CHILD CRISIS CENTER RENOVATION
PHASE D – FINAL RENOVATION
RALEIGH, NORTH CAROLINA

100% CONSTRUCTION DOCUMENTS

LS3P
434 FAYETTEVILLE STREET, SUITE 1700
RALEIGH, NORTH CAROLINA 27601
PHONE: (919) 829-2700

LS3P COMMISSION NUMBER: 8405-177070
This page intentionally left blank.
SECTION 000107 - SEALS PAGE

DESIGN PROFESSIONALS OF RECORD

ARCHITECT

LS3P ASSOCIATES LTD.
434 Fayetteville Street, Suite 1700
Raleigh, NC 27601
Corporate License No. 50417

ARCHITECT

Jeffrey Robert Mural, AIA, EDAC
License No. 13432

STRUCTURAL

Jamie L. Brueggeman, P.E.
NV5 Engineers + Consultants
3300 Regency Parkway, Suite 100
Cary, NC 27518
License No. 029384

CIVIL

Jamie L. Powless, P.E.
NV5 Engineers + Consultants
3300 Regency Parkway, Suite 100
Cary, NC 27518
License No. 38704
This page intentionally left blank.
LANDSCAPE
Walter R. Havener, R.L.A.
Surface 678
215 Morris Street, Suite 150
Durham, NC 27701
License No. 593

FIRE PROTECTION
Richard T. Thorne, Jr., P.E.
HDM Associates, Inc.
106 Tarheel Court
Elizabeth City, NC 27909
License No. 18043

PLUMBING
Richard T. Thorne, Jr., P.E.
HDM Associates, Inc.
106 Tarheel Court
Elizabeth City, NC 27909
License No. 18043

MECHANICAL
Richard T. Thorne, Jr., P.E.
HDM Associates, Inc.
106 Tarheel Court
Elizabeth City, NC 27909
License No. 18043
This page intentionally left blank.
ELECTRICAL

Richard T. Thorne, Jr., P.E.
HDM Associates, Inc.
106 Tarheel Court
Elizabeth City, NC 27909
License No. 18043.

END OF DOCUMENT 000107
TABLE OF CONTENTS

DIVISION 00 — PROCUREMENT AND CONTRACTING REQUIREMENTS
00015  ALLIANCE - FORMAL BID FORMS
0001   ADVERTISEMENT FOR BIDS
0002   INTENDED BID SCHEDULE
0003   INSTRUCTIONS TO BIDDERS
0004   NON-DISCRIMINATION AND EQUAL EMPLOYMENT OPPORTUNITY
0005   GUIDELINES FOR RECRUITMENT AND SELECTION OF MINORITY BUSINESSES
0006   FORMS CHECKLIST
   A. MINORITY PARTICIPATION FORMS-AFFIDAVIT A, AFFIDAVIT B, AFFIDAVIT C
   APPENDIX E
   B. BID FORM
   C. NO REPLY BID FORM
   D. NON-COLLUSION AFFIDAVIT
   E. ALLIANCE VENDOR PROFILE FORM
   F. ALLIANCE EFT AUTHORIZATION FORM
   G. W-9 FORM
   H. AFFIDAVIT OF COMPLIANCE (E-VERIFY)
   I. SPECIAL NOTICE - NORTH CAROLINA SALES TAX
   J. NCDOR E-589C1 AFFIDAVIT OF CAPITAL IMPROVEMENT
   K. PERFORMANCE BOND - SAMPLE
   L. POWER OF ATTORNEY – SAMPLE
   M. APPENDIX E – MINORITY BUSINESS ENTERPRISE (MBE) DOCUMENTATION FOR
      CONTRACT PAYMENTS SAMPLE

003126 - EXISTING HAZARDOUS MATERIAL INFORMATION
003126A - HAZMAT REPORT - LEAD PAINT EXCERPT
003126B - UST EVALUATION
003132 - GEOTECHNICAL DATA
003132A - GEOTECHNICAL EXPLORATION REPORT
006000 - PROJECT FORMS
006313 - REQUEST FOR INFORMATION FORM
006325 - REQUEST FOR SUBSTITUTION FORM

DIVISION 01 — GENERAL REQUIREMENTS
011000 - SUMMARY
012100 - ALLOWANCES
012200 - UNIT PRICES
012300 - ALTERNATES
012500 - SUBSTITUTION PROCEDURES
012600 - CONTRACT MODIFICATION PROCEDURES
012900 - PAYMENT PROCEDURES
013100 - PROJECT MANAGEMENT AND COORDINATION
013200 - CONSTRUCTION PROGRESS DOCUMENTATION
013233 - PHOTOGRAPHIC DOCUMENTATION
013300 - SUBMITTAL PROCEDURES
013301 - DIGITAL DATA LETTER OF AGREEMENT
014000 - QUALITY REQUIREMENTS
014100 - SPECIAL INSPECTIONS
014101 - CONTRACTOR'S STATEMENT OF RESPONSIBILITY
015000 - TEMPORARY FACILITIES AND CONTROLS
016000 - PRODUCT REQUIREMENTS
017300 - EXECUTION
017329 - CUTTING AND PATCHING
017700 - CLOSEOUT PROCEDURES
017823 - OPERATION AND MAINTENANCE DATA
017836 - WARRANTIES
017839 - PROJECT RECORD DOCUMENTS
017900 - DEMONSTRATION AND TRAINING

DIVISION 02 — EXISTING CONDITIONS
024119 - SELECTIVE DEMOLITION

DIVISION 03 — CONCRETE
033000 - CAST-IN-PLACE CONCRETE
033300 - LANDSCAPE ARCHITECTURAL CONCRETE

DIVISION 04 — MASONRY
042000 - UNIT MASONRY

DIVISION 05 — METALS
051200 - STRUCTURAL STEEL FRAMING
057000 - STEEL DECKING
055000 - METAL FABRICATIONS
055813 - METAL COLUMN WRAPS

DIVISION 06 — WOOD, PLASTICS, AND COMPOSITES
061053 - MISCELLANEOUS ROUGH CARPENTRY
061600 - SHEATHING
064023 - INTERIOR ARCHITECTURAL WOODWORK

DIVISION 07 — THERMAL AND MOISTURE PROTECTION
070150 - ROOF PATCHING AND REPAIR
070150A - GAF 20 YEAR WARRANTY
072100 - THERMAL INSULATION
072419 - WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)
072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS
074243 - METAL COMPOSITE WALL AND SOFFIT PANELS
075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING
076200 - SHEET METAL FLASHING AND TRIM
077100 - ROOF SPECIALTIES
077200 - ROOF ACCESSORIES
078413 - PENETRATION FIRESTOPPING
078446 - FIRE-RESISTIVE JOINT SYSTEMS
079200 - JOINT SEALANTS
079500 - EXPANSION CONTROL
DIVISION 08 — OPENINGS
081113 - HOLLOW METAL DOORS AND FRAMES
081416 - FLUSH WOOD DOORS
083113 - ACCESS DOORS AND FRAMES
084413 - GLAZED ALUMINUM CURTAIN WALLS
085653 - SECURITY WINDOWS
086200 - UNIT SKYLIGHTS
087100 - DOOR HARDWARE
087100A - DOOR HARDWARE SCHEDULE
088000 - GLAZING
088853 - SECURITY GLAZING
089000 - LOUVERS

DIVISION 09 — FINISHES
092216 - NON-STRUCTURAL METAL FRAMING
092900 - GYPSUM BOARD
093000 - TILING
095113 - ACOUSTICAL PANEL CEILINGS
096513 - RESILIENT BASE AND ACCESSORIES
096529 - RESILIENT SHEET FLOORING
096813 - TILE CARPETING
097200 - WALL COVERINGS
097700 - FIBERGLASS REINFORCED PLASTIC (FRP) PANELS
099113 - EXTERIOR PAINTING
099123 - INTERIOR PAINTING
099600 - HIGH-PERFORMANCE COATINGS

DIVISION 10 — SPECIALTIES
101100 - VISUAL DISPLAY SURFACES
102600 - WALL AND DOOR PROTECTION
102600 - WALL PROTECTION
102800 - TOILET AND BATH ACCESSORIES
104400 - FIRE-PROTECTION SPECIALTIES
105126 - SOLID-PHENOLIC LOCKERS
109000 - MISCELLANEOUS SPECIALTIES

