/hr-ft<sup>2</sup>-°F conductivity at 75°F mean temperature, 0.05 permeance rating. Insulation shall meet the requirements of NFPA 90A and B and shall be UL rated. Provide foil-scrim-kraft (FSK) tape.

## 2.3 EQUIPMENT INSULATION

- A. Fiberglass (Hot Equipment): Semi-rigid fiberglass board conforming to Fed. Spec. HH-I-558B, Form B, Type I. Thermal conductivity shall be 0.32 Btu-in/hr-ft<sup>2</sup>-°F at 150°F mean temperature (ASTM C177), insulation shall be suitable for 650°F service. Insulation jacket shall be "all service" type conforming to Fed. Spec. HH-I-100B Type I or II. Jacket permeability shall not exceed 0.02 perms (ASTM E96).
- B. Flexible Unicellular (Cold Equipment and Piping): Flexible unicellular with thermal conductivity of 0.27 Btu-in/hr-ft<sup>2</sup>-°F at 75°F mean temperature. Insulation shall conform to ASTM C534, Type II, sheet and shall be suitable for 200°F service. Permeability shall not exceed 0.10 perms (ASTM E96). Insulation adhesive shall conform to Mil. Spec. MIL-A-24179A, Type II, Class 1.

## PART 3 EXECUTION

### 3.1 SURFACE CONDITIONS

- A. Inspection:
  - 1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
  - 2. Verify that the insulation systems may be installed in accordance with pertinent codes and regulations and the reviewed Submittals.

### 3.2 GENERAL

- A. Insulate after system tests have been completed and surfaces to be insulated have been cleaned of dirt, rust, and scale and are dry.
- B. Install insulation with jackets drawn tight and cement down longitudinal and end laps. Do not use scrap pieces where a full length section will fit. Insulation shall be continuous through sleeves, wall and ceiling openings, except at fire dampers in duct systems and pipe penetrations through fire rated assemblies. Extend surface finishes to protect ends, and raw edges of insulation. Apply coatings and adhesives at the manufacturer's recommended coverage per gallon. Individually insulate piping and ductwork. Keep insulation and piping dry during the application of the finish. Bevel and seal the edges of exposed insulation.
- C. Unless otherwise indicated, do not insulate the following:
  - 1. Factory preinsulated flexible ductwork.
  - 2. Factory pre-insulated ductwork, plenums, casings, mixing boxes, and filter boxes.
  - 3. Chrome plated pipes and fire protection pipes.
  - 4. Vibration isolating connections.
  - 5. Adjacent insulation.
  - 6. ASME stamps, nameplates, access plates.
  - 7. Ductwork exposed to view in a normally occupied space.
  - 8. Hydronic specialties: Low water cutoff, relief valves, relief valve discharge piping, pressure reducing valves, and expansion tanks.

### 3.3 PIPING INSULATION

- A. Pipe Insulation (Fiberglass): Place sections of insulation around the pipe and joints, tightly butt into place. Draw jacket laps tight and smooth. Secure jacket with fire resistant adhesive, or factory applied self sealing lap. Cover circumferential joints with butt strips, not less than 3-inches wide, of material identical to the jacket material. Overlap longitudinal laps of jacket material not less than 1-1/2 inches. Adhesive used to secure the butt strip shall be the same as used to secure the jacket laps.
- B. Flanges, Flexible Connectors, Pump Connectors, Unions, Valves and Fittings Insulation (Fiberglass): Factory fabricated removable and reusable insulation covers. Place factory premolded, precut or field-fabricated segmented insulation of the same thickness and conductivity as the adjoining pipe insulation around the flange, union, valve, and fitting abutting the adjoining pipe insulation. Install factory premolded one-piece PVC fitting covers over the insulation and secure by stapling or with metal or plastic tacks made for securing PVC fitting covers and secure with PVC vapor barrier tape. All loop water valves and components shall be insulated and sealed to prevent sweating.
- C. Pipe Insulation (Flexible Unicellular): Bond cuts, butt joints, ends, and longitudinal joints with adhesive. Miter 90-degree turns and elbows, tees, and valve insulation. Insulate flanges, flexible connectors, pump connectors, unions, valves, pump casings, hydronic accessories and components and fittings.
- D. Where penetrating roofs and exterior walls, insulate piping to a point flush with the underside of the deck or wall and seal with a vapor barrier coating.
- E. Hangers and Anchors: Pipe insulation shall be continuous through pipe hangers. Where pipe is supported by the insulation, provide MSS SP-58, Type 40 galvanized steel shields

(16 gage minimum). For fiberglass insulation systems on pipe sizes 2 inches through 3", provide insulation inserts at points of hangers and supports. Insulation inserts shall be of molded glass fiber (minimum 12 pcf). Insulation inserts shall cover the bottom half of the pipe circumference, 180 degrees, and be not less than 12" long and shall not compress the insulation. Vapor-barrier facing of the insert shall be of the same material as the facing on the adjacent insulation. Seal inserts into the insulation. Insulation inserts for pipe sizes 4" and larger shall be welded pipe saddles. Install insulation in void area of saddle of same material used on adjacent insulation. **For pipe sizes 2" and smaller, insulation inserts for flexible unicellular insulation systems shall be wooden doweling set on end of length equal to insulation thickness. Seal dowel to insulation with adhesive.**

- F. PVC or Metal Jackets: Provide over exterior insulation exposed to the weather. Machine cut jacket to smooth edge of circumferential joints. Overlap metal jacket not less than 2 inches at longitudinal and circumferential joints and secure with metal bands at not more than 9 inch centers. Overlap longitudinal joints down to shed water. Seal circumferential joints with a coating recommended by insulation manufacturer for weatherproofing. Solvent weld PVC jacket system to provide continuous watertight seal.

*Provide 30 mil glossy PVC jacketing over insulation in finished areas where exposed to view. Provide PVC jacketing over insulation in unfinished spaces such as Mechanical and Boiler Rooms within 10' of the finished floor. See the Reflected Ceiling Plans and Room Finish Schedules for additional information.*

### 3.4 DUCT INSULATION

- A. Rigid Insulation: Secure rigid insulation by impaling over pins or anchors located not more than 3 inches from joint edges of boards, spaced not more than 12 inches on centers and secure with washers and clips. Spot weld anchor pins or attach with a waterproof adhesive especially designed for use on metal surfaces. Each pin or anchor shall be capable of supporting a 20-pound load. Cut off protruding ends of pins. After installing washers, provide foil-scrim-kraft (FSK) tape to seal break in vapor barrier, tape shall extend 1" minimum around pin. Apply insulation with joints tightly butted. Bevel insulation around name plates and access plates and doors. Seal joints with FSK tape. Provide additional adhesive or staples to assist tape adhesion in difficult applications.
- B. Flexible Blanket Insulation: Apply insulation with joints tightly butted. Staple laps of jacket with outward clinching staples and seal with foil scrim kraft (FSK) tape. Sagging of flexible duct insulation shall not be permitted. For ductwork over 24-inches wide on horizontal duct runs, provide pins, washers and clips. Install speed washers with pins and pin trimmed to washer. Cut off protruding ends of pins after clips are secured. Seal with FSK tape, extend tape 1" minimum around pin. Use pins on sides of vertical ductwork being insulated. Space pins and clips on 18 inch centers and not more than 18 inches from duct corners. Carry insulation over standing seams and trapeze-type hangers.

### 3.5 EQUIPMENT INSULATION

- A. General Procedures: Apply equipment insulation suitable for temperature and service to fit as closely as possible to equipment. Join sections of insulation with adhesive. Bevel insulation around nameplates, ASME Stamp, and access plates. For insulation on equipment that must be opened periodically for inspection, cleaning, or repair, construct insulation to be removable and replaceable without damage. Provide vapor barrier seal at joints and seams for "cold" equipment.

- B. Heating Equipment: Provide semi-rigid mineral fiberboard insulation. Seal longitudinal and lateral seams with FSK tape. Bond cuts, ends, and mitered sections with adhesive. Provide a vinyl-acrylic mastic coating on exposed fiberglass ends.
- C. Cold Equipment including all equipment, valves and piping system components associated with the Geothermal Loop Water System, Valves, Pump Casings, Flexible Connections and Accessories: Provide flexible unicellular sheet insulation, bond cuts, butt joints, longitudinal joints and ends with vapor barrier adhesive. Vapor seal exposed edges to equipment.

### 3.6 INSULATION APPLICATION SCHEDULE

SERVICE	THICKNESS	MATERIAL/JACKET
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#### PIPING:

Domestic Cold Water Piping		
1" and smaller	3/4"	Fiberglass w/ASJ or Flexible Unicellular
1 1/4" and larger	1"	Fiberglass w/ASJ or Flexible Unicellular
Domestic Hot Water Piping and Domestic Hot Water Recirculation Piping		
1-1/4" and larger	2"	Fiberglass w/ASJ or Flexible Unicellular
1" and smaller	1"	Fiberglass w/ASJ or Flexible Unicellular
Water and Drain Piping Under Handicap Accessible Fixtures		Insulation Kit
Domestic Water Branch Piping Less than 10 ft in Stud Walls	1/2"	Fiberglass w/ASJ or Flexible Unicellular
Horizontal and Vertical Rain Leaders and Roof Drain Sump Bodies and Pans	1"	Flexible Unicellular

#### DUCTWORK:

Supply and Return Ductwork In unconditioned spaces (Such as mechanical rooms)	2"	Ductwrap, FSK
Exhaust Ductwork from a point three (3) feet interior of the motorized control damper or backdraft damper to the exterior wall, roof, or louver.	2"	Ductboard, FSK

<u>SERVICE</u>	<u>THICKNESS</u>	<u>MATERIAL/JACKET</u>
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EQUIPMENT:

Water Meter	1/2"	Flexible Unicellular
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Backflow Preventer	1/2"	Flexible Unicellular
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3.8 FIELD INSPECTION

- A. Visually inspect to ensure that materials used conform to specifications. Inspect installations progressively for compliance with requirements.

\* END OF SECTION \*

## SECTION 23 09 00 - INSTRUMENTATION AND CONTROLS FOR HVAC

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to install the automatic temperature control system indicated. The system shall be a direct digital control (DDC) system with dynamic color graphics software to provide the sequences as described in these specifications. The ATC system shall be complete with required components including, low voltage and line voltage wiring and conduit. Control wiring shall include all control-related devices / components and associated interlock wiring, including that furnished or required by the HVAC equipment manufacturers, including sensors, controllers, valves, etc. Coordinate with the respective equipment manufacturers. Wiring shall be in accordance with Division 26, "Electrical" of the specifications and NFPA 70, National Electrical Code. See "System Input-Output Summary" for additional requirements and information. The automatic temperature controls for this project shall be an extension of the system installed for the main school building on the same site.
- B. Recognized hazardous materials such as lead, mercury or asbestos shall be prohibited from the project. Submit MSDS sheets to the Owner for review.
- C. The control system shall be fully compatible and integrated with the existing Brunswick School System DDC control systems (Siemens "Apogee") and be "open protocol / architecture". All required software licenses and updates available during the warranty period shall be included. The system platform shall be based on the Niagara 4.3 Framework / Tridium / JACE 8000, or equal, web-based.

#### 1.2 ACCEPTABLE MANUFACTURERS

- A. System manufacturer and installer shall be the same manufacturer and installer as the main school building on the same site. (ONLY)

#### 1.3 RELATED DOCUMENTS

- A. The drawings and the specifications including SECTION 23 05 00 "Common Work Results for HVAC" are hereby made a part of the work of this section.
- B. Section 23 00 00 – HVAC.
- C. Section 01 91 33 – HVAC SYSTEM COMMISSIONING.

#### 1.4 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00 relative to competition and the (ONLY) notation. Familiarity with this section shall be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the shop drawings paragraph in Section 23 05 00 "Common Work Results for HVAC", apply are as follows:

1. Temperature control system schematic including variables, flow diagrams, ladder diagrams, and point to point wiring diagrams, indicating set points, reset ranges, throttling ranges, controller gains, differentials, operating ranges, normal positions, controller action, dial ranges, voltages, currents, mounting locations, indicators, and terminal strip points.
2. Sequence of operation for each system and function.
3. Generic, functional description of each control component indicated.
4. Equipment interlocks required by sequence of operation.
5. Automatic valve schedule showing flow, Cv, and pressure drop.
6. Manufacturer's Data:
  - a. Dampers, valves and operators.
  - b. Controllers, including wiring and connection diagrams.
  - c. Thermostats, temperature sensors, including wiring and connection diagrams.
  - d. Temperature and pressure indicators.
  - e. Pressure sensors, including wiring and connection diagrams.
  - f. Switches, relays, transmitters, transformers, including wiring and connection diagrams.
7. Dynamic color graphics software data.
8. Airflow measuring stations.
9. Flowmeters.

#### 1.5 COMMISSIONING

- A. Mechanical systems and controls in this project will be commissioned by an independent commissioning agent hired by the owner. The ATC contractor will be responsible for carrying out the commissioning requirements specified in Section 019133 - General Commissioning Requirements, and other sections referenced in 019133, at no additional cost to the owner.
- B. The ATC contractor shall provide a qualified technician to assist the commissioning agent to perform all the functional tests for the HVAC equipment. The functional testing will involve checks of the sequence of operation by observing control system responses to setpoint adjustments, various input values (such as temperature, time, humidity, CO2 level, etc.
- C. The ATC contractor shall provide remote access to the control system to the commissioning agent so that periodic system observations can be performed by the commissioning agent from a remote location, without additional costs or fees.
- D. The ATC contractor shall set up and provide access to trend logs for monitoring purposes as requested by the commissioning agent.

1.6 WARRANTY

- A. The automatic temperature control system shall have a **two (2) year parts and labor** warranty.

PART 2 – PRODUCTS AND FEATURES

2.1 CONTROL PANELS

- A. In general, relays, transformers, or other control devices (not including room thermostats or duct-mounted instruments) shall be grouped and mounted in a factory-built cabinet enclosure.

2.2 AUTOMATIC CONTROL DAMPERS

- A. Automatic dampers not furnished with equipment shall be furnished under this paragraph. Automatic dampers shall be constructed and installed in accordance with the following specifications:
  - 1. Damper Blades: All automatic dampers, including dampers for static pressure control, shall be of the balanced type, factory-fabricated, with fully gasketed galvanized steel airfoil blades, mounted in welded frames. Damper blades shall be not more than 8 inches wide, shall have interlocking edges, edge and jamb seals and be capable of operation against 4" static pressure differential. Dampers shall be Arrow "Arrow-Foil" Model PBDAF-206, OBDAF-207, Ruskin Model CD-60 or Tamco Series 1000.
  - 2. Modulating Dampers: All modulating dampers shall be of the opposed blade type.
  - 3. Damper Size and Bearings: Damper blades shall have steel trunnions mounted in oil-impregnated bearings. Dampers shall be not more than 48 inches in length between bearings.
  - 4. Frames: Damper frames shall be of welded channel or angle-iron, with heavy steel corner gussets and braces or stiffened with steel tie-rods where necessary. Frames shall be painted with aluminum paint to prevent rusting.
  - 5. Dampers shall be guaranteed to close tightly, and shall provide substantially the full area of the opening when open. All outdoor air intakes and all exhaust ducts to outside and all fresh air, return air and exhaust air dampers in systems shall have damper blades with inflatable seals or other devices to guarantee low leakage, not to exceed 6 CFM/SF at 1 in. WG pressure differential.
  - 6. Damper Linkages: Damper-operating links shall be cadmium plated steel or brass rods, adjustable in length with ball and socket joints and of such proportions that they will withstand, without appreciable deflection, a load equal to not less than twice the maximum operating force of the damper motor. Linkages shall be concealed in the frame.
- B. Damper Actuators: For each automatically controlled damper, a suitable damper actuator or actuators shall be provided in accordance with the following specifications:



1. Actuator: Damper actuators shall be electronic, direct-coupled, spring-return type and have a rating of not less than twice the torque needed for actual operation of the damper.
2. Adjustments: Provide adjustable stops for the open and closed positions.
3. Mounting: Damper actuators shall be direct-coupled over the shaft. The damper actuators and mounting base shall not be mounted directly on cold or insulated ducts and casings, but shall be mounted outside the insulated covering in such a manner as to prevent sweating and interference with the insulation.
4. Where indicated, damper actuators shall be provided with an auxiliary switch rated at 120 V AC, and accept a 0 to 20 ma input.

## 2.3 AUTOMATIC CONTROL VALVES (HOT WATER, 250°F MAX.)

- A. Valves shall have removable composition discs with monel stem, globe pattern, or ball valves, Belimo, or equal. Bodies two inches or smaller shall be bronze with screwed ends. Bodies 2-1/2 inches and larger shall be cast-iron with flanged ends. Valve bodies, trim and stuffing boxes shall be designed for not less than 125 psi working pressure. Valve packing shall be non-lubricated teflon packing suitable for hot water service, as required.
- B. See the Control Valve Schedule on the Drawings. Modulating valves shall be sized for maximum pressure drop of 1.5 to 4.0 psi. Two position valves shall be line size or have a maximum pressure drop of 1.0 psig.
- C. Automatic control valve differential shut-off pressure shall be a minimum of 35 psig.
- D. Heating valves shall fail to the "normally-open" position.
- E. Valves shall have a clearly marked position indicator as part of the operating linkage.
- F. Actuator: Shall be electronic, direct-coupled, pulse width modulation (PWM) or spring return type and have a rating of not less than twice the torque needed for actual operation of the valve.

## 2.4 TEMPERATURE SENSORS

- A. Temperature Sensors: RTD Elements, accuracy of  $\pm 0.1\%$  at 70°F, sensors shall be securely attached to a single gang electrical box or other suitable base, securely mounted on the wall or other building surface. Each sensor shall be located where shown or, if not shown, where it will respond to the average temperature in the room. Sensors, generally, shall be mounted 48 inches above the floor, and shall not be mounted on outside walls if other locations are possible. If located on an outside wall, it shall have an insulated base. Sensors shall have locked or concealed adjustment devices, by means of which the operating points can be adjusted through a range of not less than 10 degrees above and below the operating points specified.
- B. Room temperature sensors shall be equal to Vaisala, Kele, or equal, with adjustable setpoint range limits. Provide an override button with LED indicator light. Except for Public Areas, room sensors shall have an adjustable heating / cooling range with limits set by the Facilities

Director. Temperature sensors / thermostats with guards shall have a blank, lockable cover (tamperproof).

## 2.5 CO<sub>2</sub> and IAQ SENSORS

- A. Duct mounted: CO<sub>2</sub> sensors shall be Vaisala Carbocap Series, Model GMD20, Kele, Telaire or TSI and utilize Non-Dispersive Infrared Detection (NDIR) or Photo-Acoustic Sensing and be capable of daily self-calibration during “unoccupied” periods.
- B. Wall-mounted room sensors: CO<sub>2</sub> sensors shall be equal to Vaisala Carbocap Series, Model GMW20, Kele, Telaire or TSI combination temperature and CO<sub>2</sub> without CO<sub>2</sub> display. IAQ sensors shall be BAPI “AQS”, or equal, self-calibrating. Sensors shall be mounted at 48” A.F.F.

## 2.6 FLOW TRANSMITTERS

- A. Flow Transmitters: Clamp-on Ultrasonic type, accuracy of +/-0.5% to 1% of flow rate, 0.15% repeatability, NEMA4X electrical enclosure, dual channel, 4-20mA output to the BAS with local display.

## 2.7 VARIABLE FREQUENCY DRIVES

- A. Unless specified and furnished with packaged equipment under other sections of the specifications (Section 23 00 00), variable frequency drives shall be furnished and installed under this section. Drives shall be Toshiba, Yaskawa, Square D or Danfoss, 460 volt, 60 Hz., 3 phase, have microprocessor based adjustment of three phase motor, utilize a vector torque control strategy to regulate motor flux to optimize motor torque without the need for encoders. Drives requiring voltage, dwell and current adjustments to achieve improved torque control are not acceptable. The controller shall be rated to control the scheduled fans / pumps.
- B. The drives shall be pulse width modulated design converting the utility input voltage and frequency to a variable voltage and frequency output via a two step operation. Insulated gate bipolar transistors shall be used in the inverter section.
- C. The drives shall have an efficiency that exceeds 97% at 100% speed and load. The efficiency shall exceed 80% at 50% speed and load. The drive shall maintain the line side displacement power factor no less than 0.95 regardless of speed and load. The drives shall have a one minute overload current rating of 110% and shall be capable of operating NEMA B induction motor.
- D. The drives shall limit harmonic distortion level as defined by IEEE 519 for general system applications. Harmonic attenuation shall be provided by the addition of drive line reactance. Harmonic calculations shall be provided upon request and shall be calculated based on the kVA capacity, X/R and impedance of the transformer supplying the drive.
- E. The drives shall be capable of operating into a spinning motor and shall be capable of determining motor speed and direction and resume operation without tripping.
- F. Operating conditions shall be:
  - 1. Incoming Power: 460 volt, three phase, 60 Hz.

2. Frequency stability of +0.5% for 24 hours with voltage regulation of +2.0% of maximum rated output voltage.
  3. Motor slip dependent speed regulation of 1.0%.
  4. Five cycle carry over during utility loss.
  5. Temperature range 32 - 105°F. Humidity range 0 - 95%.
- G. Drive control function shall be adjustable from a digital operator keypad located on the front of the drive. Drive parameters shall include the following: Programmable keypad speed and start command; forward or reverse start; stop and digital speed control; maximum and minimum frequency limits; two acceleration and deceleration times; critical frequency avoidance lockout zones; electronic overload and torque limit; multiple attempt restart; jog and preset speeds; spinning motor functions; two digital output relays; analog output relay; DC injection braking time; programmable PI process control; digital potentiometer.
- H. The drives shall have the following system interfaces:
1. Inputs: Process control speed reference interface to receive either a 0-10 Vdc; 4-20 mAdc or speed potentiometer signal; remote mode start and stop contacts; remote forward and reverse contacts; remote preset speed contacts; remote external stop contact; remote reset contact; remote jog contact.
  2. Outputs: Two programmable digital relays N.O. contact; Form C contact to indicate protective function trip; two programmable analog output signals.
  3. Provide a BacNet interface card for each drive, compatible with the BAS.
- I. Drives shall have a two line sixteen character each display indicating output current, output frequency, motor RPM, output voltage, power, load, elapsed time, cause of trip.
- J. The drives shall contain the following protection functions; over current, over/under voltage, over frequency, phase loss, over temperature, ground fault and short circuit.
- K. Drives shall have a 3 year warranty (parts and labor) and be started up by a factory-authorized technician. Drive enclosures shall be NEMA 1 rated.
- L. Provide one drive for each fan or pump motor (as indicated).
- 2.8 REMOTE NOTIFICATION
- A. The workstation shall be configured to send out messages to numeric pagers, alphanumeric pagers, phones (via text to speech technology), and email accounts based on a point's alarm condition. All "critical" alarms shall be configured for Remote Notification. See "Input-Output Summary" sheets.
- B. There shall be no limit to the number of points that can be configured for remote notification of alarm conditions and no limit on the number of remote devices which can receive messages from the system.

- C. On a per point basis, system shall be configurable to send messages to an individual or group and shall be configurable to send different messages to different remote devices based on alarm message priority level.
- D. Remote devices may be scheduled as to when they receive messages from the system to account for operators' work schedules.
- E. The system shall be configurable to send messages to an escalation list so that if the first device does not respond, the message is sent on to the next device after a configurable time has elapsed.
- F. The message detail shall be configurable on a per user basis.
- G. The workstation shall have the ability to send manual messages allowing an operator to type in a message to be sent immediately.
- H. The workstation shall have a feature to send a heartbeat message to periodically notify users that they have communication with the system.

## 2.10 SEQUENCE OF CONTROL

- A. Provide and install electronic/electric DDC components to enable the mechanical system to operate in the following sequences:
  - 1. Exhaust Fans, (**EF-1**):
    - a. EF-1 shall operate based on a wall mounted switch.
  - 2. Electric Wall Heaters:
    - a. The electric wall heater shall operate to maintain the space temperature setpoint.
  - 3. Packaged Heating and Air Conditioning Units (HVAC-1):
    - a. Fans: Supply fan shall operate continuously during the occupied period. The motorized dampers shall open and end switches shall energize the fans.
    - b. Outside Air: The outside air damper shall operate between 50% and 100% **of the scheduled airflow** to satisfy the space CO2 sensor.
    - c. Cooling Coil: Shall operate subject to enthalpy economizer. The DX cooling shall operate in stages as required to satisfy the room sensor cooling demand. The unit shall also operate to maintain space humidity by operating the DX cooling with hot gas reheat to prevent overcooling the space.
    - d. Gas Furnace: The gas furnace shall operate in two (2) stages as required to satisfy the room sensor.
    - e. Freeze Protection: A manual reset freezestat shall shutdown the fans and close the outside air and exhaust air dampers if the discharge air drops below 45°F.

- f. Motorized Dampers: Outside air and exhaust air motorized dampers shall close upon unit shutdown.
- g. Smoke Detector: Upon detection of smoke by either the supply or return air duct smoke detectors, the unit shall be de-energized and the outside air and exhaust air dampers shall close. This function shall send an alarm to the BAS and fire alarm system.
- h. During the unoccupied period (as determined by the BAS), the supply fan shall operate (with the outside air damper closed) and the unit shall utilize the dx-cooling and gas furnace heating to satisfy the unoccupied space temperature setpoint.

### PART 3 - EXECUTION

#### 3.1 SURFACE CONDITIONS

A. Inspection:

- 1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
- 2. Verify that the automatic temperature control system may be installed in strict accordance with pertinent codes and regulations and the reviewed Shop Drawings.

#### 3.2 INSTALLATION

- A. Provide wiring, and conduit to connect the ATC components for an operational ATC system. Wiring and installation shall conform to NFPA 70.
- B. Identification: Label or code each field wire at each end. Permanently label or code each point of field terminal strips to show the instrument or item served. Color-coded cable with annotated cable diagrams may be used to accomplish cable identification.
- C. Temperature Sensors: Stabilize sensors to permit on-the-job installation that will require minimum field adjustment or calibration. Temperature sensor assemblies shall be readily accessible and adaptable to each type of application to allow quick, easy replacement and servicing without special tools or skills. Strap-on sensor mountings, using helical screw stainless steel clamps, shall be permitted on new piping for unit heater or other on-off operation only, after pipe is cleaned to bright metal. Strap-on bulb and pipe shall be insulated after installation. Strap-on sensor mountings are also permitted for hot water piping sizes up to 2 inches. Other liquid temperature sensors shall be provided with wells.
- D. Duct Sensors: Provide sensors in ductwork; specific location within duct shall be selected to accurately sense air properties. Do not locate sensors in dead air spaces or positions obstructed by ducts or equipment. Installation shall be within the vibration and velocity limits of the sensing element. Where an extended surface element is required to sense the average or lowest air temperature, position and securely mount sensor within duct in accordance with sensor manufacturer's recommendations. Temperature sensing elements shall be thermally isolated from brackets and supports. Provide separate duct flange for each

sensing element; securely seal ducts where elements or connections penetrate duct. Seal penetrations of duct insulation vapor barrier with vapor barrier coating compound to provide a vapor-tight covering. Mount sensor enclosures to allow easy removal and servicing without disturbance or removal of duct insulation or vapor barrier. On downstream side of each sensor, provide access doors.