DIVISION 12 — FURNISHINGS
122413 - ROLLER WINDOW SHADES
124813 - ENTRANCE WALK-OFF MATS

DIVISION 21 — FIRE SUPPRESSION
211313 - WET-PIPE AND DRY-PIPE SPRINKLER SYSTEMS

DIVISION 22 — PLUMBING
220500 - BASIC PLUMBING MATERIALS & METHODS
220523 - PLUMBING VALVES
220529 - HANGERS & SUPPORTS FOR PLUMBING PIPE
220553 - IDENTIFICATION FOR PLUMBING PIPING
220700 - PLUMBING PIPE INSULATION
221116 - DOMESTIC WATER PIPING
221119 - PLUMBING SPECIALTIES
<table>
<thead>
<tr>
<th>Division</th>
<th>Description</th>
<th>Section Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Sanitary Waste &amp; Vent Piping</td>
<td>221316</td>
</tr>
<tr>
<td>22</td>
<td>Storm Drainage Piping</td>
<td>221413</td>
</tr>
<tr>
<td>22</td>
<td>Plumbering Fixtures</td>
<td>224000</td>
</tr>
<tr>
<td>23</td>
<td>Heating Ventilating and Air Conditioning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Basic Mechanical Materials &amp; Methods</td>
<td>230500</td>
</tr>
<tr>
<td></td>
<td>Common Motor Requirements for HVAC Equipment</td>
<td>230513</td>
</tr>
<tr>
<td></td>
<td>Identification for HVAC Piping &amp; Equipment</td>
<td>230553</td>
</tr>
<tr>
<td></td>
<td>Testing, Adjusting, &amp; Balancing for HVAC</td>
<td>230593</td>
</tr>
<tr>
<td></td>
<td>Duct Insulation</td>
<td>230713</td>
</tr>
<tr>
<td></td>
<td>Fuel Gas Piping</td>
<td>231123</td>
</tr>
<tr>
<td></td>
<td>Metal Ducts</td>
<td>233113</td>
</tr>
<tr>
<td></td>
<td>Air Duct Accessories</td>
<td>233300</td>
</tr>
<tr>
<td></td>
<td>HVAC Power Ventilators</td>
<td>233423</td>
</tr>
<tr>
<td></td>
<td>Diffusers, Registers &amp; Grilles</td>
<td>233713</td>
</tr>
<tr>
<td></td>
<td>HVAC Gravity Ventilators</td>
<td>233723</td>
</tr>
<tr>
<td></td>
<td>Rooftop Air Conditioners</td>
<td>237413</td>
</tr>
<tr>
<td>24</td>
<td>Fuel Gas Piping</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HVAC Power Ventilators</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HVAC Gravity Ventilators</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rooftop Air Conditioners</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Electrical</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Basic Electrical Materials &amp; Methods</td>
<td>260100</td>
</tr>
<tr>
<td></td>
<td>Low-Voltage Electrical Power Conductors &amp; Cables</td>
<td>260519</td>
</tr>
<tr>
<td></td>
<td>Grounding &amp; Bonding for Electrical Systems</td>
<td>260526</td>
</tr>
<tr>
<td></td>
<td>Raceways &amp; Boxes for Electrical Systems</td>
<td>260533</td>
</tr>
<tr>
<td></td>
<td>Identification for Electrical Systems</td>
<td>260553</td>
</tr>
<tr>
<td></td>
<td>Panelboards</td>
<td>262416</td>
</tr>
<tr>
<td></td>
<td>Wiring Devices</td>
<td>262726</td>
</tr>
<tr>
<td></td>
<td>Fuses</td>
<td>262813</td>
</tr>
<tr>
<td></td>
<td>Enclosed Switches &amp; Circuit Breakers</td>
<td>262816</td>
</tr>
<tr>
<td></td>
<td>Diesel Emergency Engine Generators</td>
<td>263213.13</td>
</tr>
<tr>
<td></td>
<td>Transfer Switches</td>
<td>263600</td>
</tr>
<tr>
<td></td>
<td>LED Interior Switches</td>
<td>265119</td>
</tr>
<tr>
<td></td>
<td>Emergency and Exit Lighting</td>
<td>265213</td>
</tr>
<tr>
<td>26</td>
<td>Communications</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Communication Pathways and Wiring</td>
<td>270528</td>
</tr>
<tr>
<td></td>
<td>Communication Copper Horizontal Cabling</td>
<td>271513</td>
</tr>
<tr>
<td>27</td>
<td>Electronic Safety and Security</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Addressable Fire-Alarm Systems</td>
<td>284621.11</td>
</tr>
<tr>
<td>28</td>
<td>Earthwork</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Site Clearing</td>
<td>311000</td>
</tr>
<tr>
<td></td>
<td>Termite Control</td>
<td>313116</td>
</tr>
<tr>
<td>29</td>
<td>Exterior Improvements</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asphalt Paving</td>
<td>321216</td>
</tr>
<tr>
<td></td>
<td>Concrete Paving</td>
<td>321313</td>
</tr>
<tr>
<td></td>
<td>Concrete Paving Joint Sealants</td>
<td>321373</td>
</tr>
<tr>
<td></td>
<td>Pavement Markings</td>
<td>321723</td>
</tr>
<tr>
<td></td>
<td>Synthetic Grass Surfacing</td>
<td>321813</td>
</tr>
<tr>
<td></td>
<td>Playground Protective Surfacing</td>
<td>321816.13</td>
</tr>
<tr>
<td></td>
<td>Welded Wire Fencing</td>
<td>323123</td>
</tr>
<tr>
<td></td>
<td>Site Furnishings</td>
<td>323300</td>
</tr>
<tr>
<td>Division 33 — Utilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>334200 - Stormwater Conveyance</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table of Contents**

- 328400 - Planting Irrigation
- 329200 - Turf and Grasses
- 329300 - Plants

**End of Table of Contents**
This page intentionally left blank.
INVITATION FOR BIDS – CONSTRUCTION SERVICES
IFB 21-003

General Construction - Phase D
Alliance Child Crisis Center
400 W. Ransom St.
Fuquay Varina, NC 27526

Architect Contact Information
LS3P
434 Fayetteville Street,
Suite 1700, Raleigh, NC 27601
Eileen McDonough 919-829-2700
eileenmcdonough@ls3p.com
# INVITATION FOR BIDS – CONSTRUCTION SERVICES

**IFB 21-003**

General Construction - Phase D  
Alliance Child Crisis Center  
400 W. Ransom St.  
Fuquay Varina, NC 27526

## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTERS</th>
<th>PAGE #</th>
</tr>
</thead>
<tbody>
<tr>
<td>0001 Advertisement for Bids</td>
<td>2 - 5</td>
</tr>
<tr>
<td>0002 Intended Bid Schedule</td>
<td>6</td>
</tr>
<tr>
<td>0003 Instructions to Bidders</td>
<td>7 - 10</td>
</tr>
<tr>
<td>0004 Non-Discrimination and Equal Employment Opportunity</td>
<td>11</td>
</tr>
<tr>
<td>0005 Guidelines for Recruitment and Selection of Minority Businesses</td>
<td>12 - 14</td>
</tr>
<tr>
<td>0006 Forms Checklist</td>
<td>15</td>
</tr>
<tr>
<td>a. Minority Participation Forms-Affidavit A, Affidavit B, Affidavit C</td>
<td></td>
</tr>
<tr>
<td>b. Bid Form</td>
<td></td>
</tr>
<tr>
<td>c. No Reply Bid Form</td>
<td></td>
</tr>
<tr>
<td>d. Non-Collusion Affidavit</td>
<td></td>
</tr>
<tr>
<td>e. Alliance Vendor Profile Form</td>
<td></td>
</tr>
<tr>
<td>f. W-9 Form</td>
<td></td>
</tr>
<tr>
<td>g. Alliance EFT Authorization Form</td>
<td></td>
</tr>
<tr>
<td>h. Affidavit of Compliance (E-Verify)</td>
<td></td>
</tr>
<tr>
<td>i. Special Notice - North Carolina Sales Tax</td>
<td></td>
</tr>
<tr>
<td>j. NCDOR E-589C1 Affidavit of Capital Improvement</td>
<td></td>
</tr>
<tr>
<td>k. Performance Bond - Sample</td>
<td></td>
</tr>
<tr>
<td>l. Power of Attorney – Sample</td>
<td></td>
</tr>
<tr>
<td>m. Appendix E – Minority Business Enterprise (MBE) Documentation for Contract Payments Sample</td>
<td></td>
</tr>
</tbody>
</table>

**Drawings**  
Separate Online Document  

**Technical Specifications**  
Separate Online Document
Pursuant to the General Statutes of North Carolina, Section 143-129, sealed proposals are invited and will be received by Alliance Health Home Office until Wednesday, October 7, 2020 by 3:00 PM, ET at 5200 W. Paramount Pkwy, Suite 200, Morrisville, NC 27560.

Description of project and location:
The project renovations and additions to an existing shell building to create a new Child and Adolescent Facility Based Crisis Center and a Behavioral Health Urgent Care. The project will generally include site work, general construction, warranted roofing alterations, mechanical, electrical, plumbing and fire protection work. Alliance Health has performed the following work by separate contract prior to the commencement of Phase D: Phase A – Interior Demolition and Abatement, Phase B – Roof Replacement, and Phase C – Pavement Repair. Any alternates will be as indicated in the Technical Specifications.

Plans, Drawings, Specifications, Contract Documents & Addenda:
Complete plans, specifications, contract documents and Addenda may be obtained electronically by going to http://infoexchange.ls3p.com and login using your e-mail address and “anonymous” as the password. Click on the download link for the Alliance Child Crisis Center.

From the date of this advertisement until proposal due date, the Advertisement for Bids and Addendums issued will be posted on the Alliance website: https://www.alliancehealthplan.org/ as needed under About Alliance/Work with Alliance/RFP’s, RFI’s, RFQs, Q&A’s available from LS3P, and available at the following locations:

<table>
<thead>
<tr>
<th>Business/Entity</th>
<th>City</th>
<th>Location/Phone</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duncan Parnell</td>
<td>Raleigh, NC</td>
<td>201 Glenwood Ave.</td>
<td><a href="https://www.duncan-parnell.com/planrooms">https://www.duncan-parnell.com/planrooms</a></td>
</tr>
<tr>
<td>Carolinas Association of General Contractors (now Construct Connect)</td>
<td></td>
<td>800-364-2059</td>
<td><a href="https://www.constructconnect.com/">https://www.constructconnect.com/</a></td>
</tr>
<tr>
<td>Construction Market Data (now Construct Connect)</td>
<td></td>
<td>800-364-2059</td>
<td><a href="https://www.constructconnect.com/">https://www.constructconnect.com/</a></td>
</tr>
<tr>
<td>Hispanic Contractors Association of the Carolinas (HCAC)</td>
<td>Winston-Salem/Charlotte/Raleigh Areas</td>
<td>704-583-4184</td>
<td><a href="mailto:info@hcacarolinas.org">info@hcacarolinas.org</a>/ <a href="http://www.hcacarolinas.org">www.hcacarolinas.org</a></td>
</tr>
</tbody>
</table>
Contractors who bid shall be licensed to do work in the State of North Carolina under the Act to Regulate the Practice of General Contracting.

**Mandatory Pre-Bid Conference:** See Intended Bid Schedule in Section 0002 below. **Note:** Please check in at the front desk. The pre-bid conference is Mandatory and sign-in upon arrival is required.

**Mandatory Site Visit:** A Mandatory site visit will be held directly following the Mandatory pre-bid meeting to provide potential bidders with an opportunity to view the project site and become familiar with existing conditions. No other site visits will be conducted. All Bidders who intend to bid are required to attend the Mandatory pre-bid and the Mandatory Site Visit. During the site visit, information shall not be exchanged, and no interpretations of the contract documents shall be made.

3. **Questions:** See Intended Bid Schedule in Section 0002 below.

4. **Addendums:** Answers to questions will be addressed in an Addendum. Any Addendums issued will be posted on Alliance’s website [https://www.alliancehealthplan.org/](https://www.alliancehealthplan.org/) as needed under About Alliance/Work with Alliance/RFP’s, RFI’s, RFQs, Q&A’s; will be on file with LS3P and available at the above listed locations. Addendums issued will become part thereof the contract.

It shall be the Contractor’s responsibility to ascertain bid includes any changes issued in Addendums.

The Architect will not be responsible for any explanation or interpretation of the proposed documents. Neither the Owner nor the Architect will be responsible for any oral instructions. Any interpretation of the proposed document will be made only by Addendum duly issued.

All Addenda shall be acknowledged by the Bidder(s) on the Bid Form. Failure to do so shall disqualify the bid and shall cause the bid to be rejected.

**Note:** Alliance Health is not responsible for direct distribution of addenda to all vendors who wish to submit a proposal. Alliance Health cannot guarantee internet access. It is highly recommended that vendors review posting locations for any additional information prior to the bid closing date and time.

5. **Substitutions:** in accordance with the provisions of G.S. 133-3, material, product, or equipment substitutions proposed by the bidders to those specified herein can only be considered during the bidding phase until ten (10) days prior to the receipt of bids when submitted to the Architect with sufficient data to confirm material, product, or equipment

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>State of NC HUB Bid Opportunities</td>
<td>Raleigh, NC</td>
<td>N/A</td>
<td><a href="https://ncadmin.nc.gov/businesses/hub/events">https://ncadmin.nc.gov/businesses/hub/events</a></td>
</tr>
</tbody>
</table>
equality. Proposed substitutions submitted after this time will be considered only as potential change order.

Submittals for proposed substitutions shall include the following information:

a. Name, address, and telephone number of manufacturer and supplier as appropriate.
b. Trade name, model or catalog designation.
c. Product data including performance and test data, reference standards, and technical descriptions of material, product, or equipment. Include color samples and samples of available finishes as appropriate.
d. Detailed comparison with specified products including performance capabilities, warranties, and test results.
e. Other pertinent data including data requested by the Designer to confirm product equality.

If a proposed material, product, or equipment substitution is deemed equal by the Architect to those specified, all bidders of record will be notified by Addendum.

6. **Proposals:** Proposal due date and delivery address: See Intended Bid Schedule in Section 0002 below **Note: Bids will be opened publicly.**

All copies of the Bid, the Bid Bond/Security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope.

Submit one (1) original hard copy, and one (1) flash drive.

**Envelope shall be identified with the project name, bid number (IFB 21-003), due date and time, the Bidder's name, address, and the Contractor's North Carolina license number.**

**Notes:** It is the responsibility of the Bidder to ensure that the bid arrives at or before the time and date indicated. Alliance is not responsible for mail or delivery system failures. Bids received after the due date and time will not be opened.

The IFB is provided as a .pdf document. The expectation for filling out required forms is to print these forms, fill in (handwritten is acceptable), sign and **notarize** as necessary, and return with submittal.
This page intentionally left blank.
## INTENDED BID SCHEDULE

### INVITATION FOR BIDS – CONSTRUCTION SERVICES

**IFB 21-003**

General Construction - Phase D -
Alliance Child Crisis Center
400 W. Ransom St., Fuquay Varina, NC 27526

<table>
<thead>
<tr>
<th>Event Description</th>
<th>Date/Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advertisement for Bids - Legal Notice</td>
<td>September 16, 2020</td>
</tr>
<tr>
<td>Posted at <a href="https://www.alliancehealthplan.org/">https://www.alliancehealthplan.org/</a> as needed under About Alliance/Work with Alliance/RFP’s, RFI’s, RFQs, Q&amp;A’s</td>
<td></td>
</tr>
<tr>
<td>Mandatory Pre-Bid Conference-at Project Site</td>
<td>September 22 at 10:00 AM, ET</td>
</tr>
<tr>
<td>Alliance Child Crisis Center</td>
<td></td>
</tr>
<tr>
<td>400 W. Ransom St. Fuquay Varina, NC 27526</td>
<td></td>
</tr>
<tr>
<td>Meet in front of building</td>
<td></td>
</tr>
<tr>
<td>Mandatory Site Visit</td>
<td>To be held directly following the Mandatory pre-bid conference</td>
</tr>
<tr>
<td>Vendor Questions Due to: <a href="mailto:admcontracts@alliancehealthplan.org">admcontracts@alliancehealthplan.org</a></td>
<td>September 25, 2020 by 5:00 PM, ET</td>
</tr>
<tr>
<td>Addendum</td>
<td>September 30, 2020</td>
</tr>
<tr>
<td>Issued and posted as necessary on the AH website: <a href="https://www.alliancehealthplan.org/">https://www.alliancehealthplan.org/</a> as needed under About Alliance/Work with Alliance/RFP’s, RFI’s, RFQs, Q&amp;A’s.</td>
<td></td>
</tr>
<tr>
<td>Proposals Due</td>
<td>October 7, 2020 at 3:00 pm, ET</td>
</tr>
</tbody>
</table>
This page intentionally left blank.
1. **General Information:** For a Bid to be considered, it shall be in accordance with the following instructions:

Bids shall be made in strict accordance with the “Bid Form” provided herein and all blank spaces for the Bid Alternates and Unit Prices shall be properly filled in. When requested alternates are not bid, the Bidder shall indicate by the words “No Bid”. Any blanks shall be interpreted as “No Bid”. The Bidder agrees that Bids on a Bid Form detached from specifications will be considered and will have the same force and effect as if attached hereto. Bid numbers shall be stated both in writing and in figures for the Base Bid and Alternates. If figures and writing differ, the written number will supersede the figures.