- E. Pipe Sensors: Provide wells for sensors measuring temperatures in pressure vessels or in pipes. Wells shall be noncorrosive to the medium being measured and shall have sufficient physical strength to withstand the working and test pressures and velocities. Locate wells to sense continuous flow conditions. Do not install wells using extension couplings. Where piping diameters are smaller than the length of the wells, provide wells in the piping at elbows to effect proper flow across the entire area of the well. Wells may either look upstream or downstream. Provide thermal transmission material within the well to speed the response of temperature measurement. Provide wells with sealing nuts to contain the thermal transmission material and allow for easy removal. Wells shall not restrict flow area to less than 70 percent of line-size-pipe normal flow area. Increase piping size as required to avoid restriction.

### 3.3 ADJUSTMENTS

- A. Adjust controls and equipment to maintain the conditions indicated, to perform the functions indicated, and to operate in the sequence specified.

### 3.4 DUCT SMOKE DETECTORS

- A. The Fire Alarm Contractor shall furnish and wire duct smoke detectors. Installation shall be accomplished by the sheetmetal contractor and be wired by the Fire Alarm Contractor.

### 3.5 INSTRUCTING OPERATING PERSONNEL

- A. Upon completion of the work and when designated by the Architect, furnish the services of a competent technician regularly employed by the temperature control manufacturer for the instruction of Owner in the operation and maintenance of each automatic space temperature control system. The period of instruction shall be for not less than three (3) 8-hour non-concurrent working days (twenty-four (24) hours total) and shall include video tape demonstration of all controllers and devices.

### 3.6 FIELD INSPECTION AND TESTS

- A. Tests shall be performed or supervised by employees of the ATC system or manufacturer of the ATC system, or by an authorized representative of the ATC manufacturer. Give Architect 14 calendar days advance written notice prior to the date of the field acceptance testing. If the Architect witnesses tests, such tests shall be subject to approval. If the Architect does not witness tests, provide performance certification.
- B. Plan for Inspections and Tests: Furnish a written inspections and tests plan at least 60 days prior to the field acceptance test date. This plan shall be developed by the manufacturer of the ATC system. The plan shall delineate the inspections and testing procedures required for the ATC system to demonstrate compliance with the requirements specified. Additionally, the test plan shall indicate how ATC system is to be tested, what variables will be monitored during test, names of individuals performing tests, and what criteria for acceptance should be

used. Indicate how operation of H&V system and ATC system in each seasonal condition will be simulated.

- C. Field Acceptance Testing: Upon completion of 72 hours of continuous H&V and ATC systems operation and before final acceptance of work, test the automatic temperature control systems in service with the heating, ventilating and air conditioning systems to demonstrate compliance with contract requirements. Test controls through each cycle of operation, including simulation of each season insofar as possible. Test safety controls to demonstrate performance of required function. Adjust or repair defective or malfunctioning automatic space temperature control equipment or replace with new equipment. Repeat tests to demonstrate compliance with contract requirements.

END OF SECTION

## SECTION 23 30 00 - HVAC FOR DISTRIBUTION

### PART 1 GENERAL

#### 1.1 RELATED DOCUMENTS

- A. The drawings and the specifications including SECTION 23 05 00 "Common Work Results for HVAC" are hereby made a part of the work of this section.
- B. Section 01 23 00 – ALTERNATES.
- C. Section 01 91 33 – HVAC SYSTEM COMMISSIONING.

#### 1.2 DESCRIPTION OF WORK

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to install the ductwork systems indicated.

#### 1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section should be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 23 05 00 "Common Work Results for HVAC", apply are as follows:
  - 1. Ductwork.
  - 2. Ductwork accessories.
  - 3. Air devices.
  - 4. Acoustical duct liner.
  - 5. Ductwork sealing products.

### PART 2 PRODUCTS

#### 2.1 DUCTWORK

- A. Classification of Ductwork: Low pressure ductwork: up to 2" W.G. static pressure. Medium pressure ductwork: 2" to 6" W.G. static pressure. The duct pressure class shall be determined by multiplying the total static pressure scheduled in the fan schedules by 1.2.
- B. Materials: Unless otherwise indicated low pressure ductwork shall be galvanized steel. Galvanized sheet metal shall be new galvanized steel sheets of lock forming quality with zinc coating that will not flake or peel under forming operation.



C. Construction for Low Pressure Round and Rectangular Ductwork:

1. Material: Galvanized steel conforming to ASTM A527, weight of galvanized coating shall be not less than 1-1/4 ounces total for both sides of one sq.ft. of a sheet. Construction, metal gage, and reinforcements shall conform with SMACNA "Duct Construction Standards" and NFPA 90A for 2" W.G. pressure class.
2. Fittings: Shall be constructed in accordance with SMACNA Standards and shall be of the types indicated (ONLY).
3. Longitudinal seams shall be Pittsburgh lockseam (ONLY). Button punch snap locks are not acceptable.
4. Joints and seams shall be sealed to SMACNA seal class B (Leakage Class 12 for rectangular ducts and Leakage Class 6 for round and flat oval ducts).
5. Unless indicated otherwise, exhaust ductwork above the roof shall be Type 304 stainless steel construction.

D. Construction for Spiral Seam Round and Flat Oval Ductwork:

1. Ductwork and fittings shall be United McGill Uni-seal or Uni-rib, Eastern Sheetmetal, Lindab, Semco or Monroe Sheetmetal, galvanized steel, factory fabricated, spiral lockseam or welded longitudinal seam, round or flat oval type, as indicated. Seams shall be solid welded or spot-welded and factory sealed airtight. Ducts and fittings shall be specifically designed for medium pressure application. Round or flat oval ductwork indicated as acoustically lined or double-wall (DW) shall be United-McGill Acousti-K27, double wall medium pressure construction with solid 26 gauge sheetmetal inner liner and 1" thick fiberglass insulation. Fittings shall be furnished with solid liners. Insulation shall be provided with thermal conductivity of 0.27 BTU/HR-°F-FT<sup>2</sup>-IN. Exposed ductwork in finished spaces specified to be painted shall be "Paint-Grip" galvanized material. Interior ductwork shall be constructed of galvanized sheetmetal. Interior double wall supply ductwork shall have 1" thick fiberglass insulation with "Paint-Grip" galvanized exterior shell and galvanized steel interior liner and all seams and joints sealed.
  - a. Sheetmetal Gauges: Per SMACNA for listed pressure class.
  - b. Fittings: Fittings shall be machine formed type or welded multi-segment type. All seams shall be factory sealed or welded airtight. Tap offs shall be 90° conical type or 45° standard type, with smooth, machine formed entrance, designed for low pressure drop and low noise generation. 90° elbows shall be 5 piece construction (where space permits) or vaned type mitered elbow where space is restricted. Unless specifically indicated (and field-verified) as 5 piece construction, use vaned 90° elbows. Vanes shall be single thickness, solid-welded in place.
  - c. Joints on round spiral ductwork shall be slip type, coupling type, Van Stone flanges, or factory fabricated flange system type connectors, as standard with the manufacturer. Flat oval joints shall be Van Stone flanges (gasketed) or factory fabricated flange system type connectors. Joints shall be made up with

- joint sealer applied in strict accordance with the manufacturer's recommendations. Joint sealer shall be as recommended by the manufacturer.
- d. Duct and fittings shall have been tested for air friction loss and leakage in an independent testing laboratory. Test results shall be submitted with the Shop Drawings for review.
  - e. External reinforcing angles shall be provided in accordance with the manufacturer's recommendations. External reinforcing angles shall be galvanized or painted with a rust inhibiting aluminum paint. Include reinforcing data with Shop Drawing submittal. Duct and reinforcing shall be designed for a positive static pressure of 6 inches of water gage.
  - f. No internal tie rod reinforcing will be allowed.
  - g. Hangers shall be of the clamp-on or trapeze type. Exposed ductwork shall use clamp-on hangers only. Holes shall not be drilled through the ducts.
- E. Acoustical duct liner for rectangular ductwork shall be Type AP Armaflex SA duct liner. The liner shall be elastomeric unicellular (closed cell) and have a thermal conductivity of 0.27 Btuh/°F.-sf-in. and be cleanable and suitable for duct velocities of 4000 FPM. Duct liner thickness shall be 1" unless indicated otherwise. The installation shall include 100% coverage of the manufacturer's recommended adhesive and protective Z-strips at all exposed upstream edges. Mechanical fasteners shall be used in addition to adhesive. Insulation shall comply with NFPA 90A and NFPA 90B and be approved by Factory Mutual. Return ductwork shall be lined.
- F. Exposed Ductwork: Interior exposed ductwork shall be spiral seam "Paint-Grip" galvanized, suitable for field-painting without dents or other visible cosmetic damage.

## 2.2 DUCTWORK ACCESSORIES

- A. Access Doors:
- 1. Medium Pressure Duct Systems: Ruskin Model ADHP-3, 12"x12" size, 16 gauge galvanized steel, foam gasket, insulated door, spring latches.
  - 2. Low Pressure Duct Systems: Ruskin Model ADC2, 12"x12" size, 24 gauge galvanized steel, steel on both sides of door, foam gasket seals, 1" insulation, 2 cam locks, no hinge.
- B. Counter Balanced Dampers (CBD): Aluminum frame and blades, extruded vinyl edge seals, 2-1/4" deep, set 0.06" WG.
- C. Backdraft Dampers (BDD): Ruskin Model CBD2 or American Warming and Ventilating aluminum frame and blades, extruded vinyl edge seals, field set at 0.10" W.G. pressure differential for full open operation.
- E. Turning Vanes: (Low Pressure):

1. Solid blade, mounted with the long edge downstream in accordance with duct construction details indicated. Submit a 12"x12" sample elbow for review prior to fabrication.

F. Volume Dampers:

1. Factory fabricated as specified, or shop fabricated in accordance with SMACNA "HVAC Duct Construction Standards".
2. Rectangular: Ruskin Model MD-35, or American Warming and Ventilating, 12 gauge galvanized steel, locking quadrant, opposed blade over 11", single blade 11" and under.
3. Round: Ruskin Model MDRS25, or American Warming and Ventilating, 20 gauge galvanized steel with locking quadrant(ONLY). Dampers may be provided integral with spin-in fittings.

G. Flexible Ductwork:

1. Not allowed.

I. Joint Sealer:

1. Duro-Dyne DDS181, Design Polymerics DP 1010 water-based polymeric duct sealant, Hardcast DT tape and FTA-50 activator or Airseal #33 fiber-reinforced water-based brush-on sealer by Polymer Adhesive Sealant Systems, Inc. (UL181A-M or 181B-M labeled).
2. Provide waterproof sealer where watertight seal is specified.

2.3 AIR DEVICES (Krueger, Price, Metal Aire, Titus) ONLY

- A. Material and Finishes: Construct diffusers, registers, and grilles of aluminum. Exterior and exposed edges shall be rolled, or otherwise stiffened and rounded. Steel parts shall be factory zinc-phosphate treated prior to priming and painting or have a baked-on enamel finish. Aluminum parts shall be finish painted. Provide frame style compatible with ceiling or wall type. Colors shall be selected by Architect. Devices to be installed on exposed duct installations shall be furnished in primer suitable for field application of color coat.
- B. **Sound Level:** Manufacturer certified sound level rating of inlets and outlets in accordance with ADC 1062 R4. Conform with the maximum permissible room / diffuser noise criteria (NC) level for each device as scheduled. Provide submittal data accordingly.
- C. Throw: Defined as distance from the diffuser, register, or grille to the point which the resultant room air velocity is 50 to 35 feet per minute.
- D. Ceiling Diffusers: Equip with core styles required to provide air distribution pattern indicated. Internal parts shall be removable through the diffuser-neck for access to the duct and without the use of special tools. Construct each diffuser of four or more concentric elements designed to deliver air in a generally horizontal direction. The interior elements of square and rectangular ceiling diffusers may be square or rectangular as manufacturer's standard. Screws or bolts in exposed face of frames or core elements are not acceptable.

Diffusers shall have an opposed blade volume damper in the diffuser neck if no damper is indicated in the branch duct (see Drawings). Diffusers shall have a 24"x24" lay-in panel for areas with acoustical ceilings and surface-mount frame for GWB ceilings. Ceiling diffusers shall be Price AMX series, aluminum construction, high induction type with induction vanes. Variable Air Volume diffusers shall be Price "Prodigy" PPD2-series with Model PIC-TS-LCD thermostat, mounted 48" AFF.

- E. Grilles and Registers: Construction and finish as indicated, 1/2" louver spacing, 45° curved blade. Registers shall have opposed-blade volume dampers with screwdriver adjuster. Unless otherwise indicated, registers shall be provided.
- F. Linear Diffusers and Bar Grilles: Linear bar grilles/registers and linear slot diffusers shall be as scheduled and indicated. Bar grilles shall have a 1" border with face screws, heavy duty construction. Provide opposed blade volume dampers for each bar grille / diffuser and adjustable pattern controllers (for linear slot supply diffusers). Return air slots shall be without pattern controllers. "Revers-A-Core" diffusers shall have deflection vanes. Construction shall be extruded aluminum with an anodized finish. Slot diffusers shall have a factory fabricated "sloped shoulder" boot plenum with 1/2" thick Armaflex duct liner.
- G. General: The interior of all sheetmetal connections to grilles, registers and diffusers shall be painted with a non-specular flat black paint so that no sheetmetal surfaces are visible from the finished space.

### PART 3 - EXECUTION

#### 3.1 SURFACE CONDITIONS

- A. Inspection:
  - 1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
  - 2. Verify that the duct systems may be installed in accordance with pertinent codes and regulations and the reviewed Submittals.

#### 3.2 INSTALLATION OF DUCTWORK AND AIR DEVICES

- A. Provide and erect in accordance with the best practice of the trade ductwork shown on the drawings and as required to complete the intended installation. Make offsets as shown or required to place ductwork in proper position to avoid conflicts with other work and to allow the application of insulation and finish painting to the satisfaction of the Architect. Sizes given are "inside - clear" dimensions and not necessarily that of sheet metal. Ducts shall be arranged to adjust to "field conditions". The Sheet Metal trades shall coordinate his work with other trades. Work shall conform to ASHRAE duct construction recommendations, SMACNA "Duct Construction Standards", NFPA, and the requirements of the IBC code.
- B. Joint Sealing: See PRODUCTS section.
- C. Longitudinal joints: See PRODUCTS section.

- D. Turns shall be made with long radius elbows or, if physically impossible to use long radius elbows, shall be square turns with specified turning vanes. CAUTION: Turns not conforming to this requirement shall be ordered removed and replaced with properly built turns.
- E. Access Doors: Provide access doors for concealed apparatus requiring service and inspection in the duct system including but not limited to dampers, sensors and motors, and upstream and downstream from duct coils.
- F. Duct Sleeves and Prepared Openings: Install duct sleeves and prepared openings for duct mains, duct branches, and ducts passing through walls, roofs, and ceilings. Insure the proper size and location of sleeves and prepared openings. Allow one-inch clearance between duct and sleeve or one-inch clearance between insulation and sleeve for insulated ducts, except at grilles, registers, and diffusers.
- G. Duct Supports: Unless otherwise indicated, provide one-inch wide by 16 gage galvanized steel sheet metal strips on each side of ducts. Anchor risers in the center of the vertical run to allow ends or riser free vertical movements. Attach supports only to structural framing members. Do not anchor supports to metal decking unless a means is provided (architectural review required) for preventing the anchors from puncturing the metal decking. Where supports are required between structural framing members, provide suitable intermediate metal framing. Where C clamps are used, use retainer clips.
- H. Flexible Collars and Connections: Provide flexible collars between fans and ducts or casings and where ducts are of dissimilar metals, except where fans are internally connected to the casing with flexible connectors. For round ducts, securely fasten flexible connections using stainless steel clinch-type draw-band. Nylon drawbands may be used if installed using the drawband manufacturer's lever-action tightening tool. For rectangular ducts, lock flexible connections to metal collars. All air handling equipment fan connections to the duct systems shall have flexible connections, factory or field-installed.
- I. Flexible Ducts: Not allowed.
- J. Any deviation in the duct system must be submitted as a shop drawing and stamped. CAUTION: Any deviation not submitted and favorably reviewed will be ordered removed from the system and replaced with that which is shown on the Drawings.
- K. Discrepancies between actual field conditions and the Contract Documents shall be brought to the attention of the Architect prior to fabrication.
- L. Field Changes to Ductwork: Field changes of ducts such as those required to suit the sizes of factory-fabricated equipment actually furnished shall be designed to minimize expansion and contraction. Use 4:1 transitions in field changes as well as modifications to connecting ducts.
- M. Transitions with a slope greater than 4 to 1 shall be ordered removed from the system and replaced with a transition which meets this criteria.
- N. Joints and seams at intake and exhaust plenums and joints on intake and exhaust ductwork for a distance of 3 feet from the plenum shall be sealed watertight on the bottom and side joints and seams.

- O. Isolation dampers at intake and exhaust louvers and vent hoods shall be sealed to the ductwork to provide an airtight assembly with similar performance characteristics to the isolation damper.
- P. The inside of sheetmetal connections to grilles, registers and diffusers shall be painted flat black so that no sheetmetal is visible from the finished space.
- Q. All sharp edges and corners on ductwork, hangers or equipment located within 7'-0" of the finished floor shall be protected with a suitable padding material and identified with fluorescent orange paint.

### 3.3 CLOSING IN WORK

- A. Cover up or enclose work after it has been properly and completely tested and reviewed.
- B. No additional cost to the Owner will be allowed for uncovering or recovering any work that is covered or enclosed prior to required test and review.

### 3.4 TEST AND ADJUST

- A. Ductwork shall be leak tested in accordance with Section 23 05 93 "Testing and Balancing for HVAC". Provide end cap and closure pieces. Close off and seal openings in ductwork to be tested. Ductwork shall be tested before it is insulated.
- B. Before operating any system, the system shall be cleaned out to remove dust and foreign materials.
- C. After the installation is complete and ready for operation, test the system under normal operating conditions in the presence of the Architect and demonstrate that the system functions as designed.
- D. Correct defects which develop during the test period, conduct additional testing until defect free operation is achieved.

### 3.5 CLEANUP AND CORROSION PREVENTION

- A. Ductwork and equipment shall be thoroughly cleaned. Dirt, dust, and debris shall be removed and the premises left in a clean and neat condition.
- B. Before covering is applied to duct systems, clips, rods, clevises and other hanger attachments, and before uncovered piping is permitted to be concealed, corrosion and rust shall be wire brushed and cleaned and in the case of iron products, a coat of approved protective paint applied to these surfaces.

### 3.6 INSTRUCTIONS

- A. On completion of the project, instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. The time of instruction shall be arranged with the Owner. In addition to the prime Mechanical Contractor, the control system Contractor, Balancing Contractor, and Owner's representative shall be present and participate in the Owner's instruction.

3.7 FIRESTOPPING

- A. Firestopping shall be performed in accordance with Specification Section 07 84 13 "Penetration Firestopping". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

\* END OF SECTION \*

## SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

### 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. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.

- B. Related Requirements:

- 1. Section 271500 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

### PART 2 - PRODUCTS

#### 2.1 CONDUCTORS AND CABLES

- 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. General Cable Technologies Corporation.
  - 2. Southwire Incorporated.
  - 3. The Okonite Company.

- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.

- D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for Metal Clad cable, Type MC or SO cable.



## 2.2 CONNECTORS AND SPLICES

- 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. AFC Cable Systems, Inc.
  - 2. Gardner Bender.
  - 3. Hubbell Power Systems, Inc.
  - 4. Ideal Industries, Inc.
  - 5. IlSCO; a branch of Bardes Corporation.
  - 6. NSi Industries LLC.
  - 7. O-Z/Gedney; a brand of the EGS Electrical Group.
  - 8. 3M; Electrical Markets Division.
  - 9. Tyco Electronics.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## 2.3 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- C. All conductor sizes shown on drawings are for copper unless noted otherwise.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway.
- B. Feeders: Type THHN-2-THWN-2, single conductors in raceway.
- C. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Metal Clad Cable, Type MC.

- E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### 3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### 3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- B. Test and Inspection Reports: Prepare a written report to record the following:
1. Procedures used.
  2. Results that comply with requirements.
  3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

## SECTION 260533

### RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

#### 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. Metal conduits, tubing, and fittings.
  - 2. Boxes, enclosures, and cabinets.

##### 1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

#### PART 2 - PRODUCTS

##### 2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. EMT: Comply with ANSI C80.3 and UL 797.
- D. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- E. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT:
    - a. Material: Steel or die cast.
    - b. Type: Setscrew.
  2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions were installed, and including flexible external bonding jumper.
- G. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.2 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- D. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- H. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- I. Gangable boxes are allowed.
- J. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.
  1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- K. Recessed device box.
  1. Non-metallic, recessed electrical box with trim plate.

2. Two-gang style to allow installation of two duplex receptacles, or two low voltage devices in the box.

### PART 3 - EXECUTION

#### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
  1. Exposed Conduit: GRC.
  2. Concealed Conduit, Aboveground: GRC.
  3. Underground: RNC
  4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC.
  5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
  1. Exposed: EMT.
  2. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  4. Damp or Wet Locations: GRC.
  5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations including kitchens.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  2. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
  3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

#### 3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.

- D. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- J. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- K. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- M. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- O. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - 1. Use LFMC in damp or wet locations subject to severe physical damage.
- P. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- Q. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- R. Locate boxes so that cover or plate will not span different building finishes.

- S. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- T. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- U. Set metal floor boxes level and flush with finished floor surface.
- V. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 BOXES FOR WIRING DEVICES IN EXTERIOR WALLS AND INTERIOR SOUND CONTROL WALLS BETWEEN RESIDENT ROOMS.

- A. Provide air vapor barrier install per manufacturer's instructions. Provide LESSCO model number: VAPORBOX

3.4 INSTALLATION OF ELECTRICAL BOXES IN FIRE RATED WALLS

- A. Outlet boxes on opposite sides of the wall shall be separated as follows:
  - 1. By a horizontal distance of not less than 24 inches (610 mm);
  - 2. By a horizontal distance of not less than the depth of the wall cavity where the wall cavity is filled with cellulose loose fill, rockwool or slag mineral wool insulation.
  - 3. By protecting both outlet boxes by listed putty pads, 3M Catalog # MPP+ or equal.
- B. Boxes exceeding 16 sq. in. (103 sq. cm) must be protected by listed putty pads, 3M Catalog # MPP+ or equal.

3.5 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

END OF SECTION 260533



## SECTION 262726 - WIRING DEVICES

### 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. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. Weather-resistant receptacles.
  - 3. Snap switches.
  - 4. Cord and plug sets.

#### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. UTP: Unshielded twisted pair.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 2. Cord and Plug Sets: Match equipment requirements.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
  - 1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
  - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  - 3. Leviton Mfg. Company Inc. (Leviton).
  - 4. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

### 2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
  - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
  - 2. Devices shall comply with the requirements in this Section.

### 2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

### 2.4 GFCI RECEPTACLES

- A. General Description:
  - 1. Straight blade, non-feed-through type.
  - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
  - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

## 2.5 CORD AND PLUG SETS

### A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

## 2.6 TOGGLE SWITCHES

### A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

### B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

## 2.7 WALL-BOX DIMMERS

### A. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

## 2.8 WALL PLATES

### A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: **Per Architect**
3. Material for Unfinished Spaces: **Stainless Steel.**
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover and listed and labeled for use in wet and damp locations.

### B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

## 2.9 FLOOR SERVICE FITTINGS

### A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

### B. Compartments: Barrier separates power from voice and data communication cabling.

- C. Service Plate: Round, die-cast aluminum with satin finish.
- D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for UTP cable complying with requirements in Section 271500 "Communications Horizontal Cabling."

## 2.10 FINISHES

- A. Device Color:
  - 1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
  - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
  - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
  - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
  - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
- D. Device Installation:
  - 1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### 3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

### 3.3 IDENTIFICATION

- A. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

- A. Test straight-blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).
- B. Wiring device will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 262726

## SECTION 264700 - PANELBOARDS

### PART 1 GENERAL

#### 1.01 WORK INCLUDED

- A. Branch circuit panelboards

#### 1.02 RELATED WORK

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

#### 1.03 REFERENCES

- A. NECA (National Electrical Contractors Assoc.) "Standard of Installation".
- B. FS W-C-375 - Circuit Breakers, Molded Case, Branch Circuit and Service.
- C. NEMA AB 1 - Molded Case Circuit Breakers.
- D. NEMA KS 1 - Enclosed Switches.
- E. NEMA PB 1 - Panelboards.
- F. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- G. NEMA PB 1.2 - Application Guide for Ground-Fault Protective Devices for Equipment.
- H. NFPA 70 - National Electrical Code.

#### 1.04 SUBMITTALS

- A. Submit shop drawings for equipment and component devices.
- B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

#### 1.05 SPARE PARTS

- A. Keys: Furnish 4 each to Owner.

### PART 2 PRODUCTS

#### 2.01 PANELBOARDS

Branch Circuit Panelboards

1. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type. FS W-P-115; Type I, Class 1.
2. Enclosure: NEMA PB 1; Type 1.
3. Cabinet Size: 6 inches deep; 20 inches wide for 240 volt and less panelboards.
4. Provide surface cabinet front with concealed trip clamps, concealed hinge and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
5. Provide panelboards with aluminum bus, ratings as scheduled on Drawings. Provide copper ground bus in all panelboards.
6. Molded Case Circuit Breakers: NEMA AB 1 FS W-C- 375; bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on Drawings.
7. Current Limiting Molded Case Circuit Breakers: NEMA AB 1 FS W-C-375; provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.
8. Provide circuit breaker accessory trip units and auxiliary contacts as indicated.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install panelboards plumb and flush with wall finishes, in conformance with NEMA PB 1.1.
- B. Height: 6 feet to top of panelboard maximum.
- C. Provide filler plates for unused spaces in panelboards.
- D. Provide typed or neatly handwritten circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads. Label Panels per Section 261950.
- E. Provide 6 – 1" EMT conduits from recessed panelboards to accessible point above the ceiling wherever possible.

#### 3.02 FIELD QUALITY CONTROL

- A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

\*\*\* END OF SECTION \*\*\*



SECTION 265100  
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Interior lighting fixtures, LEDs and drivers.
  - 2. Emergency lighting units.
  - 3. Exit signs.
  - 4. Lighting fixture supports.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. LER: Luminaire efficacy rating.
- D. Lumen: Measured output of lamp and luminaire, or both.
- E. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of lighting fixture including dimensions.
  - 2. Emergency lighting units including battery and charger.
  - 3. Energy-efficiency data.
  - 4. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
  - 5. Lamp data including dimensions, color temperature and power consumption
  - 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

- a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
- b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Installation instructions.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
  1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

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. Lamps: 10 of each type and rating installed. Furnish at least one of each type.
  2. Plastic Diffusers and Lenses: One of each type and rating installed. Furnish at least one of each type.
  3. Ballasts: 2 of each type and rating installed. Furnish at least one of each type.
  4. Globes and Guards: 1 of each type and rating installed. Furnish at least one of each type.