Any modifications to the Form of Proposal (including alternates and/or unit prices) will disqualify the bid and may cause the bid to be rejected.

**Bids are invited on the basis of a Single Prime Contract.**

The Contractor shall fill in the Bid Form as follows:

A. If the documents are executed by a sole Owner, that fact shall be evidenced by the word “Owner” appearing after the name of the person.

B. If the documents are executed by a Partnership, that fact shall be evidenced by the word “Co-Partner” appearing after the name of the partner executing them.

C. If the documents are executed on the part of a Corporation, they shall be executed by either the President or the Vice-President and attested by the Secretary or Assistant Secretary in either case or the title of the office of such person shall appear after their signatures. The Seal of the Corporation shall be impressed on each signature page of the documents.

D. If the Bid is made by a Joint Venture, it shall be executed by each member of the Joint Venture in the above form for sole Owner, Partnership, or Corporation, whichever form is applicable.

E. All signatures shall be properly witnessed.

F. It shall be the specific responsibility of the Bidder to deliver this Bid to the proper official at the appointed place and prior to the time for the opening of the Bids. Late delivery of a Bid for any reason, including delivery by the United States Mail, shall disqualify the Bid.

G. Modifications of previously deposited Bids will be acceptable only if delivered to the place of the bid opening prior to the time for opening Bids.

H. Unit Prices quoted in the Bids shall include overhead and profit and shall be the full compensation for the Contractor’s cost involved in the work.

**Contractors who bid shall be licensed to do work in the State of North Carolina under the Act to Regulate the Practice of General Contracting.**

2. **Examination of Conditions:** It is understood and mutually agreed that by submitting a Bid the Contractor acknowledges that he/she has carefully examined the bidding documents pertaining to the work, the locations, accessibility and general character of the site of the work and all existing buildings and structures within and adjacent to the site; and has satisfied him/herself as to the nature of the work, the condition of the existing buildings and structures, the conformation of the ground, the character, quality and quantity of the materials to be encountered; the character of the equipment, machinery, plant and other facilities needed preliminary to and during prosecuting of the work; the general and local conditions; the construction hazards; and all other matters, including but not limited to, the labor situation...
which can in any way affect the work under the Contract; and including all safety measures required by the Occupational Safety Health Act of 1970 and all rules and regulations issued pursuant thereto. It is further mutually agreed that by submitting a Bid, the Contractor acknowledges that he/she has satisfied him/herself as to the feasibility and meaning of the plans, drawings, Specifications, and other contract documents for the construction of the work, that he/she accepts all terms, conditions and stipulations contained therein, and that he/she is prepared to work in cooperation with the other contractors performing work on the site.

Reference is made to contract documents for the identification of those surveys and investigation reports of subsurface or latent physical conditions at the site or otherwise affecting performance of the work, which have been relied upon by the designer in preparing the documents. The owner will make copies of all such surveys and reports available to the bidder upon request.

Each bidder may, at his own expense, make such additional surveys and investigations, as he may deem necessary to determine his bid price for the performance of the work. Any on-site investigation shall be done at the convenience of the owner. Any reasonable request for access to the site prior to bid due date will be honored by the owner.

3. **Bid Tabulation:** Bids will be examined promptly after private opening and award will be made at the earliest possible date. The prices quoted shall be held firm for ninety (90) days.

Bid withdrawal after opening is permitted only if all conditions specified in North Carolina General Statutes Section 143-129.1

Bids shall be evaluated using the Total Bid. The Total Bid shall be the summation of the product of all of the Items’ Unit Bid Prices by their Estimated Quantities. In the event of a math error, the Extended Totals and the Total Bid will be corrected based on the Unit Price furnished in the bid. Bids with math errors will be compared using the corrected Total Bid (i.e., the math shall be correct before a bid is considered for award).

4. **Bid Evaluation and Award:** The Owner shall award the contract to the lowest responsible, responsive Bidder taking into consideration the past performance of the Bidder on Construction Contracts for Alliance Health, the State of North Carolina, or other governmental agencies with particular concern given to completion times, quality of work, cooperation with other Contractors, and cooperation with the Architect and Owner.

In the event the lowest responsible bids are in excess of the funds available for the project, Alliance will enter into negotiations with the lowest responsible bidder, making reasonable changes in the plans and specifications as may be necessary to bring the contract price within the funds available. If a contract cannot be let under the above conditions, Alliance is authorized to re-advertise, as herein provided, after having made such changes in plans and specifications as may be necessary to bring the cost of the project or purchase within the funds available therefor. The procedure above specified may be repeated if necessary in order to secure an acceptable contract within the funds available therefor.

5. **Contract:** American Institute of Architects AIA A101-2007, Agreement between Owner and Contractor, and the AIA A201-2007, General Conditions of the Contract for Construction will be utilized. The IFB, Addendums, Bid Proposal, and other bid documents as necessary will be attached to the construction contract.

6. **Lien Agent:** Pursuant to 44A-34, Article 1 and 2 of Chapter 44A are not applicable to public bodies or public buildings. Therefore is not applicable to this project.
7. **Performance Bond and Power of Attorney:** The Contractor shall furnish bonds covering the faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or required by North Carolina law. Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall permit a copy to be made.

Power of Attorney shall be included when submitting a Performance Bond.

8. **Insurance:** Contractor shall procure and maintain for the duration of the contract the following insurance coverage from an insurance company(s) possessing a rating of A-VI or higher from the A.M. Best Company or an equivalent rating service. All of the policies required of the Contractor shall contain a waiver of subrogation provision to waive all rights of recovery under subrogation or otherwise against Alliance. Contractor shall advise Alliance of any cancellation, non-renewal, or material change in any policy within ten (10) days of notification of such action and provide updated certificates of insurance evidencing renewals within fifteen (15) days of expiration. All of the policies required of the Contractor shall be primary and the Contractor agrees that any insurance or self-funded liability programs maintained by Alliance shall be non-contributing with respect to the Contractor’s insurance.

   **8.1 Commercial General Liability**
   Shall be a limit of not less than $2,000,000 per occurrence and $5,000,000 aggregate. Coverage shall be in a form providing coverage not less than the standard Insurance Services Office Form CG 00 01 and include products and completed operations, property damage, bodily injury, and personal & advertising injury. The products-completed operations coverage shall be provided for a minimum of six (6) years following final acceptance of the work.

   **8.2 Commercial Automobile Liability**
   Shall be a limit of not less than $2,000,000 per occurrence for any (Code 1) vehicle.

   **8.3 Worker’s Compensation and Employers Liability**
   Shall be at North Carolina statutory limits. Contractor shall satisfy all compulsory requirements relating to workers compensation in any jurisdiction in which benefits may be claimed. Employers Liability shall be a limit of not less than $1,000,000 per accident for bodily injury or disease.

   **8.4 Professional Liability**
   Shall be a limit of not less than $5,000,000 per occurrence or claim, and $5,000,000 aggregate. There shall be an extended reporting period of not less than six (6) years.

   **8.5 Contractor’s Pollution Legal Liability**
   Shall be at a limit not less than $5,000,000 per occurrence or claim and $5,000,000 aggregate.

   **8.6 “All Risk” Property (Contractor’s Property)**
   Replacement cost coverage under an “All Risk” policy for any of the Contractor’s real or personal property. Policy shall include coverage for equipment owned, leased, rented, and borrowed, whether such equipment is located at a job site or “in transit.”