1.7 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

1.8 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

### 2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Diffusers and Globes:
  - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
    - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
    - b. UV stabilized.
  - 2. Glass: Annealed crystal glass unless otherwise indicated.

### 2.3 LEDs:

- 1. The light source of the luminaires shall consist of LED arrays or bars. If required, the LED arrays or bars shall be removable.
- 2. The LEDs shall be either white or RGB, according to the light fixture schedule and Drawings. For luminaires specified with white light, it is not acceptable to provide RGB LEDs mixed to produce white light.
- 3. Refer to the light fixture schedule and Drawings for the specified correlated color temperature (CCT) of each luminaire.
- 4. Individual LEDs shall be binned by manufacturer to comply with ANSI C78.377.
- 5. The LEDs shall be manufactured by Cree, Philips, Toshiba, Osram, Samsung, or Nichia, unless otherwise noted.

2.4 DRIVERS:

1. The driver or power supply for the luminaire shall be modular and replaceable.
2. The rated life of the driver shall match the rated life of the LEDs and luminaire.
3. In general, the drive current rating of the driver shall be minimized, while still maintaining the required lumen output, to improve luminaire efficiency and life.
4. The driver shall meet the emission standards of IEC EN-61000-6-3 at a minimum. For healthcare or other applications with EMI sensitive equipment, provide drivers that meet more stringent standards as required.

2.5 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
  - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
  - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
  - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
  - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
  - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.6 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

#### B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

#### C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

#### D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### 3.2 IDENTIFICATION

#### A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.3 FIELD QUALITY CONTROL

#### A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

### 3.4 STARTUP SERVICE

#### A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 265100

## SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

### 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. UTP cabling.
- 2. Coaxial Cable
- 3. Cable connecting hardware, patch panels, and cross-connects.
- 4. Telecommunications outlet/connectors.
- 5. Cabling system identification products.

#### 1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- C. EMI: Electromagnetic interference.
- D. IDC: Insulation displacement connector.
- E. LAN: Local area network.
- F. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- G. RCDD: Registered Communications Distribution Designer.
- H. UTP: Unshielded twisted pair.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.
- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Patch-Panel Units: One of each type.
  - 2. Connecting Blocks: One of each type.
  - 3. Device Plates: One of each type.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  - 1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings and RCDD.
  - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
  - 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
  - 1. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the



communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.

1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
  2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
  3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

## 2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
  2. Smoke-Developed Index: 50 or less.
- C. 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.
- D. Grounding: Comply with J-STD-607-A.

## 2.3 UTP CABLE

- A. Description: 100-ohm, four-pair UTP, covered with a blue thermoplastic jacket.
1. Comply with ICEA S-90-661 for mechanical properties.
  2. Comply with TIA/EIA-568-B.1 for performance specifications.
  3. Comply with TIA/EIA-568-B.2, **Category 6**.
  4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
    - a. Communications, General Purpose: Type CM or CMG.
    - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
    - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
    - d. Communications, Limited Purpose: Type CMX.
    - e. Multipurpose: Type MP or MPG.
    - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
    - g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

## 2.4 UTP CABLE HARDWARE

- A. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- B. Connecting Blocks: 110-style IDC for **Category 6**. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- C. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
- D. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
- E. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
  - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure **Category 6** performance. Patch cords shall have latch guards to protect against snagging.

## 2.5 COAXIAL CABLE

- A. The drop cable shall be plenum rated RG-6U with 100% shielding. The cable shall be West Penn Wire 25841 or approved equal.

## 2.6 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
- B. Workstation Outlets: Port-connector assemblies, with quantities shown on drawings, mounted in single faceplate.
  - 1. Faceplate: Coordinate color with Section 262726 "Wiring Devices."
  - 2. For use with snap-in jacks accommodating any combination of UTP.
  - 3. Legend: Machine printed, in the field, using adhesive-tape label.
  - 4. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

## 2.7 GROUNDING

- A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Comply with J-STD-607-A.

## 2.8 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Section 260553 "Identification for Electrical Systems."

## PART 3 - EXECUTION

### 3.1 WIRING METHODS

- A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal pathways and cables except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
- B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures:
  - 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
  - 2. Install lacing bars and distribution spools.
  - 3. Install conductors parallel with or at right angles to sides and back of enclosure.

### 3.2 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Comply with TIA/EIA-568-B.1.
  - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
  - 3. Install 110-style IDC termination hardware unless otherwise indicated.
  - 4. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  - 5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - 6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
  - 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.

8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
10. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

### 3.3 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-B, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

### 3.4 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

### 3.5 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section "Identification for Electrical Systems."
- B. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

- C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
- D. Cable and Wire Identification:
  - 1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
  - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
  - 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
    - a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    - b. Label each unit and field within distribution racks and frames.
  - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- E. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
  - 1. Cables use flexible vinyl or polyester that flex as cables are bent.

### 3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA/EIA-568-B.1.
  - 2. Visually confirm **Category 6**, marking of outlets, cover plates, outlet/connectors, and patch panels.
  - 3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- B. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

CHA Architecture Project No. 17078  
Brunswick, ME

Kate Furbish Elementary - Discovery Classroom  
Issued for Bid

END OF SECTION 271500

## SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Manual fire-alarm boxes.
2. System smoke detectors.
3. Heat detectors.
4. Notification appliances.
5. Addressable interface device.

#### 1.2 SYSTEM DESCRIPTION

- A. Interface with Existing Fire Alarm Equipment - The equipment specified herein shall operate as an extension to an existing configuration. The new equipment shall be connected to the **existing Fire Alarm control panel**. Existing monitoring equipment shall be expanded, modified, or supplemented as necessary to extend the existing monitoring functions to the new points. New components shall be capable of merging with the existing configuration without degrading the performance of either system. The scope of the acceptance tests of paragraph Testing shall include aspects of operation that involve combined use of both new and existing portions of the final configuration.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
  2. Include voltage drop calculations for notification appliance circuits.
  3. Include battery-size calculations.
  4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
  5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
- C. General Submittal Requirements:



1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
  - a. Trained and certified by manufacturer in fire-alarm system design.
  - b. NICET-certified fire-alarm technician, Level III minimum.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
  1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
  2. Station Reset: Key- or wrench-operated switch.

#### 2.2 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
  1. Comply with UL 268; operating at 24-V dc, nominal.
  2. Detectors shall be four-wire type.
  3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
  4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
  5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
- B. Photoelectric Smoke Detectors:
  1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
  - a. Primary status.
  - b. Device type.
  - c. Present average value.
  - d. Present sensitivity selected.
  - e. Sensor range (normal, dirty, etc.).

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
  - a. Primary status.
  - b. Device type.
  - c. Present average value.
  - d. Present sensitivity selected.
  - e. Sensor range (normal, dirty, etc.).
3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

## 2.3 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
  1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
  2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

## 2.4 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
  1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

- B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.
- C. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
  - 1. Rated Light Output:
    - a. 15/30/75/110 cd, selectable in the field.
  - 2. Mounting: Wall mounted unless otherwise indicated.
  - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
  - 4. Flashing shall be in a temporal pattern, synchronized with other units.
  - 5. Strobe Leads: Factory connected to screw terminals.
  - 6. Mounting Faceplate: Factory finished, red.

## 2.5 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall or operate Fire/Smoke damper.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- C. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
- D. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- E. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

- F. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- G. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- H. Device Location-Indicating Lights: Locate in public space near the device they monitor.

### 3.2 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section "Door Hardware." Connect hardware and devices to fire-alarm system.
  - 1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
  - 1. Alarm-initiating connection to elevator recall system and components.
  - 2. Supervisory connections at valve supervisory switches.
  - 3. Supervisory connections at elevator shunt trip breaker.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

### 3.4 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

END OF SECTION 283111

## SECTION 310100.01 – SITE PERMIT REQUIREMENTS

### PART 1 - GENERAL

- A. Construction of this project must meet the terms and conditions of the following permits:
  - a. State of Maine Site Location of Development Act Permit; and a Maine General Construction Permit.
  - b. Town of Brunswick Special Permit
  - c. Town of Brunswick Site Plan Review Permit.

These permits are attached at the end of this section. The aforementioned permits shall be the extent of Owner supplied permits. Any other permits required to conduct the work shall be obtained by the Contractor.

- B. Some of the permits require inspection or the work by the Owner or Engineer. The contractor shall review these requirements and provide the Owner a minimum of 48 hours prior to the need for a specified inspection. The Owner will respond and arrange for a time for the inspections to occur. It is the responsibility of the Contractor to have these inspections performed during the course of the work.
- C. Certain conditions of the permits will be the responsibility of the Contractor. The Contractor is responsible for familiarizing himself with all specific and standard conditions of the permits issued for the project, and for undertaking all work in strict conformance with these.
- D. A copy of the permits and the approved plans shall be available at the Project Site at all times.
- E. A copy of all erosion inspection logs, reports and meeting minutes shall be available at the Project Site at all times.

### PART 2 - PERMITS

- A. The MaineDEP Site Location of Development Act Permit and the Maine General Construction Permit attached hereto.
- B. Town of Brunswick Special Permit and Site Plan Review Permit attached hereto.

END OF SECTION 310100.01

**MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION SITE LOCATION OF  
DEVELOPMENT ACT PERMIT AND MAINE CONSTRUCTION GENERAL PERMIT**



STATE OF MAINE  
DEPARTMENT OF ENVIRONMENTAL PROTECTION  
17 STATE HOUSE STATION AUGUSTA, MAINE 04333-0017

DEPARTMENT ORDER

IN THE MATTER OF

TOWN OF BRUNSWICK	) SITE LOCATION OF DEVELOPMENT ACT
SCHOOL DEPARTMENT	)
Brunswick, Cumberland County	)
JORDAN ACRES SCHOOL	)
L-27771-22-A-N (approval)	) FINDINGS OF FACT AND ORDER

Pursuant to the provisions of 38 M.R.S. §§ 481–489-E and Chapters 373, 375, 376, and 500 of Department rules, the Department of Environmental Protection has considered the application of the TOWN OF BRUNSWICK SCHOOL DEPARTMENT with the supportive data, agency review comments, and other related materials on file and FINDS THE FOLLOWING FACTS:

1. PROJECT DESCRIPTION:

A. History of Project: The Town of Brunswick owns an approximately 10.5-acre parcel of land that is currently developed with the former Jordan Acres Elementary School and its associated walkways, parking area, outdoor basketball court, and athletic field. The school campus predates the October 1, 1975 definition of structure in the Site Location of Development Act (Site Law), 38 M.R.S.A. Section 482(6). The Town also owns an adjacent parcel of land, which is 6.66 acres in size and currently undeveloped.

B. Summary: The applicant proposes to redevelop the two, 17.1-acre parcels to construct a new elementary school with an approximately 90,000-square foot building along with associated drives, walkways, parking areas, and play areas. When completed, the new school campus will result in a total of 8.75 acres of developed area, of which 4.46 acres are impervious area. The proposed project will create approximately 1.78 acres of new impervious area and 0.35 acres of new non-impervious developed area, beyond the existing conditions. The proposed development is shown on a set of plans the first of which is titled “Jordan Acres School,” prepared by Atlantic Resources Consultants, and dated November 22, 2017, with a last revision date of February 5, 2018. The project site is located on the north side Jordan Street in the Town of Brunswick.

C. Current Use of Site: The site of the proposed project is developed with the former Jordan Acres Elementary School. The adjacent parcel is undeveloped woodland and forested wetland. The parcels are identified as Map 54, Lot 14 and Map U06, Lot 5 on the Town of Brunswick’s tax maps.

2. FINANCIAL CAPACITY:

The total cost of the project is estimated to be \$28,000,000. The proposed project will be financed through a bond, an action that requires approval by the Town Council. Voter

approval for the town Council to move forward on issuance of the bond was granted on June 13, 2017. Prior to the start of construction, the applicant must submit evidence that it has been granted a line of credit or a loan by a financial institution authorized to do business in this State or evidence of any other form of financial assurance determined by Department Rules, Chapter 373(1), to be adequate to the Bureau of Land Resources (BLR) for review and approval.

Provided the additional financial information is submitted as outlined above, the Department finds that the applicant has demonstrated adequate financial capacity to comply with Department standards.

3. TECHNICAL ABILITY:

The applicant provided resume information for key persons involved with the project and a list of projects successfully constructed by the applicant. The applicant also retained the services of Atlantic Resource Consultants, a professional engineering firm, to assist in the design and engineering of the project.

The Department finds that the applicant has demonstrated adequate technical ability to comply with Department standards.

4. NOISE:

The proposed facility is located in a residential area with single-family residences abutting the property. The project will have a minor sound impact. Typical noises emanating from the development will be from cars, buses, and children playing. The greatest sound impact will occur during the staging of buses at the beginning and end of each school day.

The applicant stated that the school will continue to be operated in compliance with the Town of Brunswick's noise ordinance. The Town's noise ordinance is quantifiable and contains limits that are not higher than the noise limits contained within Chapter 375 of the Department's Rules by more than 5 dBA. Therefore, the local standard applies to the proposed project.

The applicant proposes to limit construction on the site to the hours between 7:00 A.M. and 7:00 P.M. Construction noise generated during these hours is not regulated pursuant to 38 M.R.S. § 484(3)(A).

The Department finds that the applicant has made adequate provision for the control of excessive environmental noise from the proposed project.

5. SCENIC CHARACTER:

The proposed project includes a bus drop-off loop, a parent drop-off loop, and parking spaces to accommodate the traffic generated by arriving and departing students. The



perimeter of the site will be a combination of chain-link fence and screen fencing. These areas will be illuminated by downward-aimed LED light fixtures set on timers to go off by 10:00 pm. The photometric model shown on the Illumination Summary Plan indicates that light intensities of 0.5 foot-candles will not intrude beyond the property boundaries.

Based on the project's location and design, the Department finds that the proposed project will not have an unreasonable adverse effect on the scenic character of the surrounding area.

6. WILDLIFE AND FISHERIES:

The Maine Department of Inland Fisheries and Wildlife (MDIFW) reviewed the proposed project. In its comments, MDIFW stated that it found no records of any Essential or Significant Wildlife Habitats, or other wildlife habitats of special concern associated with this site. No fisheries concerns were identified.

The Department finds that the applicant has made adequate provision for the protection of wildlife and fisheries.

7. HISTORIC SITES AND UNUSUAL NATURAL AREAS:

The Maine Historic Preservation Commission reviewed the proposed project and stated that it will have no effect upon any structure or site of historic, architectural, or archaeological significance as defined by the National Historic Preservation Act of 1966.

The Maine Natural Areas Program database does not contain any records documenting the existence of rare or unique botanical features on the project site and, as discussed in Finding 6, MDIFW did not identify any unusual wildlife habitats located on the project site.

The Department finds that the proposed development will not have an adverse effect on the preservation of any historic sites or unusual natural areas either on or near the development site.

8. BUFFER STRIPS:

The applicant is not proposing to utilize any formal buffer strips for the proposed project.

9. SOILS:

The applicant submitted a soil survey map and report and a geotechnical report based on the soils found at the project site. The soil survey report was prepared by a certified soils scientist the geotechnical report was prepared by a registered professional engineer. The reports were reviewed by staff from the Division of Environmental Assessment (DEA) of the Bureau of Water Quality (BWQ).

The Department finds that, based on these reports, and DEA's review, the soils on the project site present no limitations to the proposed project that cannot be overcome through standard engineering practices.

10. STORMWATER MANAGEMENT:

When completed, the new school campus will result in a total of 8.75 acres of developed area, of which 4.46 acres are impervious area. The proposed project will create approximately 1.78 acres of new impervious area and 0.35 acres of new non-impervious developed area, beyond the existing conditions. The project site lies within the watershed of the Androscoggin River. The applicant submitted a stormwater management plan based on the Basic, General, and Flooding standards contained in Chapter 500 Stormwater Management rules (06-096 C.M.R. ch. 500, effective August 12, 2015). The proposed stormwater management system consists of catch basins, a subsurface drainage system, five infiltration basins, and a roof dripline filter.

A. Basic Standards:

(1) Erosion and Sedimentation Control: The applicant submitted an Erosion and Sedimentation Control Plan (Section 14 of the application) that is based on the performance standards contained in Appendix A of Chapter 500 and the Best Management Practices outlined in the Maine Erosion and Sediment Control BMPs, which were developed by the Department. This plan and plan sheets containing erosion control details were reviewed by, and revised in response to the comments of, the BLR.

Erosion control details will be included on the final construction plans and the erosion control narrative will be included in the project specifications to be provided to the construction contractor.

(2) Inspection and Maintenance: The applicant submitted a maintenance plan that addresses both short and long-term maintenance requirements. The maintenance plan is based on the standards contained in Appendix B of Chapter 500. This plan was reviewed by, and revised in response to the comments of, BLR. The applicant will be responsible for the maintenance of all common facilities including the stormwater management system.

Storm sewer grit and sediment materials removed from stormwater control structures during maintenance activities must be disposed of in compliance with the Maine Solid Waste Management Rules.

(3) Housekeeping: The proposed project will comply with the performance standards outlined in Appendix C of Chapter 500.

Based on BLR's review of the erosion and sedimentation control plan and the maintenance plan, the Department finds that the proposed project meets the Basic Standards contained in Chapter 500(4)(B).

B. General Standards:

Pursuant to Department Rules, Chapter 500(4)(C)(2)(d), the treatment requirement for a redevelopment project is scaled based on the change of use of existing developed area to the proposed developed area. Mitigation for the proposed project control runoff from no less than 50% of the new developed area. Mitigation for the proposed project is being achieved by using Best Management Practices (BMPs) that will control runoff from no less than 63% of the impervious area and no less than 58% of the developed area.

The proposed infiltration system was reviewed by staff from DEA, as discussed in Finding 11. The applicant must ensure that the discharge of soluble pollutants to the infiltration area is minimized and that the infiltration area is maintained to assure that its capacity is unimpaired. Based on DEA's review, the Department does not anticipate that the infiltration area will adversely impact groundwater quality.

The stormwater management system proposed by the applicant was reviewed by BLR. After a final review, BLR commented that the proposed stormwater management system is designed in accordance with the General Standards contained in Chapter 500(4)(C) and recommended that the applicant's design engineer or another qualified engineer oversee the construction of the stormwater management structures to ensure that they are installed in accordance with the details and notes specified on the approved plans. Within 30 days from completion of the entire system, or if the project takes more than one year to complete, at least once per year, the applicant must submit a log of inspection reports detailing the items inspected, photographs taken, and the dates of each inspection to the BLR for review.

Based on the stormwater system's design and BLR's review, the Department finds that the applicant has made adequate provision to ensure that the proposed project will meet the General Standards contained in Chapter 500(4)(C) provided that the applicant retains a professional engineer to inspect and document construction of the stormwater management system as outlined above.

C. Flooding Standard:

The applicant is proposing to utilize a stormwater management system based on estimates of pre- and post-development stormwater runoff flows obtained by using Hydrocad, a stormwater modeling software that utilizes the methodologies outlined in Technical Releases #55 and #20, U.S.D.A., Soil Conservation Service and detains or results in infiltration of stormwater from 24-hour storms of 2-, 10-, and 25-year frequency. The post-development peak flow from the site will not exceed the pre-development peak flow from the site and the peak flow of the receiving water will not be increased as a result of stormwater runoff from the development site.

BLR commented that the proposed system is designed in accordance with the Flooding Standard contained in Chapter 500(4)(F).

Based on the system's design and BLR's review, the Department finds that the applicant has made adequate provision to ensure that the proposed project will meet the Flooding Standard contained in Chapter 500(4)(F) for peak flow from the project site, and channel limits and runoff areas.

A portion of the stormwater runoff from the existing campus discharges to the Town of Brunswick's storm sewer system. Overflow grates in the infiltration basins will direct stormwater flows that exceed the 24-hour, 25-year storm event out of the infiltration basins and into the Town's storm sewer system.

The Department further finds that the proposed project will meet the Chapter 500 standards for discharge to freshwater wetlands and discharges to public storm sewer systems.

11. GROUNDWATER:

The project site is located over a mapped sand and gravel aquifer. The proposed project does not propose any withdrawal from, or discharge to, the groundwater.

Stormwater runoff from the site will be discharged, in part, to infiltration systems. No underground fuel tanks are associated with this project. No underground oil tanks are associated with this project.

The applicant proposes to line the infiltration basins with 18 inches of loam (from salvaged top soil) amended with fine sand and superhumus to ensure the permeability of the soil at the depth of the base of the infiltration basins is no greater than 2.41 inches per hour, in accordance with Department Rules (Chapter 500, Appendix D(4)(a)). DEA recommended, and the applicant agreed, to perform permeability tests after installation of the loam liner to verify that the uniformity of the liner and that soil permeability is no greater than 2.41 inches per hour. Results of the permeability tests must be included with inspection reports discussed in Finding 10. Based on DEA's review, the Department does not anticipate that the infiltration area will adversely impact groundwater quality.

The proposed infiltration basins must be registered with the Department's Underground Injection Control Program. Copies of the registrations for the infiltration basins must be submitted to the BLR prior to start of construction of the infiltration basins.

The Department finds that the proposed project will not pose an unreasonable risk that a discharge to a significant groundwater aquifer will occur provided that the infiltration basins are registered with the Department's Underground Injection Control Program and results of permeability tests are included with the construction oversight inspections set forth in Finding 10. The Department further finds that the proposed project will not have an unreasonable adverse effect on ground water quality or quantity.

12. WATER SUPPLY:

When completed, the proposed project is anticipated to use 2,400 gallons of water per day. Water will be supplied by the Brunswick & Topsham Water District. The applicant submitted a letter from the District, dated November 16, 2017, indicating that it will be capable of servicing this project.

The Department finds that the applicant has made adequate provision for securing and maintaining a sufficient and healthful water supply.

13. WASTEWATER DISPOSAL:

When completed, the proposed project is anticipated to discharge 2,400 gallons of wastewater per day to the Brunswick Sewer District's wastewater treatment facility. The applicant submitted a letter from the Brunswick Sewer District, dated October 10, 2017, stating that it will accept these flows. This project was reviewed by the Division of Water Quality Management (DWQM) of the BWQ, which commented that the Brunswick Sewer District has the capacity to treat these flows and is operating in compliance with the water quality laws of the State of Maine.

Based on DWQM's comments, the Department finds that the applicant has made adequate provision for wastewater disposal at a facility that has the capacity to ensure satisfactory treatment.

14. SOLID WASTE:

When completed, the proposed project is anticipated to generate 265 pounds of municipal solid waste per day. All general solid wastes from the proposed project will be disposed of at the Graham Road Landfill in Brunswick, which is currently in substantial compliance with the Maine Solid Waste Management Rules.

The proposed project will generate approximately four cubic yards of stumps and grubblings. All stumps and grubblings generated will be chipped and ground on site, and used as erosion control mix and landscape mulching in compliance with the Solid Waste Management Regulations of the State of Maine.

The proposed project will generate approximately 2,000 cubic yards of construction debris and demolition debris. All construction and demolition debris generated will be disposed of at the Graham Road Landfill in Brunswick, which is currently in substantial compliance with the Maine Solid Waste Management Rules. Approximately 824 cubic yards of asphalt will be recycled at either the Crooker facility in Topsham, the Shaw Brothers facility in Gorham, or the Grondin facility in Gorham, all of which are currently in substantial compliance with the Maine Solid Waste Management Rules.

Based on the above information, the Department finds that the applicant has made adequate provision for solid waste disposal.

15. FLOODING:

The proposed project is not located within the 100-year flood plain of any river or stream.

The Department finds that the proposed project is unlikely to cause or increase flooding or cause an unreasonable flood hazard to any structure.

BASED on the above findings of fact, and subject to the conditions listed below, the Department makes the following conclusions pursuant to 38 M.R.S. §§ 481–489-E:

- A. The applicant has provided adequate evidence of financial capacity and technical ability to develop the project in a manner consistent with state environmental standards provided that final financial evidence is submitted to the BLWQ for review and approval as outlined in Finding 2.
- B. The applicant has made adequate provision for fitting the development harmoniously into the existing natural environment and the development will not adversely affect existing uses, scenic character, air quality, water quality or other natural resources in the municipality or in neighboring municipalities.
- C. The proposed development will be built on soil types which are suitable to the nature of the undertaking and will not cause unreasonable erosion of soil or sediment nor inhibit the natural transfer of soil.
- D. The proposed development meets the standards for storm water management in 38 M.R.S. § 420-D and the standard for erosion and sedimentation control in 38 M.R.S. § 420-C provided that grit and sediment materials removed from stormwater structures during maintenance activities are disposed of in compliance with the Maine Solid Waste Management Rules and the applicant retains a professional engineer to inspect and document construction of the stormwater management system as outlined in Finding 10.
- E. The proposed development will not pose an unreasonable risk that a discharge to a significant groundwater aquifer will occur provided that the infiltration basins are registered with the Department's Underground Injection Control Program and results of permeability tests are included with the construction oversight inspections set forth in Findings 10 and 11.
- F. The applicant has made adequate provision of utilities, including water supplies, sewerage facilities and solid waste disposal required for the development and the development will not have an unreasonable adverse effect on the existing or proposed utilities in the municipality or area served by those services.
- G. The activity will not unreasonably cause or increase the flooding of the alteration area or adjacent properties nor create an unreasonable flood hazard to any structure.

THEREFORE, the Department APPROVES the application of the TOWN OF BRUNSWICK SCHOOL DEPARTMENT to construct a new elementary school as described in Finding 1, SUBJECT TO THE FOLLOWING CONDITIONS and all applicable standards and regulations:

1. The Standard Conditions of Approval, a copy attached.
2. In addition to any specific erosion control measures described in this or previous orders, the applicant shall take all necessary actions to ensure that its activities or those of its agents do not result in noticeable erosion of soils or fugitive dust emissions on the site during the construction and operation of the project covered by this approval.
3. Severability. The invalidity or unenforceability of any provision, or part thereof, of this License shall not affect the remainder of the provision or any other provisions. This License shall be construed and enforced in all respects as if such invalid or unenforceable provision or part thereof had been omitted.
4. Prior to the start of construction, the applicant shall submit evidence that it has been granted a line of credit or a loan by a financial institution authorized to do business in this State or evidence of any other form of financial assurance determined by Department Rules, Chapter 373(1), to be adequate to the BLWQ for review and approval.
5. Storm sewer grit and sediment materials removed from stormwater control structures shall be disposed of in compliance with the Maine Solid Waste Management Rules.
6. The applicant shall retain a professional engineer to oversee the construction of the stormwater management system according to the details and notes specified on the approved plans. Within 30 days of completion of the entire system or if the project takes more than one year to complete, at least once per year, the applicant shall submit a log of inspection reports detailing the items inspected, photographs taken, and dates of each inspection to the BLR for review.
7. Results of the permeability tests for the infiltration basin liners shall be included with the inspection reports required in Special Condition #6.

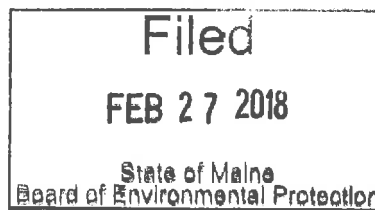
8. Prior to start of construction of the infiltration basins, each infiltration basin shall be registered with the Department's Underground Injection Control Program, and copies of the registrations for the infiltration basins shall be submitted to the BLR.