9. **Builders Risk** – The Contractor is not responsible for this. Alliance shall provide its own coverage.
Insurance coverage shall be obtained from companies that are authorized to provide such coverage and that are authorized by the Commissioner of Insurance to do business in North Carolina. Contractor, upon request, shall furnish Alliance with complete copies of insurance policies required. By requiring insurance herein, Alliance does not represent that coverage, limits will necessarily be adequate to protect Contractor and such coverage, and limits shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Alliance in this Contract. Any umbrella or excess liability coverage shall be at least as broad as the primary coverage and contain all coverage provisions that are required of the primary coverage.

The failure of Alliance at any time to enforce the insurance provisions, to demand such certificates of insurance, or to identify a deficiency shall not constitute a waiver of those provisions, nor reduce the obligations of the Contractor to maintain such insurance or to meet its obligations under the indemnification provisions.

The contractor shall provide Alliance a valid certificate of insurance, in advance of the performance of any work, exhibiting coverage as required by Alliance. Providing and maintaining adequate insurance coverage is a material obligation of the Contractor. Contractor shall require its subcontractors to maintain insurance coverage required herein or cover the subcontractors' under the Contractor's policies. The Certificate of Insurance shall be provided on the industry standard form (ACORD 25).

Notwithstanding the foregoing, nothing contained in this section shall be deemed to constitute a waiver of the governmental immunity of Alliance, which immunity is hereby reserved to Alliance.

10. **Contract Completion Time:** Commencement of onsite Construction Activities: Immediately upon award of contract; Substantial Completion Date: no later than June 1, 2021 (or later date as determined by Alliance).

11. **Security of Non-public Records:** Pursuant to N.C.G.S. § 132-1.7, entitled, “Sensitive Public Security Information”, public records, as defined in G.S. 132-1, shall not include information containing specific details of public security plans and arrangements or the detailed plans and drawings of public buildings and infrastructure facilities. Therefore, all information provided, received, gathered or obtained by Bidder containing specific details of public security plans and arrangements or the detailed plans and drawings of public buildings and infrastructure facilities shall be held confidential and shall be used by the Bidder only for responding to this bid. All plans and drawings shall be returned to Alliance. Any breach of this paragraph by the Bidder may result in Bidder being barred from being awarded any contracts with Alliance.

12. **E-Verify:** As a condition of payment for services rendered under this agreement, Contractor shall comply with the requirements of Article 2 of Chapter 64 of the General Statutes, as applicable. Further, if Contractor provides the services to Alliance utilizing a subcontractor, Contractor shall require the subcontractor to comply with the requirements of Article 2 of Chapter 64 of the General Statutes as well. Contractor shall verify, by affidavit, compliance of the terms of this section upon request by Alliance.
0004 – Non-Discrimination & Equal Employment Opportunity

During the performance of this contract, the contractor agrees as follows:

a. Contractor represents that it does not discriminate, harass, or retaliate against any employee or applicant for employment including but not limited to race, color, ethnicity, national origin, age, disability, sex, pregnancy, religion, National Guard or veteran status, sexual orientation, gender identity or gender expression.

In addition, Contractor takes affirmative action to ensure that qualified applicants are employed and that employees are treated fairly and legally during employment with regard to race, color, ethnicity, national origin, age, disability, sex, pregnancy, religion, National Guard or veteran status, sexual orientation, gender identity or gender expression. In the event a Contractor is determined by the final order of an appropriate agency or court to be in violation of any non-discrimination provision of federal, state or local law or this provision, this Contract may be canceled, terminated or suspended in whole or in part by Alliance.

b. 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, ethnicity, national origin, age, disability, sex, pregnancy, religion, National Guard or veteran status, sexual orientation, gender identity or gender expression.

c. The Contractor will send to each labor union or representative of workers with which he/she has a collective bargaining agreement or other contract or understanding a notice to be provided advising the labor union or workers’ representative of the Contractor’s commitments under the Equal Employment Opportunity section of this contract and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

d. In the event of the Contractor’s noncompliance with nondiscrimination clauses of this contract or with any such rules, regulations or orders, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Alliance contracts.

e. The Contractor will include the provisions of this section in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Board of Directors of Alliance Health, North Carolina so that such provisions will be binding such subcontractor or vendor.
0005 – Guidelines for Recruitment and Selection of Minority Businesses

Program Statement:
In accordance with N.C.G.S. § 143-128.2 (effective January 1, 2002) these guidelines establish Alliance’s goals for minority participation in single-prime bidding, separate-prime bidding, construction manager at risk, and alternative contracting methods, on Alliance construction projects in the amount of $100,000 or more.

Per N.C.G.S. § 143-128.2 Alliance shall have a verifiable ten percent (10%) goal for participation by minority businesses in the total value of work for each project for which a contract or contracts are awarded. These guidelines are created to accomplish that end.

Intent:
It is the intent of these guidelines that Alliance, as the awarding authority for construction projects, and the contractors and subcontractors performing the construction contracts awarded shall cooperate and in good faith do all things legal, proper and reasonable to achieve the statutory goal of ten percent (10%) for participation by minority businesses in each construction project as mandated by N.C.G.S. § 143-128.2.

Nothing in these guidelines shall be construed to require contractors or awarding authorities to award contracts or subcontracts to or to make purchases of materials or equipment from minority-business contractors or minority-business subcontractors who are not responsive bidders and/or do not submit the lowest responsible, responsive bid or bids taking into consideration quality, performance and the time specified in the bid or bids for performance of the contract.

Nothing in these guidelines shall limit the right of Alliance to reject proposals for any reason it deems to be in the best interest of Alliance.

Definitions:
N.C.G.S. § 143-128.4 Historically Underutilized Business is defined as:
➢ At least 51% of business is owned by one or more persons who are members of at least one of the groups in G.S.143-128.4 (b).
➢ For corporations, 51% of stock shall be owned by one or more persons who are members of at least one of the groups in 143-128.4 (b).
➢ The management and daily business operations shall be controlled by at least one of the groups in 143-128.4 (b).
➢ Business shall be owned and controlled as in 143-128.4 (b) by one or more citizens or lawful permanent residents of the United States who are members of one or more of the following groups:
  • Black - A person having origins in any of the black racial groups of Africa.
  • Hispanic - A person of Spanish or Portuguese culture having origins in Mexico, South or Central America, or the Caribbean islands, regardless of race.
  • Asian American - A person having origins in any of the original peoples of the Far East, Southeast Asia, Asia, Indian continent, or Pacific islands.
  • American Indian - A person having origins in any of the original Indian peoples of North America.
  • Woman
  • Disabled - A person with a disability as defined in G.S. 168-1 or G.S. 168A-3.
  • Disadvantaged - A person who is socially and economically disadvantaged as defined in 15 U.S.C. § 637.
Minority Business Certification:
Alliance does not certify minority businesses. Any business, which desires to participate as a minority business, will be required to complete and submit for certification, documents required by one of the agencies listed below. Only those businesses holding current certification through at least one of the following agencies will be considered eligible for inclusion in meeting the minority business participation percentage goals.

Certification with one or more of the following organizations:
➢ North Carolina Department of Administration (NCDOA)
  Office for Historically Underutilized Businesses (HUB)
  1336 Mail Service Center
  Raleigh, North Carolina 27699-1336
  (919) 807-2330

➢ North Carolina Department of Transportation (NCDOT)
  Disadvantaged Business Enterprise Program (DBE)
  1511 Mail Service Center
  Raleigh, NC 27699
  (919) 508-1941

Failure to provide evidence of certification status may disqualify the firm's participation for the purpose of meeting minority business goal.

Alliance Responsibilities:
➢ HUB Procurement Reporting to https://www.ips.state.nc.us/ips/Agency/Logon.aspx
  Furnished to NC DOA HUB Office a minimum of twenty-one days prior to the bid opening, the following public Construction or Repair Services (IFB) information:
  • Project description and location;
  • Locations where bidding documents may be reviewed;
  • Name of a representative of the business owner who can be contacted during the advertising period to advise who the prospective bidders are;
  • Date, time and location of the bid opening.
  • Date, time and location of pre-bid conference, if scheduled.

➢ At least 10 days prior to the scheduled day of bid opening, notify minority businesses that have requested notices from Alliance for public construction or repair work and minority businesses that otherwise indicated to the Office for Historically Underutilized Businesses an interest in the type of work being bid or the potential contracting opportunities listed in the proposal. The notice should include at least the information set forth in NCGS 143-128.2(e) (3).

➢ Utilize other media, as appropriate, likely to inform potential minority businesses of the bid being sought (e.g., The News & Observer).

➢ Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.