THIS APPROVAL DOES NOT CONSTITUTE OR SUBSTITUTE FOR ANY OTHER REQUIRED STATE, FEDERAL OR LOCAL APPROVALS NOR DOES IT VERIFY COMPLIANCE WITH ANY APPLICABLE SHORELAND ZONING ORDINANCES.

DONE AND DATED IN AUGUSTA, MAINE, THIS 27<sup>TH</sup> DAY OF FEBRUARY, 2018.

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BY:   
For: Paul Mercer, Commissioner



PLEASE NOTE THE ATTACHED SHEET FOR GUIDANCE ON APPEAL PROCEDURES.

RLG/L27771AN/ATS#82543



**Department of Environmental Protection**  
**SITE LOCATION OF DEVELOPMENT (SITE)**  
**STANDARD CONDITIONS**

- A. Approval of Variations from Plans.** The granting of this approval is dependent upon and limited to the proposals and plans contained in the application and supporting documents submitted and affirmed to by the applicant. Any variation from these plans, proposals, and supporting documents is subject to review and approval prior to implementation. Further subdivision of proposed lots by the applicant or future owners is specifically prohibited without prior approval of the Board, and the applicant shall include deed restrictions to that effect.
- B. Compliance with All Applicable Laws.** The applicant shall secure and comply with all applicable federal, state, and local licenses, permits, authorizations, conditions, agreements, and orders prior to or during construction and operation, as appropriate.
- C. Compliance with All Terms and Conditions of Approval.** The applicant shall submit all reports and information requested by the Board or the Department demonstrating that the applicant has complied or will comply with all preconstruction terms and conditions of this approval. All preconstruction terms and conditions must be met before construction begins.
- D. Advertising.** Advertising relating to matters included in this application shall refer to this approval only if it notes that the approval has been granted WITH CONDITIONS, and indicates where copies of those conditions may be obtained.
- E. Transfer of Development.** Unless otherwise provided in this approval, the applicant shall not sell, lease, assign or otherwise transfer the development or any portion thereof without prior written approval of the Board where the purpose or consequence of the transfer is to transfer any of the obligations of the developer as incorporated in this approval. Such approval shall be granted only if the applicant or transferee demonstrates to the Board that the transferee has the technical capacity and financial ability to comply with conditions of this approval and the proposals and plans contained in the application and supporting documents submitted by the applicant.
- F. Time frame for approvals.** If the construction or operation of the activity is not begun within four years, this approval shall lapse and the applicant shall reapply to the Board for a new approval. The applicant may not begin construction or operation of the development until a new approval is granted. A reapplication for approval may include information submitted in the initial application by reference. This approval, if construction is begun within the four-year time frame, is valid for seven years. If construction is not completed within the seven-year time frame, the applicant must reapply for, and receive, approval prior to continuing construction.
- G. Approval Included in Contract Bids.** A copy of this approval must be included in or attached to all contract bid specifications for the development.
- H. Approval Shown to Contractors.** Work done by a contractor pursuant to this approval shall not begin before the contractor has been shown by the developer a copy of this approval.

**(2/81)/Revised December 27, 2011**

## **STORMWATER STANDARD CONDITIONS**

### **STRICT CONFORMANCE WITH THE STANDARD AND SPECIAL CONDITIONS OF THIS APPROVAL IS NECESSARY FOR THE PROJECT TO MEET THE STATUTORY CRITERIA FOR APPROVAL**

**Standard conditions of approval.** Unless otherwise specifically stated in the approval, a department approval is subject to the following standard conditions pursuant to Chapter 500 Stormwater Management Law.

- (1) Approval of variations from plans. The granting of this approval is dependent upon and limited to the proposals and plans contained in the application and supporting documents submitted and affirmed to by the applicant. Any variation from these plans, proposals, and supporting documents must be reviewed and approved by the department prior to implementation. Any variation undertaken without approval of the department is in violation of 38 M.R.S.A. §420-D(8) and is subject to penalties under 38 M.R.S.A. §349.
- (2) Compliance with all terms and conditions of approval. The applicant shall submit all reports and information requested by the department demonstrating that the applicant has complied or will comply with all terms and conditions of this approval. All preconstruction terms and conditions must be met before construction begins.
- (3) Advertising. Advertising relating to matters included in this application may not refer to this approval unless it notes that the approval has been granted WITH CONDITIONS, and indicates where copies of those conditions may be obtained.
- (4) Transfer of project. Unless otherwise provided in this approval, the applicant may not sell, lease, assign, or otherwise transfer the project or any portion thereof without written approval by the department where the purpose or consequence of the transfer is to transfer any of the obligations of the developer as incorporated in this approval. Such approval may only be granted if the applicant or transferee demonstrates to the department that the transferee agrees to comply with conditions of this approval and the proposals and plans contained in the application and supporting documents submitted by the applicant. Approval of a transfer of the permit must be applied for no later than two weeks after any transfer of property subject to the license.
- (5) Time frame for approvals. If the construction or operation of the activity is not begun within four years, this approval shall lapse and the applicant shall reapply to the department for a new approval. The applicant may not begin construction or operation of the project until a new approval is granted. A reapplication for approval may include information submitted in the initial application by reference. This approval, if construction is begun within the four-year time frame, is valid for seven years. If construction is not completed within the seven-year time frame, the applicant must reapply for, and receive, approval prior to continuing construction.
- (6) Certification. Contracts must specify that "all work is to comply with the conditions of the Stormwater Permit." Work done by a contractor or subcontractor pursuant to this approval may not begin before the contractor and any subcontractors have been shown a copy of this approval with the conditions by the developer, and the owner and each contractor and subcontractor has certified, on a form provided by the department, that the approval and conditions have been

received and read, and that the work will be carried out in accordance with the approval and conditions. Completed certification forms must be forwarded to the department.

- (7) Maintenance. The components of the stormwater management system must be adequately maintained to ensure that the system operates as designed, and as approved by the department.
- (8) Recertification requirement. Within three months of the expiration of each five-year interval from the date of issuance of the permit, the permittee shall certify the following to the department.
  - (a) All areas of the project site have been inspected for areas of erosion, and appropriate steps have been taken to permanently stabilize these areas.
  - (b) All aspects of the stormwater control system have been inspected for damage, wear, and malfunction, and appropriate steps have been taken to repair or replace the facilities.
  - (c) The erosion and stormwater maintenance plan for the site is being implemented as written, or modifications to the plan have been submitted to and approved by the department, and the maintenance log is being maintained.
- (9) Severability. The invalidity or unenforceability of any provision, or part thereof, of this permit shall not affect the remainder of the provision or any other provisions. This permit shall be construed and enforced in all respects as if such invalid or unenforceable provision or part thereof had been omitted.

November 16, 2005 (revised December 27, 2011)



# DEP INFORMATION SHEET

## Appealing a Department Licensing Decision

**Dated: March 2012**

**Contact: (207) 287-2811**

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### **SUMMARY**

There are two methods available to an aggrieved person seeking to appeal a licensing decision made by the Department of Environmental Protection's ("DEP") Commissioner: (1) in an administrative process before the Board of Environmental Protection ("Board"); or (2) in a judicial process before Maine's Superior Court. An aggrieved person seeking review of a licensing decision over which the Board had original jurisdiction may seek judicial review in Maine's Superior Court.

A judicial appeal of final action by the Commissioner or the Board regarding an application for an expedited wind energy development (35-A M.R.S.A. § 3451(4)) or a general permit for an offshore wind energy demonstration project (38 M.R.S.A. § 480-HH(1)) or a general permit for a tidal energy demonstration project (38 M.R.S.A. § 636-A) must be taken to the Supreme Judicial Court sitting as the Law Court.

This INFORMATION SHEET, in conjunction with a review of the statutory and regulatory provisions referred to herein, can help a person to understand his or her rights and obligations in filing an administrative or judicial appeal.

### **I. ADMINISTRATIVE APPEALS TO THE BOARD**

#### **LEGAL REFERENCES**

The laws concerning the DEP's *Organization and Powers*, 38 M.R.S.A. §§ 341-D(4) & 346, the *Maine Administrative Procedure Act*, 5 M.R.S.A. § 11001, and the DEP's *Rules Concerning the Processing of Applications and Other Administrative Matters* ("Chapter 2"), 06-096 CMR 2 (April 1, 2003).

#### **HOW LONG YOU HAVE TO SUBMIT AN APPEAL TO THE BOARD**

The Board must receive a written appeal within 30 days of the date on which the Commissioner's decision was filed with the Board. Appeals filed after 30 calendar days of the date on which the Commissioner's decision was filed with the Board will be rejected.

#### **HOW TO SUBMIT AN APPEAL TO THE BOARD**

Signed original appeal documents must be sent to: Chair, Board of Environmental Protection, c/o Department of Environmental Protection, 17 State House Station, Augusta, ME 04333-0017; faxes are acceptable for purposes of meeting the deadline when followed by the Board's receipt of mailed original documents within five (5) working days. Receipt on a particular day must be by 5:00 PM at DEP's offices in Augusta; materials received after 5:00 PM are not considered received until the following day. The person appealing a licensing decision must also send the DEP's Commissioner a copy of the appeal documents and if the person appealing is not the applicant in the license proceeding at issue the applicant must also be sent a copy of the appeal documents. All of the information listed in the next section must be submitted at the time the appeal is filed. Only the extraordinary circumstances described at the end of that section will justify evidence not in the DEP's record at the time of decision being added to the record for consideration by the Board as part of an appeal.

## **WHAT YOUR APPEAL PAPERWORK MUST CONTAIN**

Appeal materials must contain the following information at the time submitted:

1. *Aggrieved Status.* The appeal must explain how the person filing the appeal has standing to maintain an appeal. This requires an explanation of how the person filing the appeal may suffer a particularized injury as a result of the Commissioner's decision.
2. *The findings, conclusions or conditions objected to or believed to be in error.* Specific references and facts regarding the appellant's issues with the decision must be provided in the notice of appeal.
3. *The basis of the objections or challenge.* If possible, specific regulations, statutes or other facts should be referenced. This may include citing omissions of relevant requirements, and errors believed to have been made in interpretations, conclusions, and relevant requirements.
4. *The remedy sought.* This can range from reversal of the Commissioner's decision on the license or permit to changes in specific permit conditions.
5. *All the matters to be contested.* The Board will limit its consideration to those arguments specifically raised in the written notice of appeal.
6. *Request for hearing.* The Board will hear presentations on appeals at its regularly scheduled meetings, unless a public hearing on the appeal is requested and granted. A request for public hearing on an appeal must be filed as part of the notice of appeal.
7. *New or additional evidence to be offered.* The Board may allow new or additional evidence, referred to as supplemental evidence, to be considered by the Board in an appeal only when the evidence is relevant and material and that the person seeking to add information to the record can show due diligence in bringing the evidence to the DEP's attention at the earliest possible time in the licensing process or that the evidence itself is newly discovered and could not have been presented earlier in the process. Specific requirements for additional evidence are found in Chapter 2.

## **OTHER CONSIDERATIONS IN APPEALING A DECISION TO THE BOARD**

1. *Be familiar with all relevant material in the DEP record.* A license application file is public information, subject to any applicable statutory exceptions, made easily accessible by DEP. Upon request, the DEP will make the material available during normal working hours, provide space to review the file, and provide opportunity for photocopying materials. There is a charge for copies or copying services.
2. *Be familiar with the regulations and laws under which the application was processed, and the procedural rules governing your appeal.* DEP staff will provide this information on request and answer questions regarding applicable requirements.
3. *The filing of an appeal does not operate as a stay to any decision.* If a license has been granted and it has been appealed the license normally remains in effect pending the processing of the appeal. A license holder may proceed with a project pending the outcome of an appeal but the license holder runs the risk of the decision being reversed or modified as a result of the appeal.

## **WHAT TO EXPECT ONCE YOU FILE A TIMELY APPEAL WITH THE BOARD**

The Board will formally acknowledge receipt of an appeal, including the name of the DEP project manager assigned to the specific appeal. The notice of appeal, any materials accepted by the Board Chair as supplementary evidence, and any materials submitted in response to the appeal will be sent to Board members with a recommendation from DEP staff. Persons filing appeals and interested persons are notified in advance of the date set for Board consideration of an appeal or request for public hearing. With or without holding a public hearing, the Board may affirm, amend, or reverse a Commissioner decision or remand the matter to the Commissioner for further proceedings. The Board will notify the appellant, a license holder, and interested persons of its decision.

## **II. JUDICIAL APPEALS**

Maine law generally allows aggrieved persons to appeal final Commissioner or Board licensing decisions to Maine's Superior Court, see 38 M.R.S.A. § 346(1); 06-096 CMR 2; 5 M.R.S.A. § 11001; & M.R. Civ. P 80C. A party's appeal must be filed with the Superior Court within 30 days of receipt of notice of the Board's or the Commissioner's decision. For any other person, an appeal must be filed within 40 days of the date the decision was rendered. Failure to file a timely appeal will result in the Board's or the Commissioner's decision becoming final.

An appeal to court of a license decision regarding an expedited wind energy development, a general permit for an offshore wind energy demonstration project, or a general permit for a tidal energy demonstration project may only be taken directly to the Maine Supreme Judicial Court. See 38 M.R.S.A. § 346(4).

Maine's Administrative Procedure Act, DEP statutes governing a particular matter, and the Maine Rules of Civil Procedure must be consulted for the substantive and procedural details applicable to judicial appeals.

### **ADDITIONAL INFORMATION**

If you have questions or need additional information on the appeal process, for administrative appeals contact the Board's Executive Analyst at (207) 287-2452 or for judicial appeals contact the court clerk's office in which your appeal will be filed.

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**Note: The DEP provides this INFORMATION SHEET for general guidance only; it is not intended for use as a legal reference. Maine law governs an appellant's rights.**

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**TOWN OF BRUNSWICK SPECIAL PERMIT**

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## TOWN OF BRUNSWICK, MAINE

INCORPORATED 1739


DEPARTMENT OF PLANNING AND DEVELOPMENT  
85 UNION STREET  
BRUNSWICK, ME 04011

JARED WOOLSTON, AICP  
INTERIM DIRECTOR OF PLANNING & DEVELOPMENT

PHONE: 207-725-6660  
FAX: 207-725-6663

January 10, 2018

Memo to: Brunswick Town Council  
John Eldridge, Town Manager

From: Jared Woolston, AICP 

Subject: Planning Board Special Permit Approval:  
Jordan Acres Elementary School (Case #17-060)

On January 9, 2018, the Planning Board voted unanimously of those present to approve a Special Permit application to expand the nonconforming building footprint of Jordan Acres Elementary School in accordance with Subsection 5.2.4 of the Brunswick Zoning Ordinance. The school is located at 75 Jordan Avenue (Map U06, Lot 5 and Map 54, Lot 14). The subject parcel is located within the GR8 Zoning District.

The existing school building footprint is approximately 48,700 square feet and the proposed school building footprint is approximately 70,900 square feet. The maximum building footprint per structure allowed within the GR8 Zoning District is 5,000 square feet. Therefore, the proposed building exceeds the dimensional standards of GR8.

Subsection 5.2.3 of the Zoning Ordinance gives the Town Council 30 days from the day the Planning Board approves the Special Permit to exercise jurisdiction over the application. If the Council decides to exercise jurisdiction by a majority vote at a public meeting, it shall, after notice and public hearing, ratify, reverse or modify the decision of the Planning Board. If the Council ratifies the Special Permit, the permit takes effect immediately following the affirmative vote to ratify. If the Town Council does not decide to exercise jurisdiction over the Special Permit application within 30 days, the decision of the Planning Board shall be deemed ratified by the Town Council at the end of the 30 day period (February 7, 2018).

Attached to this memo are the Special Permit Findings of Fact approved by the Planning Board on January 9, 2018.

cc: Charlie Frizzle, Chair, Planning Board  
Jeff Hutchinson, Code Enforcement Officer  
Paul Perzanoski, Superintendent



**APPROVED Findings of Fact  
Special Permit (Section 5.2.3)  
Jordan Acres Elementary School  
Planning Board Review Date: January 9, 2018**

**Project Name:** Jordan Acres Elementary School Special Permit

**Case Number:** 17-060

**Tax Map:** Map U06, Lot 5 and Map 54, Lot 14

**Applicant:** Paul Perzanoski, Superintendent  
Brunswick School Department  
46 Federal Street  
Brunswick, ME 04011

**Agent:** Andrew Johnston  
Atlantic Resource Consultants  
541 US Route One, Suite 21  
Freeport, ME 04032

*Staff has reviewed the Special Permit application and determined it is complete.*

**DRAFT Motion 1:** That the Board deems the Special Permit application complete.

**PROJECT SUMMARY**

**Case # 17-060 Jordan Acres Elementary School Special Permit:** The Planning Board will hold a **Public Hearing** and take action on a **Special Permit** application submitted by authorized representative, Andrew Johnston from Atlantic Resource Consultants for the expansion of a nonconforming building footprint in accordance with Subsection 5.2.4 of the Brunswick Zoning Ordinance. The project is located at 75 Jordan Avenue (Map U06, Lot 5 and Map 54, Lot 14). The subject parcel is located within the **GR8 Zoning District**.

The proposed school building is approximately 70,900 square feet. The maximum building footprint per structure allowed within the GR8 Zoning District is 5,000 square feet. Therefore, the proposed building exceeds the dimensional standards of GR8 and is subject to the provisions of Subsection 5.2.4: Special Permits for Nonconforming Building Footprint Expansions. As required in Subsection 5.2.4, the proposed Special Permit must also comply with Subsections 5.2.2 Conditional Use Permit and 5.2.3 Special Permits.

The subject building and site details are shown on a set of plans entitled, "Jordan Acres Elementary School" prepared by Atlantic Resource Consultants, dated from December 8-10, 2017 and revised most recently on December 29, 2017. Boundary and topography

surveys of the two (2) lots that comprise the subject parcel are provided on plan sheets 1 and 2 prepared by Horizons Engineering and dated November 28, 2017.

**Review Standards: Sections 5.2.2, 5.2.3, and 5.2.4 of the  
Town of Brunswick Zoning Ordinance**

The following standards set forth herein shall be applied, where applicable, by the Planning Board when considering an application for Special Permit. The burden of proof of compliance with these standards rests solely with the applicant.

**A. The proposed structure and site design comply with all standards of this Ordinance applicable to the zoning district and any overlay district within which the property is located.**

*Excepting the footprint of the proposed school building, the proposed structure and site design comply with all standards of the GR8 Zoning District. As noted within the project summary, the maximum building footprint per structure is 5,000 square feet, and the proposed building is approximately 70,900 square feet. No overlay districts are mapped where the property is located. The proposed building footprint expansion is reviewed under Subsections I and J, herein.*

*The Planning Board finds that the proposed structure and site design comply with all standards of this Ordinance applicable to the zoning district except for maximum building footprint per structure; and that overlay district standards are not applicable within the property location.*

**B. The proposed use will not create significantly more vehicular traffic by patrons, residents, or suppliers than the uses and structure currently within 300 feet of the proposed use or structure that generates the most vehicular traffic.**

*The applicant provided a traffic analysis by a qualified professional that indicates the proposed use will result in increased AM peak hour traffic of 67 trips. However, since the proposed building is the replacement and expansion of an existing school building the anticipated increase in traffic is not considered to be significantly more traffic than the traffic generated by the former school. The traffic movement within 300 feet of the proposed structure will provide separate access for routine uses including staff and visitor parking at Charles Court, school bus drop off and parking at a driveway entrance approximately 800 feet east of Charles Court, and deliveries or emergency access at the rear of the building at Merrymeeting Road. The proposed delivery schedule was developed by the applicant with the intention of minimizing neighborhood disturbance from routine deliveries (milk, food, etc.) in the vicinity of Minat Avenue, Just-A-Mere Road, and Merrymeeting Road.*

*The Planning Board finds that the proposed use will not create significantly more vehicular traffic by patrons, residents, or suppliers than the uses and structure currently*

*within 300 feet of the proposed structure that generates the most vehicular traffic (i.e. the former Jordan Acres Elementary School building).*

- C. The proposed use will not operate or require deliveries earlier in the morning, or later at night, than the uses and structures currently within 300 feet of the proposed use or structure that operate earliest in the morning and latest at night.**

*As noted above in Subsection B, the proposed school will require routine deliveries of milk and food in order to prepare meals for students. In addition to routine food deliveries, the applicant provided a list of other anticipated deliveries such as solid waste service and vendor deliveries. The earliest service or delivery will be scheduled after 7:30 AM and the latest will be before 5:00 PM.*

*The Planning Board finds that the proposed use will not operate or require deliveries earlier in the morning, or later at night, than the uses and structures currently within 300 feet of the proposed use or structure that operated earliest in the morning and latest at night.*

- D. The proposed use shall not create any more adverse impacts on any current use or structure within 300 feet of the lot on which the proposed use or structure would be located.**

*The applicant provided a comprehensive analysis of the development review standards provided in the Brunswick Zoning Ordinance in Chapter 4 with respect to anticipated impacts within 300 feet of the subject lot. Staff note the proposed site development is subject to Major Development Review upon issuance of the Special Permit.*

*The Planning Board finds that the proposed replacement and expanded school is not expected to create any more adverse impacts on any current use or structure within 300 feet of the lot on which the proposed structure will be located.*

- E. The application shall further the planning goals of the adopted Town of Brunswick 2008 Comprehensive Plan, as amended, including but not limited to the planning goals for the Planning Area (Appendix A - Planning Areas) in which the property is located.**

*Town of Brunswick 2008 Comprehensive Plan, Chapter 7.D.1: Town Core*

*The proposed building is the replacement and expansion of an existing school building within a residential neighborhood. As allowed in the Town Core, the proposal is a moderate scale non-residential municipal facility. With the exception of the footprint of the proposed building, the remaining site improvements are designed to conform to the applicable dimensional requirements of the GR8 Zoning District which are intended to protect and enhance the existing development patterns of established neighborhoods. Additionally, the proposed school facility will further the strategic planning goals and*

*performance targets of the comprehensive plan by addressing the educational needs of Brunswick as set forth by the Brunswick School Board.*

*The Director of Planning and Development, Anna Breinich recommended conserving the undeveloped lot referenced as Map 54, Lot 14 in furtherance of the vision statement for the Town Core in the comprehensive plan. The staff recommends the protection of existing green spaces and recreational trails offered at the subject lot in perpetuity with a conservation easement.*

*The Planning Board finds the application furthers the planning goals of the Town Core.*

**F. With the exception of applications for Special Permits for nonconforming building footprint expansions (Subsection 5.2.4), if the application involves the construction of a new building, or the substantial expansion of an existing building, the size of the resulting building shall meet the applicable zoning district dimensional and density standards as stated in Tables 4.2.3 and 4.2.4 (Dimensional and Density Standards for Growth and Rural Areas respectively).**

*The Planning Board finds that the application meets the exception criteria for applications for Special Permit for a nonconforming building footprint expansion. Therefore, the proposed building expansion is not required to meet the GR8 dimensional standards for maximum building footprint per structure of 5,000 square feet.*

**G. If the proposed use or structure is located in a Planning Area(Appendix A - Planning Areas) where pedestrian oriented character is encouraged, the use shall generate patron or resident activity (not just employee activity) during normal business hours, and the majority of the front façade of the building shall be consistent with existing setbacks on street.**

*The proposed use is within the Town Core area where pedestrian oriented character is encouraged. The Co-Chair of the Brunswick Bicycle and Pedestrian Advisory Committee provided an informal review of the proposed development. Based on those comments, the applicant revised the site plan with crosswalks in public ways, and additional bicycle racks to accommodate students and staff. The staff recommend further review of the site plan by the Bicycle and Pedestrian Advisory Committee (BBPAC) as a whole at the time of development review. The application provides an analysis of existing pedestrian use by residents which indicates the new school building will maintain pedestrian character and access through the site, between Jordan Avenue and Merrymeeting Road, and to the adjacent town owned parcel to the north. Although the proposed building is setback farther from Jordan Avenue than existing residential structures on Jordan Avenue, the proposed front façade of the proposed building is in close proximity to the former school building.*

*The Planning Board finds that the use generates patron and resident activity during normal business hours, and the majority of the front façade of the building is consistent with existing setbacks on Jordan Avenue.*

**H. The proposed use will not generate more noise at any time of the day or night than any use within 300 feet of the proposed use or structure that currently generates the most noise at that time.**

*The existing and proposed use of the site is a school which currently generates the most noise within 300 feet of the site. Therefore, the proposed use is reasonably expected to generate more noise than the residential uses in the neighborhood. Based on the information provided in the application, the only anticipated increase in noise from the former school facility is from the additional children and staff using the outdoor play facilities as a result of increased enrollment at the expanded school building.*

*The Planning Board finds that the proposed use will not generate more noise at any time of the day or night than any use within 300 feet of the proposed use or structure that currently generates the most noise at that time.*

**I. The proposed building footprint expansion shall comply with all other applicable zoning district dimensional standards.**

*Except for the size of the building, the proposed building will comply with all other dimensional standards applicable to GR8.*

*The Planning Board finds that the proposed building footprint expansion complies with all other zoning district dimensional standards.*

**J. The proposed expansion shall comply with Section 4.12 (Neighborhood Protection Standards).**

*The applicant provided an analysis of all Neighborhood Protection Standards in Section 4.12 of the Brunswick Zoning Ordinance. Provisions to meet building height limits, avoid light trespass beyond property lines, providing a six (6) foot tall opaque buffer from residential uses, screening for roof mounted heating, ventilation, air conditioning, and energy producing equipment, reasonable operating hours for nonresidential uses (between 7:00AM - 11:00 PM), and avoiding unreasonable loud noises are provided.*

*The Planning Board finds that the proposed expansion complies with Section 4.12 (Neighborhood Protection Standards).*

## **APPROVED MOTION**

**Motion 2:** That the Special Permit is approved with the following condition:

1. That the Board's review and approval does hereby refer to these findings of fact, the plans and materials submitted by the applicant and the written and oral comments of the applicant, his representatives, reviewing officials, and members of the public as reflected in the public record. Any changes to the approved plan not called for in these conditions of approval or otherwise approved by the Director of Planning and Development as a minor modification shall require a review and approval in accordance with the Brunswick Zoning Ordinance.

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### **Planning Board Approval of Special Permits**

If the Planning Board votes to approve a Special Permit, that approval shall not take effect for 30 days after the Planning Board's vote. During that 30 day period, the Town Council may elect to exercise jurisdiction over the application. Decisions to exercise jurisdiction shall be made by a majority vote of the Town Council during a public meeting.

### **Planning Board Denial of Special Permits**

If the Planning Board denies an application for Special Permit, the Planning Board's decision is not subject to any appeal. However, the applicant may apply to the Town Council for a zoning amendment as provided for in Section 5.2.11 (Ordinance Text or Map Amendment) of the Town of Brunswick Zoning Ordinance.

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**TOWN OF BRUNSWICK DEVELOPMENT REVIEW PERMIT**

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**PLANNING BOARD**  
**Major Development Review**  
**APPROVED Findings of Fact**  
**Review Date: February 27, 2018**

**Project Name:** Jordan Acres Elementary School  
**Project Location:** Jordan Avenue  
**Tax Map:** Map U06, Lot 5 and Map 54, Lot 14  
**Zoning District:** GR8  
**Case Number:** 17-060  
**Applicant:** Paul Perzanoski, Superintendent  
Brunswick School Department  
46 Federal Street  
Brunswick, ME 04011

**Authorized Representative:** Andrew Johnston  
Atlantic Resource Consultants  
541 US Route One, Suite 21  
Freeport, ME 04032

*Staff reviewed the application and has determined it is complete.*

**APPROVED Motion 1:** That the Final Subdivision Plan is deemed complete.

**PROJECT SUMMARY**

Staff review is based on the Major Development Review application for, “New Jordan Acres Elementary School” as revised most recently on February 20, 2018. The Town of Brunswick’s Staff Review Committee (SRC) reviewed the development proposal on February 14, 2018. The SRC meeting notes are included in the Planning Board packet. The proposed activity involves the demolition of an existing school building and the construction of a new school building, access driveways, parking, pedestrian and bicycle pathways, and associated utility and stormwater management improvements on Jordan Avenue in Brunswick (Map U06, Lot 5 and Map 54, Lot 14).

**Review Standards from Section 4.2 of the Town of Brunswick Zoning Ordinance**  
**4.1 Applicability of Property Development Standards**

The subject property is located within the GR8 Zoning District. The project received a special permit for the school building’s non-conforming building footprint expansion. With respect to the special permit approval for the building footprint and in consideration of the proposed site features, the development complies with property development standards set forth in Chapter 4 of the Zoning Ordinance. The building footprint dimensions were clarified by the applicant to include about 1,590 square feet of canopy areas at the entrances to the building. The canopy areas were previously not included in the overall footprint calculations. The Planning Board



found the additional square footage to be a de minimis increase from the non-conforming building footprint approved in the Special Permit. *The Board finds that the provisions of Section 4.1 are satisfied.*

#### **4.2 Dimensional and Density Standards**

The existing school building footprint is approximately 48,700 square feet and the proposed school building footprint is approximately 70,900 square feet. The maximum building footprint per structure allowed within the GR8 Zoning District is 5,000 square feet. Therefore, the proposed building exceeds the dimensional standards of GR8.

On January 9, 2018, the Planning Board voted unanimously to approve a Special Permit application to expand the nonconforming building footprint of Jordan Acres Elementary School in accordance with Subsection 5.2.4 of the Brunswick Zoning Ordinance. On January 16, 2018, the majority of the Town Council voted to not exercise jurisdiction on the Special Permit application on the elementary school. As a result of the approved Special Permit, the proposed school building footprint meets the dimensional standards for maximum building footprint per structure.

The applicant provided a table on the site plan which indicates the development complies with all dimensional standards of the GR8 Zoning District. Density standards are not applicable since the project does not contain a residential use. *The Board finds that the provisions of Section 4.2 are satisfied.*

#### **4.3 Natural and Historic Areas**

- 4.3.1 Mapping of Natural and Historic Areas Requirements. With the exception of wetlands depicted on the site plan, the applicant found no features important to the natural, scenic, and historic character of the Town or that add to the visual quality of the development. The Planning staff advised the applicant to place formal conservation restrictions on the remaining undeveloped portion of the subject parcel but the applicant respectfully declined. Except for the installation of a stormwater outfall, the applicant has no plans at this time to disturb the abutting forested lot.
- 4.3.2 Pollution. The applicant provided a soils report and plans for the treatment of stormwater runoff. The proposed development requires approval from the Maine Department of Environmental Protection (DEP) pursuant to the Site Location of Development Act. Additionally, the stormwater treatment plan will require review and approval pursuant to the Stormwater Management Law (Stormwater Law). Based on the information provided, the proposed development will not result in undue water or air pollution.
- 4.3.3 Protection of Natural Vegetation. The proposed development maximizes the reuse of existing developed land and minimizes vegetation disturbance to the extent practicable. The landscaping plan includes a robust assortment of native grasses, shrubs, and trees. All new plantings will be maintained as natural site features in accordance with subsection 4.15. Therefore, the proposed development maximizes the preservation of natural landscape

features, does not occur within or cause harm to land not suitable for development, and will not have an undue adverse effect on the area's scenic or natural beauty.

- 4.3.4 Protection of Significant Plant and Animal Habitat. The proposed development is not within the Wildlife Habitat Overlay, and no other mapped significant plant and animal habitats were identified during review. Therefore, the proposed development will not have an undue adverse effect on important plant and animal habitats identified by the Maine Department of Inland Fisheries and Wildlife or Town of Brunswick, or on rare and irreplaceable natural areas, such as rare and exemplary natural communities and rare plant habitat as identified by the Maine Natural Areas Program.
- 4.3.5 Steep Slopes: The development site does not contain 5,000 square feet or more of contiguous slopes exceeding 25 percent. Therefore, Section 4.3.5. is not applicable.
- 4.3.6 Erosion and Sedimentation. The proposed development is designed in accordance with the Maine Department of Environmental Protection's Best Management Practices (BMPs) to avoid causing unreasonable soil erosion or a reduction in the land's capacity to hold water so that a dangerous or unhealthy situation results. An erosion and sedimentation control plan is provided.
- 4.3.7 Groundwater. The stormwater management plan is designed to meet the Maine DEP's BMP standards which avoid and minimize impacts to groundwater. Provided the Stormwater Law permit is approved by the Maine DEP, the development will not, alone or in conjunction with existing activities, have an undue adverse effect on the quality or quantity of groundwater.
- 4.3.8 Surface waters, Wetlands, and Marine Resources. The plans and reports for wetlands and stormwater management that were evaluated during review were prepared by qualified professionals. Based on the information provided, the proposed development will have no undue adverse effect on wetlands, waterbodies, and their shorelines within the watershed of the development site.
- 4.3.9 Historic and Archeological Resources. No historic or archeological resources were identified within the project area. Therefore, the proposed development will have no undue adverse effect on any historic or archeological resources.

*The Board finds that the provisions of Section 4.3 are conditionally satisfied upon approval of the Site Location of Development Act permit by the Maine DEP.*

#### **4.4 Flood Hazard Areas**

The proposed development is not located in a Flood Protection Overlay (FPO) District or Flood Hazard Area. *The Board finds the risk of flooding for the proposed development is not applicable.*

#### **4.5 Basic Municipal Services**

- 4.5.1. Sewage Disposal. Adequate sewage waste disposal will be provided by existing public sewer connections. The Brunswick Sewer District reviewed the

project, and the proposed sewer connection was determined to not cause an unreasonable burden on municipal surfaces.

4.5.2. Water Supply and Quality. The application states that a short main extension will be required from the existing terminus in Merrymeeting Road to the northern property line from where the fire and domestic water services to the new building will be taken. Water for fire and domestic use will be provided via the system owned and operated by Brunswick and Topsham Water District. The Brunswick-Topsham Water District confirmed their ability to serve the project. The development will have sufficient water for the reasonably foreseeable needs of the development, and no undue adverse impact on existing water supplies are anticipated.

4.5.3 Solid Waste Disposal. The proposed development is the replacement of a former school which will not generate significant quantities of solid waste during normal operations. Therefore, the proposed development will not cause an unreasonable burden on the municipalities ability to dispose of solid waste.

4.5.4. Stormwater Management. The proposed development is designed to minimize the total area of impervious surface on the development site. The proposed development incorporates stormwater management measures to minimize runoff volume and rate, as well as pollutant and nutrient loadings, from the site. The proposed activity requires a Site Location of Development permit, which is required to meet the Stormwater Management Law standards for stormwater treatment and is therefore deemed to have met the requirements of this subsection upon Maine DEP approval of the permit. *The Board finds that the provisions of Section 4.5 are conditionally satisfied upon Maine DEP approval of the Site Location of Development permit.*

#### **4.6 Landscaping Requirements**

Existing forested areas that buffer the site from abutting properties will be maintained. An existing stand of trees provides some screening on the east side of the subject lot. New native plantings will be installed to enhance proposed structures and parking areas. In accordance with the specific standards of Section 4.6.1-4.6.6., the proposed development enhances structures, parking areas and other site improvements, and minimizes the developments effect on abutting properties. Existing vegetation and grades (topography) are maintained wherever practicable. *The Board finds that the provisions of Section 4.7 are satisfied.*

#### **4.7 Residential Recreation Requirements**

The proposed development is not a residential use. Therefore, residential recreation requirements are not applicable. *The Board finds that the provisions of Section 4.6 is not applicable.*

#### **4.8 Circulation and Access**

The applicant provided supporting documentation for circulation and access with a traffic assessment from a licensed traffic engineer; and a report of recent crashes within the area. The Brunswick Bicycle and Pedestrian Advisory Committee (BBPAC) reviewed the proposed entrance, parking lot layout, pedestrian and bicycle access, and internal travel way and voted unanimously of those present to recommend

approving the plan as proposed. During the BBPAC meeting, the Planner requested additional information regarding the width of Charles Court and the vehicle and pedestrian access, specifically, for any anticipated conflict between two (2) way vehicles moving during winter conditions when snow may narrow the road corridor. The agent indicated that the road width provides 10-foot lanes and a raised sidewalk. The raised sidewalk would adequately protect pedestrians from vehicles but the travel lanes are narrower than the typical 11-foot width. Further narrowing of the road from snow accumulation was not found to be a concern with routine snow removal. Although the existing road width is limited, the applicant's agent advised that large trucks would be able to pass each other going opposite directions on Charles Court but would likely need to slow down quite a bit due to lack of clearance between vehicles. Based on the information provided, the development will not cause unreasonable congestion or unsafe conditions on highways or public roads, either existing or proposed, and the traffic associated with the development shall maintain the existing Level of Service on any public road within 200 feet of any existing or proposed curb-cut. *The Board finds that the provisions of Section 4.8 are satisfied.*

#### **4.9 Parking and Loading**

The SRC reviewed the plans and advised the proposed development provides adequate off-street parking and loading/unloading areas for motor vehicles and bicycles. *The Board finds that the provisions of Section 4.9 are satisfied.*

#### **4.10 Lighting**

The proposed lighting plan was reviewed by the SRC. All lighting is within the neighborhood protection standards. Except for security lighting, exterior lights will be adjusted to turn off at 10:00 PM. Outdoor lighting will not adversely impact road safety or adjacent properties and uses. *The Board finds that the provisions of Section 4.10 are satisfied.*

#### **4.11 Architectural Compatibility**

The proposed buildings were designed by a professional architect with design review oversight from a citizen advisory committee organized by the Town of Brunswick. The proposed development is compatible with its architectural surroundings in terms of its size, mass, and design. *The Board finds that the provisions of Section 4.11 are satisfied.*

#### **4.12 Neighborhood Protection Standards**

The proposed development is designed to be compatible with existing neighboring residential dwellings with an opaque fence along the property boundary to the south; a 200-foot fence to the north nearest to the proposed school building; and new plantings to buffer the school from the neighborhood. As a result of neighborhood preferences, the applicant revised the north and west property line fence with plantings rather than an opaque fence. *The Board finds that the provisions of Section 4.12 are satisfied.*

#### **4.13 Signs**

Preliminary sketches are provided in the application. The proposed signs must be compatible in design and scale with its surroundings and shall not unreasonably interfere with the safe operation of adjoining roads, sidewalks, parking areas, or uses. *The Board finds that the provisions of Section 4.13 are satisfied upon approval of the sign permit.*

#### **4.14 Performance Standards**

The proposed development is an elementary school with normal operating hours in conformance with Neighborhood Protection Standards in Section 4.12. No exceedance in Section 4.14 standards is anticipated. *The Board finds that the provisions of Section 4.14 are satisfied.*

#### **4.15 Site Feature Maintenance**

The proposed development contains new site features such as landscaping, outdoor lighting, parking area, and an anticipated sign (as noted in Section 4.13). In accordance with Section 4.15 standards, this finding serves to advise the applicant that site features constructed or installed as required by this development approval must be maintained in good repair, and replaced if damaged or destroyed, or in the case of living materials, if they die or are effectively destroyed after installation. *The Board finds that the provisions of Section 4.15 are satisfied.*

#### **4.16 Financial and Technical Capacity**

The project will be financed locally through municipal bonds, as approved by a community-wide referendum vote in June 2017. The applicant has adequate financial and technical capacity to meet the standards of the proposed development. *The Board finds that the provisions of Section 4.16 are satisfied.*

#### **4.17 Administrative Adjustments / Alternative Equivalent Compliance**

In response to requests from abutters to the subject parcel, an alternative equivalent to the opaque buffer required for Brunswick's Neighborhood Protection Standards will be utilized as described in subsection 4.12 and depicted on the site plan. No administrative adjustment is proposed by the applicant at this time. *The Board finds that the provisions of Section 4.17 are satisfied.*

### **APPROVED MOTIONS**

#### **CASE #17-060**

**Motion 2:** That the Final Plan is approved with the following conditions:

1. That the Board's review and approval does hereby refer to these findings of fact, the plans and materials submitted by the applicant and the written and oral comments of the applicant, his representatives, reviewing officials, and members of the public as reflected in the public record. Any changes to the approved plan not called for in these conditions of approval or otherwise approved by the Director of Planning and Development as a minor modification shall require a review and approval in accordance with the Brunswick Zoning Ordinance.

## 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 other Division 01 Specifications apply to this section
- B. 310000 – Site Clearing
- C. 312513 – Erosion Controls

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, stormwater BMPs, and all other subgrade surfaces required for this project.
  - 2. Excavating and backfilling for site improvements and structures. This includes removal and replacement of unsuitable materials underlying the proposed building footprint, and other designated areas of the site.
  - 3. Preparation of building pad including excavation and backfill of foundations, footings, floor slabs and underslab utilities.
  - 4. Moisture condition and/or chemically treat excavated soils as necessary to provide workable fill material that will meet the compaction specifications and maximize reuse of existing soils.
  - 5. Subbase course for walks and pavements.
  - 6. Subbase and base course for asphalt paving, athletic track and field surfaces.
  - 7. Excavating and backfilling for utility trenches.

#### 1.3 DEFINITIONS

- A. Backfill: Soil 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.
- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from on or off-site for use as fill or backfill.
- E. Drainage Course: Course supporting the slab-on-grade in areas where underslab drainage is required 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 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.
3. Classification

Excavation is classified as common excavation, or rock excavation, in accordance with the following definitions.

- a. Common excavation is defined as the excavation of all materials that can be excavated, transported, and unloaded using heavy ripping equipment and wheel tractor-scrapers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by excavators equipped with attachments (shovel, bucket, backhoe, dragline, or clam shell) appropriate to the material type, character, and nature of the materials. Excavation of existing structures, foundations and other improvements shall be included in the definition of common excavation.
- b. Rock excavation is defined as the excavation of rock in stratified, or unstratified masses that require blasting or the use of ripping and excavating equipment larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than 3 cubic yards encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation. The presence of isolated boulders or rock fragments larger than 3 cubic yards is not in itself sufficient cause to change the classification of the surrounding material.
- c. For the purpose of these classifications, the following definitions shall apply:
  - 1) Heavy ripping equipment is a rear-mounted, heavy duty, single-tooth, ripping attachment mounted on a track type tractor having a power rating of at least 250 flywheel horsepower unless otherwise specified.
  - 2) Wheel tractor-scraper is a self-loading (not elevating) and unloading scraper having a struck bowl capacity of at least 12 cubic yards.
  - 3) Pusher tractor is a track type tractor having a power rating of at least 250 flywheel horsepower equipped with appropriate attachments.
- d. Rock excavation is further classified in accordance with the following definitions:
  - 1) Trench Rock Excavation – The excavation and removal of rock specifically encountered within a trench excavation required for

the construction of utility and storm drain trenches, utility and storm drain structures and linear, or pier footings. Rock removal in areas where mass excavation is required to meet subgrade, and trenches are to be constructed above the surrounding subgrade is excluded from this definition.

- 2) Mass Rock Removal – definition – All excavation and removal of rock not specifically associated with trench excavation as described above, regardless of the method proposed for removal.
- G. Over-excavation: Removal of unsuitable material (existing fills and relic topsoil) encountered below subgrade elevation (required below structures and walls).
- H. Fill: Soil materials used to raise existing grades.
- I. Structures: Buildings, footings, foundations, retaining walls, slabs, curbs, electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or material placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- M. Zone of Influence (ZOI): The area below footings, or surface structures or finishes, and below imaginary lines that extend 2 ft laterally beyond the footing outer bottom edges and down on a 1H:1V slope to suitable bearing material.
- N. Pipe Zone: The pipe zone is considered to be the area from the invert of the pipe to 6 inches above the crown of the pipe.
- O. Pipe Bedding: Pipe bedding is the material placed between the bottom of the trench and the invert of the pipe.

#### 1.4 PROJECT CONDITIONS

- A. 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. A private utility detection service will be required to identify utilities within the school property. This work is considered incidental and the cost shall be included in the Base Bid Contract Sum.

#### 1.5 SUBMITTALS

- A. General
  1. Unless otherwise noted, Contractor shall forward submittals to the Engineer a minimum of two weeks prior to any planned work related to the Contractor's submittals.
  2. The time period(s) for submittals are the minimum required by the Engineer to review, comment and respond to the Contractor. The Engineer may require resubmission(s) for various reasons. The Contractor is responsible for scheduling specified submittals and resubmittals so as to prevent delays in the work.



3. The Contractor's submittals shall be reviewed and accepted by the Engineer prior to conducting any work.
  4. Acceptance of the Contractor's submittals by the Engineer does not relieve the Contractor of responsibility for the adequacy, safety and performance of the work.
- B. Excavation and Backfilling
1. A plan showing delineated site "haul roads" for heavy construction equipment such as articulated trucks and scrapers.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide satisfactory borrow soil materials when sufficient satisfactory soil materials are not available from excavations. In general, the Owner's intent is to encourage the use of onsite excavated materials for subgrade fills subject to the material requirements provided herein.
- B. Satisfactory Soils: The soils suitable for use on the site vary with the proposed location and may include
1. Granular Borrow, Structural Fill, Base and Subbase Course gravels, Underdrain sand, Crushed Stone, Sand Pipe Bedding and Initial Backfill, and Filter Soil Material, as defined below
  2. Excavated on-site loamy sand soils, as long as the material meets the Unified Soil Classification System gradations for clean sand, or clean gravel (soil classification groups GW, GP, SW, or SP).
- C. Unsatisfactory Soils: Any soils not meeting the criteria listed in Section 2.1 (B), above.
- D. Common Borrow: Common borrow shall consist of earth suitable for embankment construction. It shall be free from frozen material, peat, rubbish and other unsuitable material. In no case shall the moisture content exceed 2% above optimum, which shall be determined in accordance with AASHTO T180, Method C or D.
- E. Subbase Course: Maine DOT 703.06 Type D. (Maximum Particle Size of 4 inches)
- F. Base Course: Maine DOT 703.06 Type A. (Maximum Particle size of 2 inches)
- G. Granular Borrow: Maine DOT 703.19 with a maximum particle size of 4 inches.
- H. Underdrain Sand: Maine DOT 703.22 Underdrain Backfill Type B.
- I. ¾" Crushed Stone: Maine DOT 703.12 Aggregate for Crushed Stone Surface.
- J. Stone for roof drip edge surface: Clean, rounded river stone 2"-6" in size, suitable for use in gabion baskets.
- K. Crushed Stone Pipe Bedding and Initial Backfill: Maine DOT 703.22 Backfill for Underdrain Type C.
- L. Sand Pipe Bedding and Initial Backfill: Maine DOT 703.01 Fine Aggregate for Concrete.
- M. Filter Soil Material for use in Grassed Underdrained Soil Filters and Bioretention Cells: The filter soil bed shall consist of a single layer of material per the latest version of the Maine Stormwater Management Design Manual.
1. Filter soil material for underdrained soil filters and bioretention areas shall comprise a single layer of filter soil media eighteen inches (18") deep. The

filter soil material shall consist of a mix of fine sand, sandy loam topsoil, and superhumus. The resulting mix shall have an organic content of not less than 6%, approximately 8-12% passing the #200 sieve and less than 2% clay. Gradation and testing information on each of the constituents, and the final mixed material shall be submitted to the project engineer for review a minimum of two weeks prior to any installation. It should be noted that excavated on-site topsoil may meet the requirements for this material, subject to the approval of Contractor submitted test results. by the engineer.

- N. Structural Fill: Structural fill shall be used as fill below foundations, ground floor slabs, and as backfill within five feet (5') of the footings, piers, and foundation walls. Structural fill shall be sand and gravel mixture free of roots, topsoil, loam, organic material, and any other deleterious materials, as well as clods of silt or clay, and meet the following gradation requirements:

Sieve Size	Percent Passing By Weight
4-inch	100
3-inch	90 to 100
¼ inch	25 to 90
No. 40	0 to 30
No. 200	0 to 5

## 2.2 GABION BASKETS

- A. Gabion baskets shall be double twisted hexagonal woven galvanized steel wire mesh baskets with rectangular box shape wire mesh gabions. Gabion baskets shall be made in America and constructed to ASTM A975-97 specifications.
1. Baskets shall have a nominal width of six feet, a nominal height of twelve inches and a nominal length of twelve feet, divided into three foot long compartments.
  2. Gabion mesh size shall be 2 ½" x 3 ¼"
  3. Manufacturers/Suppliers: Gabion Supply – [www.gabionsupply.com](http://www.gabionsupply.com), Tel: 1-866-391-6295, or approved equal.

## 2.3 ACCESSORIES

- B. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility with a separate metallic "tracer". This is required for all non-metallic utility lines except "straight runs" of sewer lines and storm drains between manholes.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. The earthwork shall be conducted in accordance with the more stringent of the project Geotechnical Report, and these specifications. All cost for moisture conditioning and complying with the Contract Documents is part of the base bid.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

- C. Designated haul roads shall be established by the Contractor at the beginning of earthwork operations to minimize damage to soil subgrades resulting from construction vehicle traffic. The use of geotextile fabric and/or geogrid to stabilize haul road subgrades shall be included by the Contractor as part of the base bid.
- D. Preparation for demolition operations
  - 1. The Contractor shall contact governing utility service representatives prior to starting work at the site.
  - 2. The Contractor shall arrange for metered temporary construction water service to be provided for dust control and as otherwise necessary to support demolition activities. The cost of water service for use in dust control and to assist with demolition shall be the responsibility of the Contractor.
  - 3. All topsoil, peat, organic material, debris, rubbish, frozen soils, muck, loose, or disturbed soils and other disturbed materials shall be removed from the area of new construction. Topsoil may be stockpiled on the site, outside the future construction area for reuse in landscaped areas. Other materials may be stockpiled temporarily on-site prior to classification and/or disposal.
  - 4. Excavations will generally encounter existing site and structure improvements, including foundations and utilities, and native sandy soil materials. The soils can be excavated with conventional earthwork equipment.
  - 5. Groundwater was observed at eight and one-half feet below grade in one of the six test pits excavated at the site by SW Cole Engineering, Inc in 2013.
- E. Preparation for earthwork operations
  - 1. All topsoil, peat, organic material, debris, rubbish, frozen soils, muck, loose, or disturbed soils and other disturbed materials shall be removed from the area of new construction. Topsoil shall be stockpiled outside the construction area for reuse in landscaped areas, or lawns. Unsuitable materials include uncontrolled fills (i.e. fills placed without systematic densification and moisture control to an acceptable compaction percentage), asphaltic pavement, and other deleterious substances.
  - 2. All unsuitable materials shall be removed from the area beneath the proposed building footprint and within the Zone of Influence below footings and structures.
  - 3. Excavation work will generally encounter granular fills and native sands and silty sands. Care must be exercised during construction to limit disturbance of the bearing soils. Earthwork and grading activities should occur during non-freezing weather of Spring, Summer and Fall. Final cuts to subgrade should be performed with a smooth-edged bucket to help reduce strength loss from soil disturbance.
  - 4. Groundwater was observed at eight and one-half feet below grade in one of the six test pits excavated at the site by SW Cole Engineering, Inc in 2013. Sumping and pumping dewatering techniques should be adequate to control groundwater in excavations to within 1 foot of groundwater. Excavations below groundwater will likely require sheetpile shoring and dewatering systems. Controlling the water levels to at least one foot below planned excavation depths will help stabilize subgrades during construction. Excavations must be properly shored or sloped in accordance with OSHA Regulations to prevent sloughing and caving of the sidewalls during construction. Care must be taken

to preclude undermining adjacent structures, utilities and roadways. The design and planning of excavations, excavation support systems, and dewatering is the responsibility of the contractor.

- F. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing." during earthwork operations.
- G. Due to the previously developed nature of the site, the Project Contractor and their Subcontractors should be sensitive to the potential of encountering obstructions such as remnants from prior structures and buildings, associated foundations, and underground utilities (note: both active and abandoned) during site and earthwork activities. It is anticipated that obstructions may include, but not limited to, conduits, electrical and communications lines, and irrigation piping. Where such items are encountered beneath the proposed construction limits, they should be excavated to their full extent, removed, and replaced with compacted structural fill. The building pad shall be proofrolled and densified with at least three (3) passes of a ten ton smooth drum roller prior to excavating for footings. Areas that become soft and yielding shall be removed and replaced with Granular Borrow.
- H. The Contractor shall be responsible for locating and removing asbestos containing pipe materials intact, without sanding, grinding, abrasion or cutting with mechanical cutters. Each section must be removed using best management practices such that a minimum amount of breakage occurs during the initial removal of fasteners, other attaching system or decoupling, and the product remains intact throughout the remainder of the removal and containerization process. The Contractor shall be responsible for the cost of abatement and removal of asbestos containing pipe materials broken during the demolition process. **All abatement and transportation of asbestos containing materials shall be undertaken in strict accordance with Maine Department of Environmental Protection Maine Solid Waste Management Rules, Chapter 425 - Asbestos Management Regulations, and all other applicable State and Federal regulations.**

### 3.2 EXCAVATION FOR STRUCTURES AND SITE IMPROVEMENTS

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
- B. Remove all organic soils, unsuitable materials and unconsolidated fill materials within the ZOI of footings or slabs to expose naturally deposited soils.
- C. Excavation of bearing surfaces in soil or fill should be performed by earthwork equipment fitted with smooth-edged buckets. Final subgrade preparation should include compaction of fill or naturally deposited soil subgrades with vibratory compaction equipment. Following compaction and prior to placement of imported materials, care should be taken to limit disturbance of the bearing surfaces. Any loose, softened, or disturbed material due to construction traffic should be removed prior to placement of imported materials, and backfilled with compacted structural fill.
- D. The integrity of natural soils and fill must be maintained during cold weather conditions. Footing and slab subgrades should not be allowed to freeze. The Contractor shall take precautions to ensure subgrade soils are protected at all times. In the event frost penetration occurs, all frozen and previously frozen soils should be removed and replaced with compacted structural fill. At no time should frozen material be placed as fill.
- E. Excavation measurement and pay dimensions shall extend 12" beyond the footing or slab.

### 3.3 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.
- B. Remove all man placed fill, topsoil, organic matter, and debris encountered within the footprint of site improvements and structures.
- C. Proof-rolling should be performed using at least three passes with a ten ton smooth drum roller. Proof-rolling should not be performed over culverts, pipes, conduits, or other underground construction that might be damaged by the proof-roller. Soft areas or areas that yield excessively during proof-rolling should be over excavated and replaced with Granular Borrow. Soft areas or areas that yield excessively are characterized by weaving or rutting more than one inch deep.