➢ Review, jointly with the Architect/Designer, all requirements of G.S. 143-128.2(c) and G.S. 143-128.2(f) (i.e. bidders’ proposals for identification of the minority businesses that will be utilized with corresponding total dollar value of the bid and affidavit listing good faith efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award.
➢ Evaluate documentation to determine good faith effort has been achieved for minority business utilization prior to recommendation of award.

➢ Review prime contractors’ pay applications for compliance with minority business utilization commitments prior to payment.

➢ Make documentation showing evidence of implementation of Owner’s responsibilities available for review by State Construction Office and HUB Office, upon request.

Contact with non-certified HUB businesses will not count towards good faith efforts unless the N.C. Department of Administration HUB Office, N.C. Department of Transportation, certifies the business that you contact or the U.S. Small Business Administration Section (a) Business Development Program as a minority business enterprise before the bids are opened.

**Minority Business Responsibilities:**
While minority businesses are not required to become certified in order to participate in the construction projects, it is recommended that they become certified and should take advantage of the appropriate technical assistance that is made available. In addition, minority businesses who are contacted by owners or bidders shall respond promptly whether or not they wish to submit a bid.
This page intentionally left blank.
**0006 – FORMS CHECKLIST**

**Forms:** The following forms shall be completed and returned with your bid proposal. The forms shall be completed & notarized as stated below. If the bid form is not applicable, submit with the bid and mark the top of the form with: **N/A**. Failure to submit these forms shall be grounds for rejection of the bid.

<table>
<thead>
<tr>
<th>Forms</th>
<th>Vendor has completed &amp; included with Bid</th>
<th>Notarized</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Minority Participation Forms:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Affidavit A</td>
<td>A - ☐ Yes ☐ No</td>
<td>A - ☐ Yes ☐ No</td>
</tr>
<tr>
<td>b) Affidavit B</td>
<td>B - ☐ Yes ☐ No ☐ N/A</td>
<td>B - ☐ Yes ☐ No ☐ N/A</td>
</tr>
<tr>
<td>c) Affidavit C</td>
<td>C - ☐ Yes ☐ No ☐ N/A</td>
<td>C - ☐ Yes ☐ No ☐ N/A</td>
</tr>
<tr>
<td>2. Bid Form*</td>
<td>☐ Yes ☐ No</td>
<td>N/A</td>
</tr>
<tr>
<td>3. No Bid Reply Form*</td>
<td>☐ Yes ☐ No ☐ N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>4. Non-Collusion Affidavit</td>
<td>☐ Yes ☐ No</td>
<td>☐ Yes ☐ No</td>
</tr>
<tr>
<td>5. Alliance Vendor Profile Form</td>
<td>☐ Yes ☐ No</td>
<td>N/A</td>
</tr>
<tr>
<td>6. Alliance EFT Authorization Form</td>
<td>☐ Yes ☐ No</td>
<td>N/A</td>
</tr>
<tr>
<td>7. W-9 Form</td>
<td>☐ Yes ☐ No</td>
<td>N/A</td>
</tr>
<tr>
<td>8. Affidavit of Compliance (E-Verify)</td>
<td>☐ Yes ☐ No</td>
<td>☐ Yes ☐ No</td>
</tr>
<tr>
<td>9. Special Notice-North Carolina Sales Tax</td>
<td>☐ Yes ☐ No</td>
<td>N/A</td>
</tr>
<tr>
<td>10. NCDOR E-589C1 Affidavit of Capital Improvement</td>
<td>☐ Yes ☐ No</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*The Vendor shall submit the bid form or the no reply bid form but not both.*
General Construction - Phase D - Alliance Child Crisis Center
AFFIDAVIT A – Bidders Listing of Good Faith Efforts

State of North Carolina
County of ______________________________

Affidavit of ____________________________________

(Name of Bidder)

I have made a good faith effort to comply under the following areas checked:

Bidders shall earn at least 50 points in order to have achieved “Good Faith Effort”

☐ 1 - (10 pts) Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.

☐ 2 - (10 pts) Made the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bids are due.

☐ 3 - (15 pts) Broken down or combined elements of work into economically feasible units to facilitate minority participation.

☐ 4 - (10 pts) Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.

☐ 5 - (10 pts) Attended prebid meetings scheduled.

☐ 6 - (20 pts) Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.

☐ 7 - (15 pts) Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.

☐ 8 - (25 pts) Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder’s suppliers in order to help minority businesses in establishing credit.

☐ 9 - (20 pts) Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.

☐ 10 - (20 pts) Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors shall be in accordance with GS143-128.2(d) Failure to abide by this statutory provision will constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: _____________________ Name of Authorized Officer: __________________________

Signature: ____________________________________

Title: _____________________________________

State of North Carolina, County of ______________________________

Subscribed and sworn to before me this ___ day of _______________ 20___

Notary Public ________________________ My commission expires __________________
General Construction - Phase D - Alliance Child Crisis Center

AFFIDAVIT B – Intent to Perform Contract with Own Workforce

State of North Carolina

County of _____________________

Affidavit of ____________________________

(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the

_______________________________________ Contract.

(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement. The Bidder agrees to make a Good Faith Effort to utilize minority suppliers where possible. The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: __________________________ Name of Authorized Officer: ____________________________

Signature: __________________________

Title: __________________________

State of North Carolina, County of _____________________

Subscribed and sworn to before me this ___ day of _____________ 20___

Notary Public _______________________

My commission expires ________________
General Construction - Phase D -
Alliance Child Crisis Center

AFFIDAVIT C – Portion of Work to be Performed by Certified Minority Business

County of ____________________

If the portion of the work to be executed by minority businesses as defined in GS 143-128.2(g) and GS 128.4(a), (b), (e) is equal to or greater than 10% of the Bidder’s total contract price, then the Bidder shall complete this affidavit. The apparent lowest responsible, responsive bidder shall provide this affidavit within 72 hours after notification of being low Bidder.

Affidavit of ________________________________ I do hereby certify that
(Name of Bidder)

On the ________________________________
(Project Name)

Project ID# __________ Amount of Bid $__________________

I will expend a minimum of _______ % of the total dollar amount of the contract with minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. Attach additional sheets if required.

<table>
<thead>
<tr>
<th>Business Name &amp; Telephone Number</th>
<th>*Minority Category</th>
<th>**HUB Certified Yes/No</th>
<th>Work Description</th>
<th>Dollar Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The total value of minority business contracting will be

*Minority categories: Black, African American (B), Hispanic (H), Asian American (A), American Indian (I), Female (F), Disabled (D), and Socially and Economically Disadvantaged (S & E.D.)

**HUB Certification with the NC DOA HUB Office required to be counted toward state participation goals.

Pursuant to GS 143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the Bidder to the commitment herein set forth.

Date: _____________________ Name of Authorized Officer: ____________________________________

Signature: ________________________________

Title: ______________________________________

State of North Carolina, County of: ______________________________________

Subscribed and sworn to before me this _____day of _________________20___

Notary Public __________________________

My commission expires __________________
This page intentionally left blank.
BID FORM
FOR GENERAL CONSTRUCTION CONTRACT

PROPOSAL TO:
ALLIANCE HEALTH
IFB 21-003
General Construction - Phase D -
Alliance Child Crisis Center

Any modification to the Bid Form shall disqualify the Bid and shall cause the Bid to be rejected.

BID FROM: ________________________________

1. The undersigned Bidder agrees, if this Bid is accepted, to enter into an agreement with Owner, in the form included in the Bidding Documents, to perform and furnish the work as specified or indicated in the Bidding Documents for the Bid Price and within the Bid Times indicated in this Bid in accordance with the other terms and conditions of the Contract Documents.