### 3.4 EXCAVATION FOR UTILITY, STORM DRAIN AND UNDERDRAIN TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following trench width. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
- C. A minimum and pay width of 2'-6" for conduits up to 6" diameter.
- D. A minimum of 3'-0" or 4/3 the pipe inside diameter plus 1'-6" for conduits over 18".
- E. 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.
- F. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

### 3.5 SUBGRADE INSPECTION

- A. Proof-roll subgrade consisting of granular soils (engineered fill or glacial till) below slabs and under pavement as outlined in paragraph 3.3.C above. Any soft pockets, areas of excess yielding, or areas disturbed during excavation and construction shall be over excavated and replaced with Granular Borrow. Do not proof-roll wet or saturated subgrades or subgrades.
- B. The exposed subgrade will be examined in the field by the Engineer to observe the strength and bearing capacity of the soils. Disturbed or soft soils, as judged by the Engineer, shall be excavated and replaced with suitable material without additional compensation.
- C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, or accumulated water, as directed by Engineer, without additional compensation.
- D. Overexcavate subgrades disturbed/damaged by construction vehicle traffic to the depth and plan limits directed by the Engineer. Replace disturbed soil with suitable material without additional compensation.

### 3.6 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings with compacted Structural Fill, or Granular Borrow, as directed by the Geotechnical Engineer.
- B. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

### 3.7 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 and erosion.
- B. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
- C. Stockpiles must be contained within permissible work and staging areas in accordance with the detail shown on the Drawings.

### 3.8 UTILITY, STORM DRAIN AND UNDERDRAIN TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. All utility trench backfill shall meet the standards and specifications of the governing utility.
- C. 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.
- D. Backfill trenches with excavated Satisfactory Soil material, Granular Borrow, or crushed stone.
- E. Place and compact pipe zone backfill to a height of 6 inches over the utility pipe or conduit.
- F. Carefully compact pipe zone backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- G. Place and compact trench backfill of excavated Satisfactory Soil to final subgrade elevation.
- H. Install warning tape directly above utilities as noted in Section 2.2, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

### 3.9 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.
  - 1. Place and compact fill material in layers to required elevations as follows:
  - 2. Under grass and planted areas, use satisfactory soil material.
  - 3. Under walks and pavements, use Granular Fill below base and subbase gravels.
- B. In open areas, structural fill should be placed in level, uniform lifts not exceeding 12 inches in uncompacted thickness and be compacted with self-propelled compaction equipment. In confined areas and within 5 feet of foundation walls, structural fill should be placed in lifts not exceeding 6 inches in uncompacted thickness and be compacted with hand-operated compaction equipment. All fill placed for footing and slab support should be structural fill compacted to at least 95 percent of the maximum dry density as determined by *ASTM Standard D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>))*.

### 3.10 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, aerate or chemically treat otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### 3.11 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Granular Borrow, Structural Fill and Satisfactory Soil: Place in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment and not more than 8 inches for material compacted with hand-guided equipment.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

Location	Minimum Compaction Requirements	Testing Frequency 1 Lift per:
Structures and Walkways	95 Percent	20,000 square feet
Trenches	95 Percent Bedding and 92 Percent Trench Zone	100 linear feet
Pavement Base and Subbase Areas,	95 Percent	5,000 square feet
Landscaped Areas and Grass Playing Fields	90 Percent Nominal Compaction	20,000 square feet

- D. Notify Architect 48 hours prior to potential heavy vibration activities.

### 3.12 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.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  1. Lawn or Unpaved Areas: Plus or minus ½ inch.
  2. Walks: Plus or minus ¼" with no "bird baths".
  3. Pavements: Plus or minus ¼" with no "bird baths".

### 3.13 SUBBASE AND BASE COURSES

- A. Place subbase and base course on stable, firm subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
  1. Shape subbase and base course to required crown elevations and cross-slope grades.
- C. Compact subbase and base course in maximum 8-inch lifts in uncompacted thickness 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 1557.

### 3.14 DRAINAGE COURSE

- A. Place drainage course on stable, firm subgrades free of mud, frost, snow, or ice.

- B. On prepared subgrade or filter fabric as shown on the Drawings, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
  - 1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
- C. Compact each layer of drainage course to required cross sections and thicknesses to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

### 3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades consisting of engineered fill materials, tests will be performed to verify that the compaction requirements are achieved. Geotechnical Engineer will visually inspect subgrade conditions in natural soils (glacial till), weathered rock or bedrock.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.

### 3.16 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 without additional compensation.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
- D. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.
- E. The in-situ sandy soils and gradation makes them susceptible to “loosening” if allowed to dry out. The contractor shall keep the soils moist and cover with a 12” layer of sand/soil mix approved to the geotechnical engineer of record.
- F. All areas where soil is placed shall not have standing water. The contractor shall keep water out of the work areas until backfill is complete or adequate provisions to protect the work have been taken by the Contractor.

### 3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil except loam and materials otherwise shown on the contract drawings, waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.



END OF SECTION 312000

## SECTION 312513 – EROSION CONTROLS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Temporary and permanent erosion control systems.

#### 1.2 RELATED SECTIONS

- A. Section 311000 – Site Clearing
- B. Section 312000 – Earth Moving
- C. Construction Requirements

#### 1.3 ENVIRONMENTAL REQUIREMENTS

- A. The Site Contractor shall protect adjacent properties and water resources from erosion and sediment damage throughout the life of the construction contract in accordance with the Erosion and Sediment Control plan, details and notes prepared for this project and in accordance with the requirements of the Maine Construction General Permit (MCGP). The Erosion and Sediment Control plan, notes and details have specific restrictions on work which must be completed prior to the start of other construction, seasonal work limits, the amount of area which can be exposed at a given time, the general sequence of construction, and Site Contractor monitoring responsibilities for documenting compliance with the erosion control plan for this project. These affect the scheduling of the work.

Protected resources as referred to in this document include wetlands, and trees or vegetation outside of the work limit.

Prior to grubbing, orange safety fence shall be installed between the limit of grading and any protected resource. When the protected resource is a tree, the safety fence shall be installed at the drip line of the tree. If disturbance of the root system occurs, the Site Contractor shall have an Arborist or Nurseryman inspect the root system and provide recommendations to preserve the tree. This information shall be included in the logs for the Erosion Control Plan maintained by the Site Contractor.

- B. The Site Contractor will be required to designate, by name, a suitably qualified individual, responsible for implementation of all erosion control measures as required by current local, State and federal regulations and this specification.

Specific responsibilities will include:

- 1. Assuring and certifying the Site Contractor's construction sequence is in conformance with the specified schedule. In addition, a weekly certification stating compliance, any deviations, and corrective measures shall be filed with the owner by this person. A copy of the certification form is contained the Erosion and Sedimentation Control plan, details and notes.

2. Inspection of the project work site on a weekly basis, with the installation of added erosion control measures in areas which appear vulnerable to erosion. The erosion and sediment measures shown on the contract documents are minimum provisions. Any additional measures required to comply with the permit or intent of the Erosion and Sedimentation Control plan shall be incidental to the contract.
  3. Inspection of all erosion control measures and drainage inlets after any significant rainfall. Accumulated silt/sediment should be removed when the depth of sediment reaches 50 percent of the barrier height. Accumulated silt/sediment should be removed from behind silt fencing when the depth of the sediment reaches 6 inches. A significant rainfall shall be defined as over ½ inch of precipitation in any consecutive 24-hour period.
  4. Inspect areas for catch of grass. A minimum catch of 90 percent is required prior to removal of erosion control measures.
  5. Maintaining precipitation records and monitoring forecast activity.
- C. It shall be the responsibility of the Site Contractor to implement, maintain, monitor and document compliance with the erosion and sediment control plan for the project and to avoid turbid discharges from the site, to avoid fugitive dust emissions, to avoid sediment from leaving the site, or affecting areas outside of the project work limits.

The work includes the submission of logs and photographic evidence of compliance with the plan at the time each pay requisition is submitted. These records shall be certified as complying with the Erosion Control Plan and this specification. Deficiencies in the logs or photographic records identified by the Owner or Engineer shall be corrected before the pay requisition is processed.

The photographic documentation must include:

1. A minimum of 10 digital photos per week showing the appropriate erosion control measures in place.
  2. Evidence of stabilization of areas that are not being actively worked.
  3. Documentation of any observed releases of turbid runoff or failure of any erosion control measure.
- D. The erosion control measures specified are required to be installed in accordance with the details provided with the construction plans and manufacturer's recommendations. The method and details of the installation of these erosion control methods are of vital importance to insure the effectiveness of the erosion control measures. While precipitation amounts cannot be predicted, the Erosion Control Plan is designed to minimize erosion by restricting the amount of the site that can be open at a given time, limiting the period that an area can be open without stabilization, and requiring weather forecasts to be monitored. It is a requirement of the contract documents that these methods be incorporated on the site.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Quick growing grasses for temporary seeding (see seed mixes contained in Erosion and Sedimentation Notes).
- B. Hay or straw bales.
- C. Fencing for siltation control as specified on the plans. Mirafi prefabricated silt fence or approved equal.
- D. Biodegradable double net coir fiber erosion control blanket – North American Green C-125BN or approved equal.
- E. Temporary mulches such as loose hay, straw, netting, wood cellulose or agricultural siltage.
- G. Stone Sediment Barriers or SiltSacks™, or approved equal for inlet protection.
- J. A stabilized construction entrance to be constructed of the materials identified on the contract drawings.
- K. Calcium chloride and water for dust control.
- L. Catch basin inserts. SiltSacks™ or approved equal.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Review site erosion control plan attached to this section of the specifications.
- B. Deficiencies or changes in the erosion control plan as it is applied to current conditions will be brought to the attention of the Engineer and Owner and a remedial action prepared and implemented by the Contractor.

### 3.2 EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

- A. Provide catalog cuts and information concerning the erosion control products which will be used for construction for review by the Owner.
- B. Provide information concerning the installation of the erosion sedimentation control including anchorage trench provisions anchorage devices, and spacing for review by the Owner.
- C. Place erosion control systems in accordance with the erosion control plan and in accordance with approved installation procedures.
- D. This contract limits the surface area of erodible earth material exposed any time by clearing and grubbing, excavation, borrow and embankment operations. The Owner has the authority to direct the Site Contractor to provide immediate permanent or temporary pollution control measures. The Site Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practical time to minimize the need for temporary controls. Cut slopes shall

be permanently seeded and mulched as the excavation proceeds to the extent considered desirable and necessary to comply with the erosion control plan.

- E. The temporary erosion control systems installed by the Site Contractor shall be maintained to control siltation at all times during the life of the Contract. The Site Contractor must respond to any maintenance or additional work to comply with this specification within a 48-hour period.
- F. DIRTBAGS® are required for the discharge of any construction dewatering or pumping, and the DIRTBAG® shall be operational before any trenching.
- G. Certain erosion control measures require staged restoration. For example, reinforced cuts must be completed in 5-foot vertical increments.
- H. Fugitive dust shall be controlled through construction.

### 3.3 CONSTRUCTION OF TEMPORARY EROSION CONTROL MEASURES

#### A. Perimeter Dike/Swale Construction

- 1. All perimeter dike/swale shall have uninterrupted positive grade to an outlet.
- 2. Diverted runoff from a disturbed area shall be conveyed to a sediment trapping device.
- 3. Diverted runoff from an undisturbed area shall outlet into an undisturbed stabilized area at non-erosion velocity.
- 4. The swale shall be excavated or shaped to line grade and cross section as required to meet the criteria specified in the standard.
- 5. Stabilization of the area disturbed by the dike and swale shall be done in accordance with the standard and specifications for temporary seeding and mulching, and shall be done within 10 days.
- 6. Periodic inspection and required maintenance must be provided after each rain event.

#### B. Silt Fence Construction

- 1. Woven wire fence to be fastened securely to fence posts with wire ties or staples. Posts shall be steel either 'T' or 'U' type or hardwood.
- 2. Filter cloth to be fastened securely to woven wire fence with ties spaced every 24" at top and mid section. Fence shall be woven wire, 12 ½ gauge, 6" maximum mesh opening.
- 3. When two sections of filter cloth adjoin each other, they shall be overlapped by six inches and folded. Filter cloth shall be either Filter X, Mirafi 100X, Stabilinka T140N, or approved equivalent.
- 4. Prefabricated units shall be Geofab, EnviroFence, or approved equivalent.
- 5. Maintenance shall be performed as needed and material removed when 'bulges' develop in the silt fence.

#### C. Stabilized Construction Entrance

- 1. Stone Size – Use 2" stone, or reclaimed or recycled concrete equivalent.
- 2. Length – Not less than 50 feet (except on a single residence lot where a 30 foot minimum length would apply).
- 3. Thickness – Not less than six (6) inches.

4. Width – Twelve (12) foot minimum, but not less than the full width at points where ingress or egress occurs. Twenty-four (24) foot if single entrance to site.
5. Filter Cloth – Will be placed over the entire area prior to placing of stone.
6. Surface Water – All surface water flowing or diverted toward construction entrances shall be piped across the entrance. If piping is impractical, a mountable berm with 5:1 slopes will be permitted.
7. Maintenance – The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-of-way, all sediment spilled, dropped, washed or tracted onto public rights-of-way must be removed immediately.
8. When washing is required, it shall be done on an area stabilized with stone and which drains into an approved sediment trapping device.
9. Periodic inspection and needed maintenance shall be provided after each rain.

#### 1.4 MULCH ANCHORING REQUIREMENTS

<b>Anchoring Method or Material</b>	<b>Kind of Mulch to be Anchored</b>	<b>How to Apply</b>
Peg and Twine	Hay or straw	After mulching, divide areas into blocks approximately 1 sq. yd. in size. Drive 4-6 pegs per block to within 2" to 3" of soil surface. Secure mulch to surface by stretching twine between pegs in crisscross pattern on each block. Secure twine around each peg with 2 or more tight turns. Drive pegs flush with soil. Driving stakes into ground tightens the twine.
Mulch Netting	Hay or straw	Staple the light-weight paper, jute, wood fiber, or plastic nettings to soil surface according to manufacturer's recommendations. Should be biodegradable. Most products are not suitable for foot traffic.
Wood Cellulose Fiber	Hay or Straw	Apply with hydro seeder immediately after mulching. Use 500 lbs. Wood fiber per acre. Some products contain an adhesive material, possible advantageous.
Mulch Anchoring Tool	Hay or Straw	Apply mulch and pull a mulch anchoring tool (blunt, straight discs) over mulch as near to the contour as possible. Mulch material should be "tucked" into soil surface about 3".
Chemical	Hay or Straw	Apply Terra Tack AR 120 lbs./ac. in 480 gal. of water (#156/ac.) or Aerospray 70 (60 gal/ac.) according to manufacturer's instructions. Avoid application during rain. A 24-hour curing period and a soil temperature higher than 45° Fahrenheit are required.

END OF SECTION 312513

## SECTION 321216 - ASPHALT PAVING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Placement of uniformly blended, homogenous binder course and surface course hot-mix asphalt pavement on an approved base, in accordance with the contract documents and in conformity with the lines, grades, thicknesses and typical cross sections shown on the Drawings, to construct roads, driveways, parking lots, sidewalks and walkways.

B. Related Requirements:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specifications apply to this section.
2. Section 312000 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
3. Section 321613 – Concrete Sidewalks and Exterior Slabs on Grade
4. Section 321600 - Curbing
5. Section 321723.13 Painted Pavement Markings
6. Town of Brunswick, Maine standards for road construction.

#### 1.2 REFERENCES

- A. State of Maine Department of Transportation (Maine DOT) Standard Specifications November 2014 Edition.
- B. MS-2 – Asphalt Mix Design Methods – The Asphalt Institute (AI)
- C. MS-4 The Asphalt Manual – The Asphalt Institute (AI)
- D. Hot Mix Asphalt Paving Handbook – U.S. Army Corps of Engineers, UN-13 (CE MP-ET)
- E. MS-19 Basic Asphalt Emulsion Manual - The Asphalt Institute (AI)
- F. ASTM D956 – Standard Specification for Penetration-Graded Asphalt Binder for Use in Pavement Construction
- G. AASHTO M-226/ASTM D-3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction
- H. AASHTO M-140/ASTM D-997 – Standard Specification for Asphalt Emulsion

- I. AASHTO M-117/ASTM D-242 -Standard Specification for Mineral Filler for Bituminous Paving Mixtures

### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: The Contractor shall schedule and conduct a pre-paving conference at Project site. The list of invited attendees shall include at a minimum the Project Engineer, Owners Representative, Third Party Testing Agency, General Contractor, Site Contractor and Paving Contractor.

### 1.4 ACTION SUBMITTALS

- A. Job Mix Formula: Before any asphalt pavement is installed, the Site Contractor, or his designated sub-contractor shall submit the proposed Maine DOT approved mixes proposed for use, signed by the Department. In no case shall a design mix over three years old be submitted. The JMF shall establish a single percentage of aggregate passing each sieve size within the limits shown in Maine DOT Specification Section 703.09. The mixture shall be designed and produced, including all production tolerances, to comply with the allowable control points for the particular type of mixture as outlined in Maine DOT Specification Section 703.09. The JMF shall state the original source, gradation, and percentage to be used of each portion of the aggregate including RAP when utilized, and mineral filler if required. It shall also state the proposed PGAB content, the name and location of the refiner, the supplier, the source of PGAB submitted for approval, the type of PGAB modification if applicable, and the location of the terminal if applicable. In addition, the Contractor shall provide the following information with the proposed JMF:
  1. Properly completed JMF indicating all mix properties (Gmm, VMA, VFB, etc.)
- B. Product Data: For each type of product and/or constituent material in the asphalt pavement mix.
- C. Field density test results, minimum 2 tests per 250 tons of asphalt pavement placed. Each test result shall be referenced by station/offset, or other suitable method of identifying the test location.
- D. Plant/equipment certification indicating that the batch plant and paving equipment meets the requirements of Maine DOT Specification 401.

### 1.5 QUALITY CONTROL

- A. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Manufacturer Qualifications: Engage a firm experienced in manufacturing hot-mix asphalt similar to that indicated for this Project and with a record of successful in-service performance.
- C. Minimum Roller Train: 10 ton Vibratory Roller, 12 ton Pneumatic Roller, and a 10 ton Finish Roller for roadway work. The Owner may waive the requirement for the Pneumatic Roller in other areas.



## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if substrate is frozen, wet or excessively damp or if ambient temperature is less than specified in Maine DOT Specifications. The Contractor shall not place Hot Mix Asphalt Pavement unless the air temperature is 40°F or higher for base course asphalt, and 50°F for surface course asphalt.
- B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Maine DOT for asphalt paving work.
  - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

## PART 2 - PRODUCTS

### 2.1 AGGREGATES

Aggregates shall consist of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler as required. The aggregates should be free of ferrous sulfides, such as pyrite, or iron oxides that would cause rust staining that can bleed through the pavement markings\*. The portion retained on the No. 4 (4.75 mm) sieve is coarse aggregate. The portion passing the No. 4 (4.75 mm) sieve and retained on the No. 200 (0.075 mm) sieve is fine aggregate, and the portion passing the No. 200 (0.075 mm) sieve is mineral filler. \*Note: If there is a concern that ferrous sulfides or iron oxides may exist, an indicator to identify staining particles is to immerse the aggregate in a lime slurry. If staining particles are present, a blue-green gelatinous precipitate will form within five (5) to 10 minutes, rapidly changing to a brown color on exposure to air and light. The reaction should be complete in 30 minutes. If no brown gelatinous precipitate forms, there is little chance of reaction in concrete. (Portland Concrete Association, Design and Control of Concrete Mixtures, 15th edition).

- A. Coarse Aggregate: ASTM D 692/D 692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- B. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
- C. Mineral Filler: ASTM D 242/D 242M, rock or slag dust, hydraulic cement, or other inert material.

### 2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO M 320, PG 64-28.
- B. Tack Coat: AASHTO M 140 emulsified asphalt, or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

### 2.3 MIXES

- A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Base Course: Maine DOT 703.09 Grading Type 19mm.
3. Surface Course: Maine DOT 703.09 Grading Type 9.5mm.

### PART 3 - EXECUTION

#### 3.1 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- C. Tack Coat:
  1. Apply to contact surfaces of previously constructed asphaltic concrete base courses or Portland cement concrete and surfaces abutting or projecting into asphalt concrete and surfaces abutting or projecting into asphalt concrete pavement.
  2. Apply tack coat to asphaltic concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat on the surface of all such bases where asphaltic concrete paving will be constructed.
  3. Apply emulsified tack coat RS-1, or RS-1h.
  4. Apply at a minimum rate of 0.05 gallons per square yard of surface.
  5. Allow to dry until at proper condition to receive paving.

#### 3.2 PLACING HOT-MIX ASPHALT

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
  1. Spread mix at a minimum temperature of 275 deg F.
  2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. The Contractor shall operate the paver in such a manner as to produce a visually uniform surface texture to the specified thickness. The paver shall have a receiving hopper with sufficient capacity for a uniform spreading operation and a distribution system to place the mixture uniformly, without segregation in front of the screed. The screed assembly shall produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture. Pavers with extendible screeds shall have auger extensions and tunnel extenders as per the manufacturer's recommendations, a copy of which shall be available if requested.
- C. The Contractor shall repair or replace any paver found worn or defective, either before or during placement, to the satisfaction of the Project Engineer. Pavers that produce an unevenly textured or non-uniform mat will be repaired or replaced before continuing to place HMA.
- D. Rollers shall be static steel, pneumatic tire, oscillatory, or approved vibrator type. Rollers shall be in good mechanical condition, capable of starting and stopping smoothly, and be free from backlash when reversing direction. Rollers shall be equipped and operated in such a way as to

prevent the picking up of hot mixed material by the roller surface. The use of rollers, which result in crushing of the aggregate or in displacement of the HMA will not be permitted. Any Hot Mix Asphalt Pavement that becomes loose, broken, contaminated, shows an excess or deficiency of Performance Graded Asphalt Binder, or is in any other way defective shall be removed and replaced at no additional cost with fresh Hot Mix Asphalt Pavement, which shall be immediately compacted to conform to the adjacent area.

- E. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.
- F. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.3 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
  - 1. Transverse joints shall be straight and neatly trimmed.
  - 2. Longitudinal joints shall be straight to the direction of travel and constructed in a manner that ensures joint integrity.
  - 3. Clean contact surfaces and apply tack coat to joints.
  - 4. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
  - 5. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
  - 6. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

### 3.4 COMPACTION

- A. General: Immediately after the Hot Mix Asphalt Pavement has been spread, struck off, and any surface irregularities adjusted, the Contractor shall thoroughly and uniformly compact the HMA by rolling. The Contractor shall roll the surface when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking, or shoving. The Contractor shall prevent adhesion of the HMA to the rollers or vibrating compactors without the use of fuel oil or other petroleum-based release agents. Solvents designed to strip asphalt binders from aggregates will not be permitted as release agents on equipment, tools, or pavement surfaces. The Contractor shall immediately correct any displacement occurring as a result of the reversing of the direction of a roller or from other causes to the satisfaction of the Engineer. Any operation other than placement of variable depth shim course that results in breakdown of the aggregate shall be discontinued. Any new pavement that shows obvious cracking, checking, or displacement shall be removed and replaced for the full lane width as directed by the Engineer at no cost to the Owner.
  - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Along forms, curbs, headers, walls, and other places not accessible to the rollers, the Contractor shall thoroughly compact the HMA with mechanical vibrating compactors. The Contractor shall only use hand tamping in areas inaccessible to all other compaction equipment. On

depressed areas, the Contractor may use a trench roller or cleated compression strips under a roller to transmit compression to the depressed area. Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

- C. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- D. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
  - 1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent or greater than 96 percent.
- E. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- F. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.5 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  - 1. Base Course: Plus or minus 1/2 inch (13 mm).
  - 2. Surface Course: Plus 1/4 inch (6 mm), no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
  - 1. Base Course: 1/4 inch.
  - 2. Surface Course: 1/8 inch.
- C. The Contractor shall correct variations exceeding the tolerances above by removing defective work and replacing it with new material as directed by the Owners Representative.

### 3.6 FIELD QUALITY ASSURANCE

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Replace and compact hot-mix asphalt where core tests were taken.

- C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.7 WASTE HANDLING

- A. General: Handle asphalt-paving waste in accordance with applicable Local and State regulations.

END OF SECTION 321216

## APPENDIX A

### SECTION 401 - HOT MIX ASPHALT PAVEMENT

**The following sections of the Maine DOT Standard Specifications - November 2014 Edition, as modified herein shall apply to this project.**

401.01 Description The Contractor shall furnish a uniformly blended, homogenous mixture placed as one or more courses of Hot Mix Asphalt Pavement (HMA) on an approved base in accordance with the contract documents and in reasonably close conformity with the lines, grades, thickness, and typical cross sections shown on the plans or established by the Resident. The Department will accept this work under Quality Assurance provisions, in accordance with these specifications and the requirements of Section 106 – Quality, the provisions of AASHTO M 323 except where otherwise noted in sections 401 and 703 of these specifications, and the MaineDOT Policies and Procedures for HMA Sampling and Testing.

401.02 Materials Materials shall meet the requirements specified in Section 700 - Materials:

Asphalt Cement	702.01
Aggregates for HMA Pavement	703.07
RAP for HMA Pavement	703.08
HMA Mixture Composition	703.09

401.03 Composition of Mixtures The Contractor shall compose the Hot Mix Asphalt Pavement with aggregate, Performance Graded Asphalt Binder (PGAB), and mineral filler if required. HMA shall be designed and tested according to AASHTO R35 and the volumetric criteria in Table 1. The Contractor shall size, uniformly grade, and combine the aggregate fractions in proportions that provide a mixture meeting the grading requirements of the Job Mix Formula (JMF).

401.05 Performance Graded Asphalt Binder The Contractor may utilize either a 64-28 or 58-28 PGAB. The Contractor must stipulate which PGAB grading will be used to construct the entire HMA pavement structure prior to starting work. For mixtures containing greater than 20 percent but no more than 30 percent RAP the PGAB shall be PG 58-34. The PGAB shall meet the applicable requirements of AASHTO M320 - Standard Specification for PGAB. Polymer-modified PGAB shall meet the applicable requirements of AASHTO MP 19. The Contractor shall provide the Owner with an approved copy of the Quality Control Plan for PGAB in accordance with AASHTO R 26 Certifying Suppliers of PGAB. The Contractor shall request approval from the Owner for a change in PGAB supplier or source by submitting documentation stating the new supplier or source a minimum of 24 hours prior to the change. In the event that the PGAB supplier or source is changed, the Contractor shall make efforts to minimize the occurrence of PGAB co-mingling.

## 401.07 Hot Mix Asphalt Plant

### 401.071 General Requirements HMA plants shall conform to AASHTO M156.

a. Truck Scales When the hot mix asphalt is to be weighed on scales meeting the requirements of Section 108 - Payment, the scales shall be inspected and sealed by the State Sealer as often as the Department deems necessary to verify their accuracy.