2. In submitting this Bid, Bidder represents, as more fully set forth in the Agreement, that:
   a) This Bid will remain subject to acceptance for ninety (90) days after the day of Bid opening;
   b) The Owner has the right to reject this bid; Accompanying this proposal is a certified check (or bid bond) for $______________, which represents not less than five (5) percent of the aggregate amount of the proposal. “Payee shall be Alliance Health.”
   c) Said check, or the full amount of the bond, shall become the property of Alliance and be retained by Alliance in the event of withdrawal of the bid after the public opening or should the undersigned fail to execute a contract with Alliance and give satisfactory surety within fifteen (15) days after the award. Otherwise, said check or bid bond, to be returned to the undersigned. The undersigned agree, if awarded the contract, to deliver satisfactory surety bond in the amount equal to not less than 100% of the contract within fifteen (15) days after Notice of Award;
   d) Bidder will sign and submit the Agreement with the Bonds and other documents within 15 days after the date of the Owner’s Notice of Award;
   e) Bidder has examined copies of all the Bidding Documents;
   f) Bidder has visited the site and become familiar with the general and local site conditions;
   g) Bidder is familiar with federal, state, and local laws and regulations;
   h) Bidder certifies that no federal excise or refundable North Carolina sales taxes have been included in this bid;
   i) Bidder has correlated the information known to Bidder, information and observations obtained from visits to the site, reports and drawings identified in the Bidding Documents and additional examinations, investigations, tests, studies and data with the Bidding Documents;
   j) Bidder certifies that this proposal is made in good faith and without collusion or connection with any other person bidding on the same work, or that any official or employee of Architect or Alliance Health will be admitted to any share or part of the contract or any benefits that may arise therefrom if the contract is awarded to this company;
   k) Bidder acknowledges receipt of the following Addenda, which have been considered in the preparation of this Bid:

<table>
<thead>
<tr>
<th>Addendum No.:</th>
<th>Dated:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addendum No.:</td>
<td>Dated:</td>
</tr>
<tr>
<td>Addendum No.:</td>
<td>Dated:</td>
</tr>
</tbody>
</table>
BID FORM cont’d

3. Bidder will complete the work in accordance with the Contract Documents for the following price(s):

**SINGLE PRIME CONTRACT:**

Base Bid Lump-Sum Price $_________

In words, ____________________________________________________________________________

**ALLOWANCES:**

The undersigned Bidder acknowledges that Allowances, as specified in Section 012100 and modifying addenda, are included in their Base Bid.

**ALTERNATES:**

Should any of the alternates as described in the contract documents be accepted, the amount written below shall be the amount to be “added to” or “deducted from” the base bid.

If Sub-Contractor for Alternate Bid is different from Sub-Contractor indicated for Base Bid, General Contractor shall include name of the Sub-Contractor and the Alternate affected in the space provided below.

Sub-Contractor Name_____________________________ Alternate # _______
Sub-Contractor Name_____________________________ Alternate # _______
Sub-Contractor Name_____________________________ Alternate # _______

Alternate No. 1  (Fire Rated Plywood)

(Deduct) ___________________ Dollars($) _______

Alternate No. 2  (Very High Impact Gypsum Wallboard)

(Add) ___________________ Dollars($) _______

Alternate No. 3  (Courtyard Surfacing)

(Deduct) ___________________ Dollars($) _______

**UNIT PRICES:**

Unit prices quoted and accepted shall apply throughout the life of the contract, except as otherwise specifically noted. Unit prices shall be applied, as appropriate, to compute the total value of changes in the base bid quantity of the work all in accordance with the contract documents.

No. 1 Access Doors (Each) ___________________ Unit Price ($) _______

No. 2 Additional Slab Infil (Cubic Yard) ___________ Unit Price ($) _______

No. 3 Removal of Existing Piping (Linear Foot) ___________ Unit Price ($) _______

No. 4 Removal of Existing Ductwork (Linear Foot) ___________ Unit Price ($) _______
**BID FORM cont’d**

**MINORITY BUSINESS PARTICIPATION REQUIREMENTS:***

*Provide with the bid*: Under GS 143-128.2(c) the undersigned bidder shall identify on its bid (Identification of Minority Business Participation Form) the minority businesses that it will use on the project with the total dollar value of the bids that will be performed by the minority businesses. *Also* list the good faith efforts (Affidavit A) made to solicit minority participation in the bid effort.

NOTE: A contractor that performs all of the work with its own workforce may submit an Affidavit (B) to that effect in lieu of Affidavit (A) required above. The MB Participation Form must still be submitted even if there is zero participation.

*After the bid opening*: The Owner will consider all bids and alternates and determine the lowest responsible, responsive bidder. Upon notification of being the apparent low bidder, the bidder shall then file within 72 hours of the notification of being the apparent lowest bidder, the following:

An Affidavit (C) that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the 10% goal established. This affidavit shall give rise to the presumption that the bidder has made the required good faith effort and Affidavit D is not necessary:

* OR *

If less than the 10% goal, Affidavit (D) of its good faith effort to meet the goal shall be provided. The document must include evidence of all good faith efforts that were implemented, including any advertisements, solicitations and other specific actions demonstrating recruitment and selection of minority businesses for participation in the contract.

---

**Pursuant to N.C.G.S. 143-128(d), all Bidders shall identify on their bid the contractors they have selected for the subdivisions or branches of work for:**

<table>
<thead>
<tr>
<th>Type</th>
<th>Contractor and License Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating, Ventilating and Air Conditioning</td>
<td></td>
</tr>
<tr>
<td>Plumbing</td>
<td></td>
</tr>
<tr>
<td>Electrical</td>
<td></td>
</tr>
<tr>
<td>General</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>
A contractor whose bid is accepted shall not substitute any person as subcontractor in the place of the subcontractor listed in the original bid, except (i) if the listed subcontractor's bid is later determined by the contractor to be non-responsible or non-responsive or the listed subcontractor refuses to enter into a contract for the complete performance of the bid work, or (ii) with the approval of the awarding authority for good cause shown by the contractor. The terms, conditions, and requirements of each contract between the contractor and a subcontractor performing work under a subdivision or branch of work listed in this subsection shall incorporate by reference the terms, conditions, and requirements of the contract between the contractor and Alliance.

4. Bidder agrees that the Work will be substantially complete and ready for final payment in accordance with the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

5. The following documents are attached to and made a condition of the Bid: 

Required bid security in the form of: 

6. Bidder acknowledges the provisions in add reference here for Liquidated Damages of $500.00 per day over Substantial Completion date.

Bid Submitted On: ________________, 20__. 

Signature of Bidder: 

North Carolina Contractor’s License Number: 

If an Individual: __________________________________________.
Doing business as:__________________________________________

If a Partnership: ________________________________________.
Doing business as: ________________________________________
If a Corporation: ________________________________________
A _______________________________________________________ Corporation
By: _____________________________________________________ (SEAL & ATTEST)
Title: _____________________________________________________

Business Address of Bidder: ________________________________
If Bidder is a joint venture, other party shall sign below.

North Carolina Contractor’s License Number: __________________________
If an Individual: ______________________________________________________
Doing business as: ____________________________________________________

If a Partnership: ______________________________________________________
By: __________________________________________________________________
Title: __________________________________________________________________

If a Corporation: ______________________________________________________
A ____________________________________________________________________ Corporation
By: __________________________________________________________________
Title: __________________________________________________________________
(SEAL & ATTEST)

We have the following necessary and suitable equipment in good condition and ready for use on this work.
________________________________________________________________________
________________________________________________________________________

Further Agreements, if any: ____________________________________________
________________________________________________________________________
________________________________________________________________________
This page intentionally left blank.
NO REPLY BID FORM

Proposal to: Alliance Health
5200 W. Paramount Pkwy, Suite 200; Morrisville, NC 27560
IFB No.: 21-003 Construction Services
Bid Title: General Construction - Phase D - Alliance Child Crisis Center

To assist us in obtaining good competition on our Invitation for Bids, we ask that each firm that has received an invitation but does not wish to submit a Bid, state their reason(s) below and return to this office. This information will not preclude receipt of future invitations unless you request removal from the Bidders’ List by so indicating below, or do not return this form or bona fide bid. Check the applicable boxes.

Unfortunately, we shall offer a “No Bid” at this time because:

☐ 1. We do not wish to participate in the bid process.

☐ 2. We do not wish to submit a bid under the terms and conditions of the Bid document. Our objections are: _______________________________________________________________

☐ 3. We do not feel we can be competitive.

☐ 4. We cannot submit a Bid because of the marketing or franchising policies of the manufacturing company.

☐ 5. We do not wish to sell to the Alliance. Our objections are: ________________________________

☐ 6. We do not sell the items/services on which bids are requested.

☐ 7. Other: ________________________________________________________________

☐ We wish to remain on the Bidders’ List.