Plant scales shall be checked prior to the start of the paving season, and each time a plant is moved to a new location. Subsequent checks will be made as determined by the Resident. The Contractor will have at least ten 50 pound masses for scale testing.

401.072 Automation of Batching Batch plants shall be automated for weighing, recycling, and monitoring the system. In the case of a malfunction of the printing system, the requirements of Section 401.074 c. of this specification will apply.

The batch plant shall accurately proportion the various materials in the proper order by weight. The entire batching and mixing cycle shall be continuous and shall not require any manual operations. The batch plant shall use auxiliary interlock circuits to trigger an audible alarm whenever an error exceeding the acceptable tolerance occurs. Along with the alarm, the printer shall print an asterisk on the delivery slip in the same row containing the out-of-tolerance weight. The automatic proportioning system shall be capable of consistently delivering material within the full range of batch sizes. When RAP is being used, the plant must be capable of automatically compensating for the moisture content of the RAP.

All plants shall be equipped with an approved digital recording device. The delivery slip load ticket shall contain information required under Section 108.1.3 - Provisions Relating to Certain Measurements, Mass and paragraphs a, b, and c of Section 401.073

401.073 Automatic Ticket Printer System on Automatic HMA Plant An approved automatic ticket printer system shall be used with all approved automatic HMA plants. The requirements for delivery slips for payment of materials measured by weight, as given in the following Sections, shall be waived: 108.1.3 a., 108.1.3 b., 108.1.3 c., and 108.1.3 d. The automatic printed ticket will be considered as the Weight Certificate.

The requirements of Section 108.1.3 f. - Delivery Slips, shall be met by the weigh slip or ticket, printed by the automatic system, which accompanies each truckload, except for the following changes:

- a. The quantity information required shall be individual weights of each batch or total net weight of each truckload.
- b. Signatures (legible initials acceptable) of Weighmaster (required only in the event of a malfunction as described in 401.074 c.).
- c. The MaineDOT designation for the JMF.

#### 401.074 Weight Checks on Automatic HMA Plant

- a. A loaded truck may be intercepted and weighed on a platform scale that has been sealed by the State Sealer of Weights and Measures within the past 12 months. The inspector will notify the producer to take corrective action on any discrepancy over 1.0%. The producer may continue to operate for 48 hours under the following conditions.
  1. If the discrepancy does not exceed 1.5%; payment will still be governed by the printed ticket.
  2. If the discrepancy exceeds 1.5%, the plant will be allowed to operate as long as payment is determined by truck platform scale net weight.

If, after 48 hours the discrepancy has not been addressed and reduced below 1.0%, than plant operations will cease. Plant operation may resume after the discrepancy has been brought within 1.0%.

- b. Where platform scales are not readily available, a check will be made to verify the accuracy and sensitivity of each scale within the normal weighing range and to assure that the interlocking devices and automatic printer system are functioning properly.
- c. In the event of a malfunction of the automatic printer system, production may be continued without the use of platform truck scales for a period not to exceed the next two working days, providing total weights of each batch are recorded on weight tickets and certified by a Licensed Public Weighmaster.

401.08 Hauling Equipment Trucks for hauling Hot Mix Asphalt Pavement shall have tight, clean, and smooth metal dump bodies, which have been thinly coated with a small amount of approved release agent to prevent the mixture from adhering to the bodies. Solvent based agents developed to strip asphalts from aggregates will not be allowed as release agents.

All truck dump bodies shall have a cover of canvas or other water repellent material capable of heat retention, which completely covers the mixture. The cover shall be securely fastened on the truck, unless unloading.

All truck bodies shall have an opening on both sides, which will accommodate a thermometer stem. The opening shall be located near the midpoint of the body, at least 12 inches above the bed.

401.09 Pavers Pavers shall be self-contained, self-propelled units with an activated screed (heated if necessary) capable of placing courses of Hot Mix Asphalt Pavement in full lane widths specified in the contract on the main line, shoulder, or similar construction.

On projects with no price adjustment for smoothness, pavers shall be of sufficient class and size to place Hot Mix Asphalt Pavement over the full width of the mainline travel way with a 10 ft minimum main screed with activated extensions.



The Contractor shall place Hot Mix Asphalt Pavement on the main line with a paver using an automatic grade and slope controlled screed, unless otherwise authorized by the Owner. The controls shall automatically adjust the screed and increase or decrease the layer thickness to compensate for irregularities in the preceding course. The controls shall maintain the proper transverse slope and be readily adjustable so that transitions and superelevated curves can be properly paved. The controls shall operate from a fixed or moving reference such as a grade wire or ski type device (floating beam) with a minimum length of 30 ft, a non-contact grade control with a minimum span of 24 ft, except that a 40 ft reference shall be used on Expressway projects.

The Contractor shall operate the paver in such a manner as to produce a visually uniform surface texture and a thickness within the requirements of Section 401.101 - Surface Tolerances. The paver shall have a receiving hopper with sufficient capacity for a uniform spreading operation and a distribution system to place the mixture uniformly, without segregation in front of the screed. The screed assembly shall produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture. Pavers with extendible screeds shall have auger extensions and tunnel extenders as per the manufacturer's recommendations, a copy of which shall be available if requested.

The Contractor shall have the paver at the project site sufficiently before the start of paving operations to be inspected and approved by the Owners Representative. The Contractor shall repair or replace any paver found worn or defective, either before or during placement, to the satisfaction of the Owners Representative. Pavers that produce an unevenly textured or non-uniform mat will be repaired or replaced before continuing to place HMA on the project.

401.10 Rollers Rollers shall be static steel, pneumatic tire, oscillatory, or approved vibrator type. Rollers shall be in good mechanical condition, capable of starting and stopping smoothly, and be free from backlash when reversing direction. Rollers shall be equipped and operated in such a way as to prevent the picking up of hot mixed material by the roller surface. The use of rollers, which result in crushing of the aggregate or in displacement of the HMA will not be permitted. Any Hot Mix Asphalt Pavement that becomes loose, broken, contaminated, shows an excess or deficiency of Performance Graded Asphalt Binder, or is in any other way defective shall be removed and replaced at no additional cost with fresh Hot Mix Asphalt Pavement, which shall be immediately compacted to conform to the adjacent area.

The Contractor shall repair or replace any roller found to be worn or defective, either before or during placement, to the satisfaction of the Department. Rollers that produce grooved, unevenly textured or non-uniform mat will be repaired or replaced before continuing to place HMA on the project. The type of rollers to be used and their relative position in the compaction sequence shall generally be the Contractor's option, provided specification densities are attained and with the following requirements:

- a. On variable-depth courses, the first lift of pavement over gravel, reclaimed pavement, on irregular or milled surfaces, or on bridges, at least one roller shall be 16 ton pneumatic-tired. Unless otherwise allowed by the Resident, pneumatic-tired rollers shall be equipped with skirting to minimize the pickup of HMA materials from the paved surface. When required by the Resident, the roller shall be ballasted to 20 ton.
- b. Compaction with a vibratory or steel wheel roller shall precede pneumatic-tired rolling, unless otherwise authorized by the Owners Representative.
- c. Vibratory rollers shall not be operated in the vibratory mode when checking or cracking of the mat occurs.
- d. Any method, which results in cracking or checking of the mat, will be discontinued and corrective action taken.

The maximum operating speed for a steel wheel or pneumatic roller shall not exceed the manufacturer's recommendations, a copy of which shall be available if requested.

401.101 Surface Tolerances The Department will check surface tolerance utilizing the following methods :

- a.) A 16 ft straightedge or string line placed directly on the surface, parallel to the centerline of pavement.
- b.) A 10 ft straightedge or string line placed directly on the surface, transverse to the centerline of pavement.

The Contractor shall correct variations exceeding  $\frac{1}{4}$  in by removing defective work and replacing it with new material as directed by the Owner. The Contractor shall furnish a 10 foot straightedge for the Owner's use.

401.11 Preparation of Existing Surface The Contractor shall thoroughly clean the surface upon which Hot Mix Asphalt Pavement is to be placed of all objectionable material. When the surface of the existing base or pavement is irregular, the Contractor shall bring it to uniform grade and cross section. All surfaces shall have a tack coat applied prior to placing any new HMA course. Tack coat shall conform to the requirements of Section 409 – Bituminous Tack Coat, Section 702 – Bituminous Material, and all applicable sections of the contract.

401.12 Hot Mix Asphalt Documentation The Contractor and the Owners Representative shall agree on the amount of Hot Mix Asphalt Pavement that has been placed each day. All delivery slips shall conform to the requirements of 401.073.

401.13 Preparation of Aggregates The Contractor shall dry and heat the aggregates for the HMA to the required temperature. The Contractor shall properly adjust flames to avoid physical damage to the aggregate and to avoid depositing soot on the aggregate.

401.13 Preparation of Aggregates The Contractor shall dry and heat the aggregates for the HMA to the required temperature. The Contractor shall properly adjust flames to avoid physical damage to the aggregate and to avoid depositing soot on the aggregate.

401.14 Mixing The Contractor shall combine the dried aggregate in the mixer in the amount of each fraction of aggregate required to meet the JMF. The Contractor shall measure the amount of PGAB and introduce it into the mixer in the amount specified by the JMF.

The Contractor shall produce the HMA at the temperature established by the JMF.

The Contractor shall dry the aggregate sufficiently so that the HMA will not flush, foam excessively, or displace excessively under the action of the rollers. The Contractor shall introduce the aggregate into the mixer at a temperature of not more than 25°F above the temperature at which the viscosity of the PGAB being used is 0.150 Pa°s.

The Contractor shall store and introduce into the mixer the Performance Graded Asphalt Binder at a uniformly maintained temperature at which the viscosity of the PGAB is between 0.150 Pa°s and 0.300 Pa°s. The aggregate shall be coated completely and uniformly with a thorough distribution of the PGAB. The Contractor shall determine the wet mixing time for each plant and for each type of aggregate used. The resultant material shall be a uniformly blended, homogenous HMA mixture.

401.15 Spreading and Finishing On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the Contractor shall spread, rake, and lute the HMA with hand tools to provide the required compacted thickness. Solvent based agents developed to strip asphalts from aggregates will not be allowed as release agents.

- a. The top course shall not be placed until the bottom course has cooled sufficiently to provide stability.

401.16 Compaction Immediately after the Hot Mix Asphalt Pavement has been spread, struck off, and any surface irregularities adjusted, the Contractor shall thoroughly and uniformly compact the HMA by rolling.

The Contractor shall roll the surface when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking, or shoving. The Contractor shall prevent adhesion of the HMA to the rollers or vibrating compactors without the use of fuel oil or other petroleum based release agents. Solvents designed to strip asphalt binders from aggregates will not be permitted as release agents on equipment, tools, or pavement surfaces.

The Contractor shall immediately correct any displacement occurring as a result of the reversing of the direction of a roller or from other causes to the satisfaction of the Owners Representative. Any operation other than placement of variable depth shim course that results in breakdown of the aggregate shall be discontinued. Any new pavement that shows obvious cracking, checking, or displacement shall be removed and replaced for the full lane width as directed by the Owners Representative at no cost to the Owner.

Along forms, curbs, headers, walls, and other places not accessible to the rollers, the Contractor shall thoroughly compact the HMA with mechanical vibrating compactors. The Contractor shall only use hand tamping in areas inaccessible to all other compaction equipment. On depressed areas, the Contractor may use a trench roller or cleated compression strips under a roller to transmit compression to the depressed area.

Any HMA that becomes unacceptable due to cooling, cracking, checking, segregation or deformation as a result of an interruption in mix delivery shall be removed and replaced, with material that meets contract specifications at no cost to the Owner.

401.17 Joints The Contractor shall construct wearing course transverse and longitudinal joints in such a manner that minimum tolerances shown in Section 401.101 - Surface Tolerances are met when measured with a straightedge.

The paver shall maintain a uniform head of HMA during transverse and longitudinal joint construction.

The HMA shall be free of segregation and meet temperature requirements outlined in section 401.04. Transverse joints of the wearing course shall be straight and neatly trimmed. The Contractor may form a vertical face exposing the full depth of the course by inserting a header, by breaking the bond with the underlying course, or by cutting back with hand tools. The Owners Representative may allow feathered or "lap" joints on lower base courses or when matching existing base type pavements.

Longitudinal joints shall be generally straight to the line of travel, and constructed in a manner that best ensure joint integrity. Methods or activities that prove detrimental to the construction of straight, sound longitudinal joints will be discontinued.

The Contractor shall apply a coating of emulsified asphalt immediately before paving all joints to the vertical face and 3 in of the adjacent portion of any pavement being overlaid except those formed by pavers operating in echelon. The Contractor shall use an approved spray apparatus designed for covering a narrow surface. The Owners Representative may approve application by a brush for small surfaces, or in the event of a malfunction of the spray apparatus, but for a period of not more than one working day.

Where pavement under this contract joins an existing pavement, or when the Owner directs, the Contractor shall cut the existing pavement along a smooth line, producing a neat, even, vertical joint. The Owner will not permit broken or raveled edges. The cost of all work necessary for the preparation of joints is incidental to related contract pay items.

401.19 Quality Control Method D For items covered under Method D, the Contractor shall submit a modified QC Plan, detailing how the mix is to be placed, what equipment is to be used, and what HMA plant is to be used. All mix designs (JMF) shall be approved and verified by Maine DOT prior to use. Certified QC personnel shall not be required. The Contractor shall certify the mix and the test results by means of a Certificate of Compliance.

401.204 Acceptance Method D For hot mix asphalt items designated as Method D in Section 403 - Hot Mix Asphalt Pavement, two samples will be taken from the paver hopper or the truck body per 250 ton. The mix will be tested for gradation and PGAB content. Disputes will not be allowed. If the mix is within the tolerances listed in Table 8: Method D Acceptance Limits, the Owner will accept the mix. Contractor shall cut two 6 in cores, which shall be tested for percent TMD per AASHTO T-269 unless otherwise noted in Section 403 - Hot Mix Asphalt Pavement. If the average for the two tests falls below 92.0% , or above 97.0% the disincentive shall apply. If the test results for each 250 ton increment are outside these limits, the HMA quantity represented by the test shall be removed and replaced at no cost to the Owner.

TABLE 8: METHOD D ACCEPTANCE LIMITS

Property	USL and LSL
Percent Passing 4.75 mm and larger sieves	Target +/-7
Percent Passing 2.36 mm to 1.18 mm sieves	Target +/-5
Percent Passing 0.60 mm	Target +/-4
Percent Passing 0.30 mm to 0.075 mm sieve	Target +/-3
PGAB Content	Target +/-0.5
% TMD (In-place Density)	92.0% - 97.0%

401.22 Basis of Payment The Owner will pay for the work, in place and accepted, in accordance with the applicable sections of this Section, for each type of HMA specified.

The Owner will pay for the work specified in Section 401.11, for the HMA used, except that cleaning objectionable material from the pavement and furnishing and applying bituminous material to joints and contact surfaces is incidental.

Payment for this work under the appropriate pay items shall be full compensation for all labor, equipment, materials, and incidentals necessary to meet all related contract requirements, including design of the JMF, implementation of the QCP, obtaining core samples, filling core holes, applying emulsified asphalt to joints, and providing testing facilities and equipment.

401.221 Acceptance: The Owner will sample, test, and evaluate Hot Mix Asphalt Pavement in accordance with Section 106 - Quality and Section 401.204 - Acceptance Method D, of this Specification. Pavement will be evaluated on a pass/fail basis. Pavement not meeting the quality requirements of this specification shall be removed and replaced at no cost to the Owner.

## SECTION 321613 – CONCRETE SIDEWALKS AND EXTERIOR SLABS ON GRADE

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes cast-in-place concrete sidewalks and slabs on grade, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and supplementary Conditions and other Division 01 Specifications apply to this section

#### 1.3 REFERENCES

- A. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
  - 1. AASHTO M 182 (2005; R 2017) Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats
- B. ASTM INTERNATIONAL (ASTM)
  - 1. ASTM A1064/A1064M (2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
  - 2. ASTM A615/A615M (2016) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
  - 3. ASTM C143/C143M (2015) Standard Test Method for Slump of Hydraulic-Cement Concrete
  - 4. ASTM C171 (2016) Standard Specification for Sheet Materials for Curing Concrete
  - 5. ASTM C172/C172M (2014a) Standard Practice for Sampling Freshly Mixed Concrete
  - 6. ASTM C173/C173M (2016) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
  - 7. ASTM C231/C231M (2017) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
  - 8. ASTM C309 (2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
  - 9. ASTM C31/C31M (2015a; E 2016) Standard Practice for Making and Curing Concrete Test Specimens in the Field
  - 10. ASTM C920 (2014a) Standard Specification for Elastomeric Joint Sealants
  - 11. ASTM D1751 (2004; E 2013; R 2013) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
  - 12. ASTM D1752 (2004a; R 2013) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
  - 13. ASTM D5893/D5893M (2016) Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

- C. INTERNATIONAL CODE COUNCIL (ICC)
  - 1. ICC A117.1 COMM (2009) Standard and Commentary and Usable Buildings and Facilities

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Other Action Submittal:
  - 1. Design Mixtures: For each concrete mixture.

#### 1.5 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. Comply with ACI 301 (ACI 301M).
- C. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

#### 1.6 ENVIRONMENTAL CONDITIONS

- A. Placing During Cold Weather: Do not place concrete when the air temperature reaches 5 degrees C 40 degrees F and is falling, or is already below that point. Placement may begin when the air temperature reaches 2 degrees C 35 degrees F and is rising, or is already above 5 degrees C 40 degrees F. Make provisions to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 2 degrees C 35 degrees F, placement and protection must be approved in writing. Approval will be contingent upon full conformance with the following provisions. The underlying material must be prepared and protected so that it is entirely free of frost when the concrete is deposited. Mixing water and aggregates must be heated as necessary to result in the temperature of the in-place concrete being between 50 and 85 degrees F. Methods and equipment for heating must be approved. The aggregates must be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means must be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.
- B. Placing During Warm Weather: The temperature of the concrete as placed must not exceed 85 degrees F except where an approved retarder is used. The mixing water and aggregates must be cooled, if necessary, to maintain a satisfactory placing temperature. The placing temperature must not exceed 95 degrees F at any time.

## PART 2 - PRODUCTS

### 2.1 FORMWORK

- A. Furnish formwork and formwork accessories according to ACI 301 (ACI 301M).

### 2.2 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- C. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.
- D. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.
- E. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

### 2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout Project:
  - 1. Portland Cement: ASTM C 150, Type I/II Supplement with the following:
    - a. Fly Ash: ASTM C 618, Class C or F.
    - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregate: ASTM C 33, graded, 1-1/2-inch (38-mm) nominal maximum aggregate size.
- C. Water: ASTM C 94/C 94M.
- D. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.

### 2.4 CONCRETE MIXTURES

- A. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301 (ACI 301M), as follows:
  - 1. Minimum Compressive Strength: 5000 psi (39 MPa) at 28 days.
  - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
  - 3. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of Portland cement, which would otherwise be used, by not less than 40 percent.



4. Slump Limit: 4 inches (100 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
  5. Air Content: Maintain within range permitted by ACI 301 (ACI 301M). Do not allow air content of trowel-finished floor slabs to exceed 3 percent.
- B. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate but not less than a rate of 1.0 lb/cu. yd. (0.60 kg/cu. m).

## 2.5 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
- B. When air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

## 2.6 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

## 2.7 RELATED MATERIALS

- A. Vapor Retarder: Plastic sheet, ASTM E 1745, Class A or B.
- B. Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick; or plastic sheet, ASTM E 1745, Class C.
- C. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

## 2.8 JOINT FILLERS

- A. Pre-molded Joint Fillers: Subject to compliance with requirements, joint filler products incorporated in Work are limited to the following:

1. Sonneborn "Sonoflex F"
  2. W. R. Meadows, Inc. "Ceramarc"
- B. Polyurethane Joint Sealant ASTM C920, Type S, Grade P, Class 25: Subject to compliance with requirements, joint filler products incorporated in Work are limited to the following:
1. Euclid Chemical Company "Eucolastic I"
  2. Sika Chemical Corp. "Sikaflex ICSL"
  3. Tremco Inc. "Vulkem 45"

## 2.9 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

## PART 3 - EXECUTION

### 3.1 FORMWORK

- A. Design, construct, erect, brace, and maintain formwork according to ACI 301 (ACI 301M).

### 3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

### 3.3 VAPOR RETARDERS

- A. Install, protect, and repair vapor retarders according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.
  1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended adhesive or joint tape.

### 3.4 STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

### 3.5 JOINTS

- A. General: Construction, expansion, isolation, and contraction joints shall be located as indicated. Construction joints shall act as contraction joints. Where additional contraction joints are required to prevent shrinkage cracks, saw-cut such joints. All joints shall be straight and true to line. Saw-cut joints not less than twelve hours nor more than twenty-four hours after placing concrete, unless otherwise approved by the Engineer. Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Contraction Joints in Slabs-on-Grade: Form weakened-plane grooved contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness. All joints shall be tooled with a radius edges and smooth one inch (1") wide band.
  - 1. Sidewalk slabs shall be placed alternately, and the joints coated with an approved bituminous material before placing the adjacent slab.
- C. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
  - 2. Isolation joints shall be provided at all locations where sidewalks and slabs are constructed adjacent to a curb, building, retaining wall, or any other fixed structure.

### 3.6 CONCRETE PLACEMENT

- A. Comply with ACI 301 (ACI 301M) for placing concrete.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).
- C. Do not add water to concrete during delivery, at Project site, or during placement.
- D. Consolidate concrete with mechanical vibrating equipment.

### 3.7 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 1/2 inch (13 mm).

1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm).
  1. Apply to concrete surfaces exposed to public view.
- C. Rubbed Finish: Apply the following rubbed finish, defined in ACI 301 (ACI 301M), to smooth-formed finished as-cast concrete where indicated:
  1. Smooth-rubbed finish.
  2. Grout-cleaned finish.
  3. Cork-floated finish.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

### 3.8 FINISHING UNFORMED SURFACES

- A. General: Comply with ACI 302.1R for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.
  1. Do not further disturb surfaces before starting finishing operations.
- C. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

### 3.9 SEALING AND PROTECTION

- A. Once concrete has set for 28 days apply "salt guard" sealant to all exposed surfaces. Air temperature shall be 40F or higher at the time of application and shall be applied to clean concrete surfaces, free from dirt, dust, grease, paints or other deleterious matter that could prevent effective sealing of the surface. Sealant material shall comply with National Volatile Organic Compound Emission Standards for Architectural Coatings, Federal EPA Regulation 40 CFR, Part 49, NCHRP-244.

### 3.10 SURFACE DEFECTS

- A. Surface defects shall include honeycombing, cracking, voids and any finished concrete surface in an exposed location that does not match the texture and color of surrounding adjacent surfaces, or that was not well performed. Any defective work shall be removed in its entirety

and performed again until the surface conforms with Specification requirements, at the cost of Contractor.

3.11 GRADE AND SURFACE SMOOTHNESS REQUIREMENTS FOR CONCRETE SLABS AND SIDEWALKS

- A. Pavements shall be smooth and true to grade and cross section. When tested with a 10-foot straightedge on lines 5 feet apart parallel with the centerline of the pavement, the surface shall not vary more than 1/8 inch from the testing edge of the straightedge.

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 ACI 301 (ACI 301M) for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
  - 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 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Tests: Perform according to ACI 301 (ACI 301M).
  - 1. Testing Frequency: One composite sample shall be obtained for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m) but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
  - 2. Testing Frequency: One composite sample shall be obtained for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mix placed each day.

3.14 REPAIRS

- A. Remove and replace concrete that does not comply with requirements in this Section.

END OF SECTION 321613

## SECTION 331100 – WATER UTILITY DISTRIBUTION PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Furnish labor, materials, services, equipment, and other necessary items required for the construction of the water systems. This shall include, but not be limited to the following: pipe and fittings for onsite water line including domestic water line, valves, set lines, elevations, and grades for water distribution systems. Provide rigid insulation where cover is designated to be less than 5'-0".
- B. Related Sections:
  - 1. Section 312000 – Earth Moving.
  - 2. Local Governing Authority and Code Requirements.
  - 3. All Necessary Construction Permits.
- C. The public water supply is owned and operated by the **Brunswick and Topsham Water District**. All new work on water mains, valves and fittings shall meet the standards and specifications of **Brunswick and Topsham Water District**. All materials, installation, and workmanship shall also comply with the requirements of the Public Utilities Commission, the Maine State Plumbing Code and these specifications. Where a more stringent standard exists, the more stringent standard shall apply.

#### 1.2 SUMMARY

- A. This Section includes water-distribution piping and related components outside the building for water service and fire-service mains.
- B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

#### 1.3 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, hydrants, valves and accessories including ASTM designations, AWWA certifications and UL labels as required.
- B. Manufacturer's Certificate: Certify that products meet or exceed state or local requirements.
- C. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

- D. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

#### 1.4 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of piping, valves, connections, and invert elevations. Record a minimum of two (2) lateral measurement "swing ties", as close to 90 degrees opposed as practical, prior to backfilling pipeline from permanent fixtures such as building corners, telephone poles, fire hydrants, catch basins, manholes etc. to all valves, fittings, couplings, tees etc. for purposes of future location. Permanent fixtures shall be identified such as house numbers or description, pole numbers etc. These ties must be legibly recorded in sketch form and submitted to the Owner prior to final project acceptance. Record the same information with coordinates on the Maine State coordinate grid system for the record drawings.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

#### 1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. Comply with requirements of Brunswick and Topsham Water District. Include tapping of water mains and backflow prevention.
  - 2. Comply with standards of Brunswick and Topsham Water District, including materials, installation, testing, and disinfection.
  - 3. Comply with standards of Brunswick and Topsham Water District and Town of Brunswick Fire Department for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
- D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- F. NSF Compliance:
  - 1. Comply with NSF 14 for plastic potable-water-service piping.



2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
  1. Ensure that valves are dry and internally protected against rust and corrosion.
  2. Protect valves against damage to threaded ends and flange faces.
  3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
  1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
  2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.
- G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

#### 1.7 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution 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 water-distribution service according to requirements indicated:
  1. Notify Architect, Construction Manager, and Owner no fewer than two days in advance of proposed interruption of service.
  2. Do not proceed with interruption of water-distribution service without Owner's written permission.
- B. No valve, hydrant, or other facility on the Brunswick and Topsham Water District system shall be operated by the Contractor. Brunswick and Topsham Water District will, upon 24-hours advanced notice, furnish men and equipment for such activity as necessary at the Contractor's cost.

## 1.8 COORDINATION

- A. Coordinate connections to water mains with Brunswick and Topsham Water District.

## PART 2 - PRODUCTS

### 2.1 DUCTILE-IRON PIPE AND FITTINGS

- A. Push-on-Joint, Class 52 Double Cement Lined Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  - 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
  - 2. Cement mortar lining: AWWA C104
  - 3. Gaskets: AWWA C111, rubber.
  - 4. Pipe shall be warranted in writing from the supplier to be free from defects for 10 years, and replacement shall include all associated labor costs and will be at "no charge" to the Brunswick and Topsham Water District.
- B. Approved manufacturers:
  - 1. Ductile Iron Pipe: American Pipe, Birmingham, AL
  - 2. Ductile Iron Pipe Fittings: Tyler Union Foundry, Tyler, TX

### 2.2 PE PIPE AND FITTINGS

- A. PE, AWWA Pipe: AWWA C901-08, with PE compound number required to give pressure rating not less than 200 psig (1380 kPa).
  - 1. PE, AWWA Fittings: AWWA C901-08, with DR number matching pipe and PE compound number required to give pressure rating not less than 200 psig (1380 kPa).
- B. Approved manufacturers:
  - 1. ADS/Hancor, Inc, Hillard, OH

### C. COPPER TRACING WIRE

- 1. All PE pipe must be provided with minimum No.12 AWG insulated copper tracing wire laid along the top of the pipe and secured by means acceptable to Brunswick and Topsham Water District. Tracer wire must be continuous and not break conductivity. If wire must be cut and/or re-connected, splice wires with minimum six-inch overlap and use two u-bolt cable connectors. Tracer wire must be brought up and secured inside all gate valve boxes to within three-inches of ground surface.

### 2.3 PIPE COUPLINGS

- A. All pipe couplings shall be ductile iron and specifically designed for the intended purpose. Couplings shall meet AWWA Standard C219.

- B. All bolts and nuts shall be Type 304 stainless steel.
- C. Gaskets shall be manufactured from virgin Nitrile Butadiene Rubber compounded for water and sewer service in accordance with ASTM D2000.
- D. Approved Manufacturers: Romac Industries.

## 2.4 JOINING MATERIALS

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for commonly used joining materials.
- B. Brazing Filler Metals: AWS A5.8, BCuP Series.
- C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.
- D. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

## 2.5 PIPE JOINT RESTRAINT

- A. Wedge Action Joint Restraints:
  - 1. The joint restraint ring and its' wedging components shall be manufactured of ductile iron conforming to ASTM A 536.
  - 2. Dimensions of the restrainer must allow use with standard M.J. bell conforming to AWWA C111 and AWWA C153.
  - 3. Restrainer must be designed for up to 350 psi working pressure in 3" to 16" sizes, with a 2:1 safety factor.
- B. Acceptable Manufacturers:
  - 1. Romac Gripring, Bothell, WA
  - 2. Fast-Grip Gasket, Birmingham, AL

## 2.6 GATE VALVES

- A. AWWA, Cast-Iron Gate Valves:
  - 1. Nonrising-Stem, Resilient-Seated Gate Valves:
    - a. Description: Cast- or ductile-iron body and bonnet; meeting the latest revision of AWWA C-509.
      - 1) Valve body: including stuffing box and bonnet: cast, or ductile iron meeting latest revision of AWWA C-503.
      - 2) Minimum Pressure Rating: 200 psig (1380 kPa).

- 3) Stem: Open right, stem nut of D,E manganese bronze.
- 4) Thrust Collar: Integrally cast thrust collar with two thrust washers, placed one above and one below the stem thrust collar.
- 5) Sealing: Valve shall have a minimum of two O-rings situated such that the O-rings above the thrust collar can be replaced with the valve under pressure and in the open position.
- 6) End Connections: Mechanical joint.
- 7) Interior Coating: Complying with AWWA C550.
- 8) Operating Nut: 2" square ductile iron with a countersunk hold down nut of 316 stainless steel, or silicone bronze. Stainless steel pin through stem.

2. Acceptable Manufacturers:
  - a. American Flow Control Series 2500

## 2.7 GATE VALVE ACCESSORIES AND SPECIALTIES

### A. Tapping-Sleeve Assemblies:

1. For size on size taps a ductile iron tapping sleeve is required, for tap diameters smaller than the supply main, stainless steel sleeves are permitted.
2. Description: Sleeve and valve compatible with drilling machine.
  - a. Standard: Tapping sleeve shall conform to AWWA C-207, Class D, with rated maximum working pressure of 200psi.
  - b. Gaskets: Side rubber gaskets shall be rectangular in cross section and fit into grooved channels in the casting. These gaskets shall extend the entire length of the sleeve and shall not require cutting or trimming to match MJ end gaskets.
  - c. Flange outlet bolts: All flange outlet bolts shall be stainless steel (Type 304)
  - d. Coating: Interior and exterior shall be bituminous coated with a minimum 4 mils dry film thickness, or fusion bonded epoxy coated.
  - e. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.
3. Acceptable Manufacturers:
  - a. Ductile iron tapping sleeves: American Flow Control 2800 Series, Birmingham, AL.
  - b. Stainless steel tapping sleeves: Romac SST Series, Bothell, WA

### B. Valve Boxes.

1. Description: Valve boxes shall be heavy cast iron in conformance with ASTM A48, Class 30B, free from defects. All components shall be bituminous coated with with a minimum of 4 mils dry film thickness. Two-piece sliding type with a top flange and minimum inside shaft diameter of 5 1/4" inches
  - a. Bottom Section: Slide type with bell-type base with bottom lip.
  - b. Top Section: Slide type 36-inch long (minimum). No top flange and no bead, or bottom flange.

- c. Cover: 2" drop type to cover to fit the 7-1/4" opening of the top section. Box shall have the word "WATER" clearly cast into the cover
- d. Manufacturer: North American Manufacture.

## 2.8 CORPORATION VALVES

### A. Material requirements:

- 1. Brass shall be a UNS Copper Alloy C89933 in accordance with ASTM B584.
- 2. All brass fittings shall have a stamp indicating the manufacturer.
- 3. All brass fittings shall have a "NL" stamp indicating no lead.
- 4. All brass fittings shall be North American manufactured.
- 5. All compression connections shall be "Quik Style" fittings.
- 6. All corporations shall be CC threads on the inlet and full port opening.
- 7. All corporations and curbs shall be size on size.
- 8. All curb stops shall have a brass ball that is Teflon coated or Teflon, seats.
- 9. All curb stops shall be without a drain hole, and shall open with a 1/4 turn with a stop.

### B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

- 1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
- 2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
- 3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

### C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

### D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches (75 mm) in diameter.

- 1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

### E. Acceptable Manufacturers:

- a. Corporations: A.Y. McDonald Mfg. Co., Dubuque, IA
- b. Service Saddles: Romac Style 202N, Bothell, WA

## 2.9 WATER METERS

- A. Water meters will be furnished by Brunswick and Topsham Water District and installed in accordance with their Standards and Specifications.

## 2.10 FIRE HYDRANTS

- A. Dry-Barrel Fire Hydrants:
  - 1. Description: Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, 5-1/4-inch (133-mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet. No drain hole, or drain hole shall be plugged. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure. Operating nut shall be one and one half inch bronze pentagon, open right.
    - a. Standard: AWWA C502.
    - b. Pressure Rating: 200 psig
  - 2. Acceptable Manufacturers:
    - a. American Darling B84 B5, Birmingham, AL

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

### 3.2 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Do not use flanges or unions for underground piping.
- D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground water-service piping [NPS 3/4 to NPS 3 (DN 20 to DN 80)] shall be the following:
  - 1. PE, ASTM pipe; molded PE fittings; and heat-fusion joints.
- F. Underground water-service piping [NPS 4 to NPS 8 (DN 100 to DN 200)] shall be the following:
  - 1. Ductile-iron, push-on-joint pipe meeting AWWA C-151;.

- G. Water Meter Box Water-Service Piping [NPS 3/4 to NPS 2 (DN 20 to DN 50)] shall be same as underground water-service piping.
- H. Underground Fire-Service-Main Piping [NPS 4 to NPS 12 (DN 100 to DN 300)] shall be the following:
  - 1. Ductile-iron, push-on-joint pipe;

### 3.3 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.

### 3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. See Division 22 Section "Common Work Results for Plumbing" for piping-system common requirements.

### 3.5 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with Brunswick and Topsham Water District for tap of size and in location indicated in water main.
- B. Water-Main Connection: Tap water main according to requirements of Brunswick and Topsham Water District and of size and in location indicated.
- C. Make connections larger than NPS 2 (DN 50) with tapping machine according to the following:
  - 1. Install tapping sleeve and tapping valve according to MSS SP-60.
  - 2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
  - 3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
  - 4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- D. Make connections NPS 2 (DN 50) and smaller with drilling machine according to the following:
  - 1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
  - 2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
  - 3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
  - 4. Install corporation valves into service-saddle assemblies.

5. Install manifold for multiple taps in water main.
  6. Install curb valve in water-service piping with head pointing up and with service box.
- E. Comply with NFPA 24 for fire-service-main piping materials and installation.
1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
  2. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
- F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
- G. Install PE pipe according to ASTM D 2774 and ASTM F 645.
- H. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.
- I. Install fiberglass AWWA pipe according to AWWA M45.
- J. Bury piping with depth of cover over top at least 60 inches.
- K. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- L. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
- M. Sleeves are specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- N. Mechanical sleeve seals are specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- O. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
- P. See Division 21 Section "Water-Based Fire-Suppression Systems" for fire-suppression-water piping inside the building.
- Q. See Division 22 Section "Domestic Water Piping" for potable-water piping inside the building.
- 3.6 JOINT CONSTRUCTION
- A. See Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.
- B. Make pipe joints according to the following:



1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
3. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
4. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
5. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
  - a. Dielectric Fittings for [NPS 2 (DN 50)] and Smaller: Use dielectric unions.
  - b. Dielectric Fittings for [NPS 2-1/2 to NPS 4 (DN 65 to DN 100)] <: Use dielectric flange kits.
  - c. Dielectric Fittings for [NPS 5 (DN 125)] and Larger: Use dielectric flange kits.

### 3.7 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
  1. Concrete thrust blocks.
  2. Locking mechanical joints.
  3. Set-screw mechanical retainer glands.
  4. Bolted flanged joints.
  5. Heat-fused joints.
  6. Pipe clamps and tie rods.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
  1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
  2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
  3. Fire-Service-Main Piping: According to NFPA 24.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

### 3.8 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
- C. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.

- E. MSS Valves: Install as component of connected piping system.
- F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

### 3.9 WATER METER INSTALLATION

- A. Install water meters, piping, and specialties according to Greater Augusta Utility District's written instructions.

### 3.10 FIRE HYDRANT INSTALLATION

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.
- C. AWWA Fire Hydrants: Comply with AWWA M17.
- D. UL/FMG Fire Hydrants: Comply with NFPA 24.

### 3.11 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. See Division 22 Section "Common Work Results for Plumbing" for piping connections to valves and equipment.
- C. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve for fire hydrant connection, service clamp and corporation valve for service connection.
- D. Connect water-distribution piping to interior domestic water piping.
- E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.12 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

- C. Prepare reports of testing activities.

### 3.13 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."
- B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Division 22 Section "Common Work Results for Plumbing" for identifying devices.

### 3.14 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
  1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
  2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
  3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
    - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

END OF SECTION 331100

## SECTION 333100 – FACILITY SANITARY SEWERS

### 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. Related Sections:
  - 1. Section 312000 – Earth Moving.
  - 2. Local Governing Authority and Code Requirements.
  - 3. All Necessary Construction Permits.

#### 1.2 SUMMARY

- A. Furnish labor, materials, services, equipment, and other necessary items required for the construction of the sanitary sewer system. This shall include, but not be limited to the following: pipe and fittings for onsite sewer lines including piping and appurtenances. Provide rigid insulation where cover is designated to be less than 3'-0".
- B. Section Includes:
  - 1. Pipe and fittings.
  - 2. Non-pressure couplings.
  - 3. Cleanouts.
  - 4. Encasement for piping.
  - 5. Manholes.
- C. The public sewer system is owned and operated by the **Brunswick Sewer District**. All new work on sewer mains, manholes and fittings shall meet the standards and specifications of **Brunswick Sewer District**. All materials, installation, and workmanship shall also comply with the requirements of the Public Utilities Commission, the Maine State Plumbing Code and these specifications. Where a more stringent standard exists, the more stringent standard shall apply.

#### 1.3 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.

#### 1.4 ACTION SUBMITTALS

- A. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- B. Product certificates: For each kind of cast iron soil pipe and fitting, from manufacturer.
- C. 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.

## 1.7 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Sewerage 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 Architect, Construction Manager and Owner no fewer than two days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of service without Architect's written permission.

## PART 2 - PRODUCTS

### 2.1 PVC PIPE AND FITTINGS

- A. PVC Sewer Piping:
  - 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.

### 2.2 NONPRESSURE-TYPE TRANSITION COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
  - 1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

## 2.3 MANHOLES

### A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
4. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (100-mm) minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
5. Riser Sections: 4-inch (100-mm) minimum thickness, of length to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
9. Steps: No steps.
10. 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.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) 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: To meet Brunswick Sewer District Standards.
2. Material: ASTM A 48/A 48M, Class 35 gray iron unless otherwise indicated.

## 2.4 CONCRETE

### A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R (ACI 350M/350RM), and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

### B. Portland Cement Design Mix: 4000psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
  2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.
- C. Manhole Channels and Benches: Field formed from brick and concrete. Portland cement design mix, 4000psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
1. Channels: Brick invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
    - a. Invert Slope: To match downstream pipe.
  2. Benches: Concrete, sloped to drain into channel.
    - a. Slope: 3 – 8 percent.

### PART 3 - EXECUTION

#### 3.1 EARTHWORK

- A. Excavating, 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 sanitary sewer 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 using 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, non-pressure, drainage piping according to the following:
1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.

2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 48-inch (1220-mm) minimum cover.

### 3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, non-pressure, drainage piping according to the following:
  1. Join PVC gravity sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.

### 3.4 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Install FRP manholes according to manufacturer's written instructions.
- D. Form continuous concrete channels and benches between inlets and outlet.
- E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 6 inches above finished surface elsewhere unless otherwise indicated.
- F. Install manhole-cover inserts in frame and immediately below cover.

### 3.5 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

### 3.6 CONNECTIONS

- A. 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, and encase entire wye fitting plus 6-inch (150-mm) overlap with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
  2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
  3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches (76 mm) of concrete 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 pipe or manhole wall,



encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.

- a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated.
  - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

### 3.7 CLOSING ABANDONED SANITARY SEWER SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
1. Close open ends of piping with at least 8-inch-thick, brick masonry bulkheads.
  2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:
1. Remove manhole and close open ends of remaining piping.
  2. Remove top of manhole down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- C. Backfill to grade according to Division 31 Section "Earth Moving."

### 3.8 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
1. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

### 3.9 FIELD QUALITY CONTROL

- 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 report 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. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
      - a. Fill sewer piping with water. Test with pressure of at least 10-foot (3-m) head of water, and maintain such pressure without leakage for at least 15 minutes.
      - b. Close openings in system and fill with water.
      - c. Purge air and refill with water.
      - d. Disconnect water supply.
      - e. Test and inspect joints for leaks.
    6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
      - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
      - b. Option: Test concrete gravity sewer piping according to ASTM C 924 (ASTM C 924M).
    7. Manholes: Perform hydraulic test according to ASTM C 969 (ASTM C 969M).
  - 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.
- 3.10 CLEANING
- A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

3.11 RECORD INFORMATION

- A. Provide detailed record drawings of all elements of the constructed sewer system, including swing ties to above -ground features as necessary to accurately identify locations.
- B. Provide CCTV camera footage showing the entire on-site external sanitary sewer system (including existing lines to remain in service). Footage should be accompanied by a written summary report indicating all main features and stationing.

END OF SECTION 333100

## SECTION 334100 - STORM UTILITY DRAINAGE PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Channel drainage systems.
3. Encasement for piping.
4. Manholes.
5. Cleanouts.
6. Nonpressure transition couplings.
7. Expansion joints.
8. Catch basins.
9. Pipe outlets.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Catch basins and stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet (1:500) and vertical scale of not less than 1 inch equals 5 feet (1:50). Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.
- C. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
- D. Field quality-control reports.

#### 1.4 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 Engineer and Owner no fewer than two days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of service without Owner's written permission.

#### PART 2 - PRODUCTS

##### 2.1 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

##### 2.2 PE PIPE AND FITTINGS

- A. Corrugated PE Drainage Pipe and Fittings NPS 3 to NPS 10 (DN 80 to DN 250): AASHTO M 252M, Type S, with smooth waterway for coupling joints.
  - 1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
  - 2. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.
- B. Corrugated PE Pipe and Fittings NPS 12 to NPS 60 (DN 300 to DN 1500): AASHTO M 294M, Type S, with smooth waterway for coupling joints.
  - 1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
  - 2. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

##### 2.3 PVC PIPE AND FITTINGS

- A. PVC Corrugated Sewer Piping:
  - 1. Pipe: ASTM F 949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
  - 2. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
  - 3. Gaskets: ASTM F 477, elastomeric seals.

##### 2.4 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

- B. Sleeve Materials:
  - 1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
  - 2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
  - 3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded, Flexible Couplings:
  - 1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Shielded, Flexible Couplings:
  - 1. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- E. Ring-Type, Flexible Couplings:
  - 1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

## 2.5 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 ferrule 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.
- B. Plastic Cleanouts:
  - 1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

## 2.6 MANHOLES

- A. Standard Precast Concrete Manholes:
  - 1. Description: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
  - 2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
  - 3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
  - 4. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.

5. Riser Sections: 4-inch (102-mm) minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
9. Steps: No steps.
10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

## 2.7 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R (ACI 350M/350RM), and the following:
  1. Cement: ASTM C 150, Type II.
  2. Fine Aggregate: ASTM C 33, sand.
  3. Coarse Aggregate: ASTM C 33, crushed gravel.
  4. Water: Potable.
- B. Portland Cement Design Mix: 4500 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.
  1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
  2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4500 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
  1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
    - a. Invert Slope: Match downstream pipe through manhole.
  2. Benches: Concrete, sloped to drain into channel.
    - a. Slope: 4 percent.
- D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.
  1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
  2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

## 2.8 DRAINAGE SPECIALTIES: ENGINEERED SURFACE DRAINAGE PRODUCTS.

### 1. Drain Basins and In-line Drains:

- a. PVC surface drainage inlets shall include the drain basin, or in-line drain type as indicated on the contract drawings. The ductile iron grates for each of these fittings are to be considered an integral part of the surface drainage system and shall be furnished by the same manufacturer. Surface drainage inlets shall be as manufactured by Nyoplast, a division of Advanced Drainage Systems, or prior approved equal.
- b. The drain basins required for this contract shall be manufactured from PVC pipe stock, utilizing a thermoforming process to reform the pipe stock to the specified configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. The joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The flexible elastomeric seals shall conform to ASTM F477. The pipe bell spigot shall be joined to the main body of the drain basin or catch basin. The raw material used to manufacture the pipe stock that is used to manufacture the main body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454.
- c. The grates and frames furnished for all surface drainage inlets shall be ductile iron for sizes 8", 10", 12", 15", 18", 24" and shall be made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. Ductile iron used in the manufacture of the castings shall conform to ASTM A 536 grade 70-50-05. Grates and covers shall be painted black.

B. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.

C. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

## 2.9 CATCH BASINS

### A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 4-inch (102-mm) minimum thickness, 48-inch (1200-mm) diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
5. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 225-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and grate.



8. Steps: No steps.
  9. Pipe Connectors: ASTM C 923 (ASTM C 923M), resilient, of size required, for each pipe connecting to base section.
- B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.
1. Size: 24 by 24 inches (610 by 610 mm) minimum unless otherwise indicated.
  2. Grate Free Area: Approximately 50 percent unless otherwise indicated.
- C. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch (102-mm) minimum width flange, and 26-inch- (660-mm-) diameter flat grate with small square or short-slotted drainage openings.
1. Grate Free Area: Approximately 50 percent unless otherwise indicated.

## 2.10 SMALL CATCH BASINS

- A. Type "F" Precast Concrete Catch Basins:
1. Description: 24" Square catch basin to ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints. Designed for H-20 wheel loading.
  2. Concrete: Minimum 4,000psi at 28-days reinforced to 0.12sq.in/lf.
  3. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 5-inch (102-mm) minimum thickness for walls.
  4. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
  5. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 225-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and grate.
  6. Steps: No steps.
  7. Pipe Connectors: ASTM C 923 (ASTM C 923M), resilient, of size required, for each pipe connecting to base section.
- B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.
1. Size: 24 by 24 inches (610 by 610 mm) minimum unless otherwise indicated.
  2. Ditch Grates: Neenah Foundry square ditch grate (Model # R-4343), or approved equal.
  3. Flat grates: Neenah Foundry square grate (Model #R-4808), or approved equal.

## 2.11 PIPE OUTLETS

- A. Riprap Basins: Broken, irregularly sized and shaped, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."
1. Average Size: NSSGA No. R-3, screen opening 2 inches (51 mm).
  2. Average Size: NSSGA No. R-4, screen opening 3 inches (76 mm).
  3. Average Size: NSSGA No. R-5, screen opening 5 inches (127 mm).

- B. Filter Stone: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.
- C. Energy Dissipaters: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton (2721-kg) average weight armor stone, unless otherwise indicated.

### PART 3 - EXECUTION

#### 3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 312000 "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 piping with 36-inch (915-mm) minimum cover.
  - 3. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
  - 4. Install PE corrugated sewer piping according to ASTM D 2321.
  - 5. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

#### 3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:
  - 1. Join hub-and-spigot, cast-iron soil piping with gasketed joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
3. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
4. Join PVC corrugated sewer piping according to ASTM D 2321 for elastomeric-seal joints.
5. Join dissimilar pipe materials with nonpressure-type flexible couplings.

### 3.4 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 foot-traffic areas.
- B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches (450 by 450 by 300 mm) deep. Set with tops 1 inch (25 mm) above surrounding earth grade in landscaped areas.
- C. Set cleanout covers in turf field areas at finish stone elevation.
- D. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

### 3.5 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.

### 3.6 CATCH BASIN INSTALLATION

- A. Set frames and grates to elevations indicated.

### 3.7 STORMWATER INLET AND OUTLET INSTALLATION

- A. Construct riprap of broken stone, as indicated.
- B. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
- C. Construct energy dissipaters at outlets, as indicated.

### 3.8 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

### 3.9 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 221413 "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; and encase entire wye fitting, plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
  - 2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
  - 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 and expansion joints 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. Shielded 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 IDENTIFICATION

- A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
  - 1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

### 3.11 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) 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. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
    - b. Option: Test plastic piping according to ASTM F 1417.
    - c. Option: Test concrete piping according to ASTM C 924 (ASTM C 924M).
- 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.

END OF SECTION 334100

## SECTION 334600 - SUBDRAINAGE

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes subdrainage systems for foundations and site areas. This includes perimeter foundation drains and underdrains that surround the building.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of drainage panel or piping indicated on the drawings.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- A. Refer to the "Piping Applications" Article in Part 3 for applications of pipe, fitting, and joining materials.

#### 2.2 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated PE Pipe and Fittings: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
  - 1. Couplings: Manufacturer's standard, band type.
- B. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

#### 2.3 SOLID-WALL PIPES AND FITTINGS

- A. PE Drainage Tubing and Fittings: AASHTO M 252, Type S, corrugated, with smooth waterway, for coupled joints.
  - 1. Couplings: AASHTO M 252, corrugated, band type, matching tubing and fittings.
- B. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.
  - 1. Gaskets: ASTM F 477, elastomeric seal.

## 2.4 CLEANOUTS

- A. Cast-Iron Cleanouts: ASME A1 12.36.2M; with round-flanged, cast-iron housing; and secured, scoriated, Medium-Duty Loading class, cast-iron cover. Include cast-iron ferrule and countersunk, brass cleanout plug.

## 2.5 SOIL MATERIALS

- A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Division 31 Section "Earth Moving."

## 2.6 GEOTEXTILE FILTER FABRICS

- A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. (4480 to 13 440 L/min. per sq. m) when tested according to ASTM D4491.

# PART 3 - EXECUTION

## 3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

## 3.2 PIPING APPLICATION

- A. Underground Subdrainage Piping and Foundation Subdrainage Piping
  - 1. 4" Slotted HDPE pipe and fittings, soil tight joints.
- B. Underslab Subdrainage Piping:
  - 1. Perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.
- C. Header Piping:
  - 1. PE drainage tubing and fittings, couplings and coupled joints.
  - 2. PVC sewer pipe and fittings, couplings, and coupled joints.

## 3.3 CLEANOUT APPLICATIONS

- A. In Underground Subdrainage Piping:
  - 1. At Grade in Earth: PVC cleanouts.
  - 2. At Grade in Paved Areas: Cast-iron cleanouts.

### 3.4 FOUNDATION DRAINAGE AND UNDERDRAIN INSTALLATION

- A. Install drainage system at locations shown on the Drawings. Lay pipe flat with the invert positioned at invert elevation shown on the Drawings.
- B. Completely surround drainage pipe with a minimum of 6-inches of underdrain backfill material and geotextile filter fabric. Place pipe with joints tightly closed in accordance with manufacturer's recommendations so that flow lines conform to required grades. For perforated collector pipe, lay pipe with perforations down.
- C. Underslab drainage pipe, if used, will be embedded mid-height in a minimum 12 in. layer of drainage course directly below slabs where shown on the Drawings. Completely cover exposed soil subgrade below drainage course with geotextile filter fabric prior to placement of drainage course. Place pipe with the joints tightly closed in accordance with manufacturer's recommendations so that flow lines conform to required grades. For perforated collector pipe, lay pipe with perforations down.
- D. Provide wall through penetrations at locations shown on the Drawings to allow connection of the perimeter and underslab drain piping, if used.
- E. Any sections of piping that are not true to lines and grades, or that show any undue settlement after being laid, or are damaged will be removed and re-laid or replaced at no additional cost.
- F. Test or check lines before backfilling to assure free flow. Remove obstructions, replace damaged components, and retest system until satisfactory.
- G. Provide cleanouts for drainage piping at changes of direction, bend of lines, and wherever indicated on the Drawings, and necessary to enable system to be cleaned out. Extend cleanouts to finished grade or top of slab and provide surface protection. Coordinate cleanout locations with structural and architectural improvements.
- H. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
- I. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- J. Install PVC piping according to ASTM D 2321
- K. Install PE corrugated sewer piping according to ASTM D 2321

### 3.5 PIPE JOINT CONSTRUCTION

- A. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.
- B. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose bell-and-spigot joints.
- C. Join corrugated PE piping according to ASTM D 3212 for push-on joints



- D. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials

### 3.6 CLEANOUT INSTALLATION

#### A. Cleanouts for Foundation

1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. In vehicular-traffic areas, use NPS 4 (DN 100) cast-iron soil pipe and fittings for piping branch fittings and riser extensions to clean out. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches (450 by 450 by 300 mm) in depth. Set top of cleanout flush with grade. Cast-iron pipe may also be used for cleanouts in non-vehicular-traffic areas.
3. In non-vehicular-traffic areas, use NPS 4 (DN 100) cast-iron pipe and fittings for piping branch fittings and riser extensions to clean out. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches (300 by 300 by 100 mm) in depth. Set top of cleanout plug 1 inch (25 mm) above grade.

#### B. Cleanouts for Underslab Subdrainage:

1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. Use NPS 4 (DN 100) cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

### 3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.
- C. Where required, connect low elevations of foundation underslab subdrainage to stormwater sump pumps.

### 3.8 FIELD QUALITY CONTROL

- A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

### 3.9 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops

END OF SECTION 334600