☐ We wish to be deleted from the Bidders’ List.
This page intentionally left blank.
NON-COLLUSION AFFIDAVIT
STATE OF NORTH CAROLINA

______________________________, being first duly sworn, deposes and says that:

1. He/She is the____________________of ________________________________, the Bidder that has submitted the attached bid;

2. He/She is fully informed respecting the preparation and contents of the attached bid and of all pertinent circumstances respecting such bid;

3. Such bid is genuine and is not a collusive or sham bid;

4. Neither the said Bidder nor any of its officers, partners, owners agents, representatives, employees, parties of interest, including this affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly, with any other Bidder, firm or person to submit a collusive or sham bid in connection with the contract for which the attached bid has been submitted or to refrain from bidding in connection with such contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached bid or of any other Bidder, or to fix any overhead, profit or cost element of the bid price of any other Bidder or to secure through collusion, conspiracy, connivance or unlawful agreement any advantage against Alliance Health or any person interested in the proposed contract; and

5. The price or prices quoted in the attached bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affiant.

______________________________

TITLE

Subscribed and sworn before me,
This____day of______, 20__.

(SEAL)

Notary Public
My Commission Expires__________________________
This page intentionally left blank.
VENDOR PROFILE FORM
FOR CONSTRUCTION PROJECTS
(W-9 Form and Alliance EFT Authorization Form is required, and shall be returned with Bid)

1. Legal Name of Business:

2. Doing Business as:

3. Mailing Address:

4. Remit to Address:

5. Website Address (URL):

6. Email Address:

7. Telephone Number:

8. Federal Tax ID Number (TIN):

9. Do you require a 1099? ☐ Yes ☐ No

10. Business Type (check all applicable boxes):
    ☐ C-Corp. ☐ S-Corp. ☐ LLC ☐ General Partnership ☐ Sole Proprietorship
    ☐ Limited Partnership ☐ PC ☐ LLP ☐ Governmental Agency ☐ for Profit
    ☐ Not for Profit ☐ Other, Explain: ____________________________

11. What City and State is your business licensed?

12. Company Classification/Certification: Check the classification that best describes your company. If you are classified as a Minority-Owned Business, be sure to also select the best descriptive choice within that category (i.e. African-American, Asian-American, etc.)

<table>
<thead>
<tr>
<th>Classification</th>
<th>(X) all that apply</th>
<th>Certified?</th>
<th>If yes, indicate certifying agency</th>
<th>Certification Expiration Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minority-Owned Business</td>
<td>☐</td>
<td>☐ Yes ☐ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>African-American</td>
<td>☐</td>
<td>☐ Yes ☐ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian-American</td>
<td>☐</td>
<td>☐ Yes ☐ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic-American</td>
<td>☐</td>
<td>☐ Yes ☐ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Native American</td>
<td>☐</td>
<td>☐ Yes ☐ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women-Owned Business</td>
<td>☐</td>
<td>☐ Yes ☐ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disabled</td>
<td>☐</td>
<td>☐ Yes ☐ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disadvantaged</td>
<td>☐</td>
<td>☐ Yes ☐ No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13. Submitted by:

Print Name/Title: _________________________________________________

Signature/Date: _________________________________________________
This page intentionally left blank.
Form W-9
Request for Taxpayer Identification Number and Certification

1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank.
2 Business name/disregarded entity name, if different from above.
3 Check appropriate box for federal tax classification; check only one of the following seven boxes:
   - Individual/sole proprietor or
   - Corporation or
   - Single-member LLC or
   - Limited liability company, enter the tax classification (C=Corporation, S=S corporation, P=partnership) □
   Note. For a single-member LLC that is disregarded, do not check LLC, check the appropriate box in the line above for
   the tax classification of the single-member owner.
   - Other (see instructions) □
4 Exemptions (codes apply only to certain entities, not Individuals; see instructions on page 3).
   - Exempt payee code (if any) □
   - Exemption from FATCA reporting code (if any) □
   Applies to accounts maintained outside the U.S.
5 Address (number, street, and apt. or suite no) [Requester’s name and address (optional)]
6 City, state, and ZIP code
7 List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)
Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid
backup withholding. For individuals, this is generally your Social Security number (SSN). However, for a
resident alien, sole proprietor, or disregarded entity, see the Part I instructions on page 3. For other
entities, it is your employer identification number (EIN). If you do not have a number, see How to get a
TIN on page 3.
Note. If the account is in more than one name, see the instructions for line 1 and the chart on page 4 for
guidelines on whose number to enter.

Social security number

Or
Employer identification number

Part II Certification
Under penalties of perjury, I certify that:
1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue
   Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am
   no longer subject to backup withholding; and
3. I am a U.S. citizen or other U.S. person (defined below); and
4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.
Certification instructions. You must enter item 2 above if you have been notified by the IRS that you are currently subject to backup withholding
because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage
interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and
generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See
the instructions on page 3.

Sign Here
Signature of U.S. person □

Date

General Instructions
Section references are to the Internal Revenue Code unless otherwise noted.
Future developments. Information about developments affecting Form W-9 (such as legislation enacted after we release it) is at www.irs.gov/f9.
Purpose of Form
An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your Social Security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following:

- Form 1099-INT (interest earned or paid)
- Form 1099-DIV (dividends, including those from stocks or mutual funds)
- Form 1099-MISC (various types of income, prizes, awards, or gross proceeds)
- Form 1099-B (stock or mutual fund sales and certain other transactions by brokers)
- Form 1099-S (proceeds from real estate transactions)
- Form 1099-K (merchant card and third party network transactions)

- Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition)
- Form 1099-C (canceled debt)
- Form 1099-A (acquisition or abandonment of secured property)

Use Form W-9 only if you are a U.S. person (including a resident alien, to provide your correct TIN.
If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See What is backup withholding? on page 2.
Say signing the third-out form, you:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued).
2. Certify that you are not subject to backup withholding.
3. Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income,
4. Certify that FATCA code(s) entered on this form (if any) indicating that you are exempt from the FATCA reporting is correct. See What is FATCA reporting? on page 2 for further information.

Cat. No. 10231X
Form W-9 (Rev. 12-2014)
# Alliance Health
## AUTHORIZATION AGREEMENT FOR ELECTRONIC FUNDS TRANSFER (EFT)

- **Initial Request**
- **Change Request**
- **Cancel Request**

### PROVIDER INFORMATION
1. PROVIDER LEGAL BUSINESS NAME (must match name on financial institution account and name registered with Alliance Behavioral Healthcare)
2. ACCOUNT HOLDER’S NAME
3. CONTACT TELEPHONE NUMBER
4. PROVIDER ADDRESS
   - CITY
   - STATE
   - ZIP
5. PROVIDER COMPLETE FEDERAL TAX ID NUMBER (must match number registered with Alliance Behavioral Healthcare)
6. EMAIL ADDRESS – for Electronic Remittance Forms to be Sent

### FINANCIAL INSTITUTION INFORMATION
1. FINANCIAL INSTITUTION ROUTING NUMBER
2. FINANCIAL INSTITUTION ACCOUNT NUMBER (include leading zeros)
3. TYPE OF ACCOUNT
   - CHECKING
   - SAVINGS
4. FINANCIAL INSTITUTION TELEPHONE NUMBER
5. FINANCIAL INSTITUTION NAME
6. FINANCIAL INSTITUTION ADDRESS
   - CITY
   - STATE
   - ZIP

- **This authorization is effective as of the signature date below and is to remain in full force and effect until Alliance Health has received written notification of its termination in such time and such manner as to afford Alliance Health and the financial institution a reasonable opportunity to act on it, or until Alliance Health deems it necessary to terminate this agreement. Under penalties of perjury, I hereby certify the checking or savings account indicated on this form are under my direct control and access; therefore, I authorize Alliance Health to initiate, change, or cancel credit entries to the financial institution account as indicated above. If my financial institution information changes, I agree to submit to Alliance Health a revised Authorization Agreement for Electronic Funds Transfer form.**

- **I hereby CANCEL my EFT authorization.**

I understand that by signing this form, payments issued will be Federal and State funds, and that any falsification or concealment of a material fact may be prosecuted under Federal and State laws.

- **Print Name**

- **Signature**

- **Date**

It is requested that you include a blank, void check or bank generated account verification form for account and routing number verification. If neither of these documents are provided as requested, Alliance Health does not accept responsibility for the accuracy of the above typed/written account information submitted by the Provider/Vendor. Please attach a voided check or an original bank letter and mail to:

**Alliance Health**
**Attention: Finance**
**5200 W Paramount Parkway**
**Suite 200**
**Morrisville, NC 27560**

[Submit Electronically]
Affidavit of Compliance (E-Verify)

STATE OF NORTH CAROLINA
AFFIDAVIT OF COMPLIANCE with N.C. E-Verify Statutes

I, ____________________________ (hereinafter the “Affiant”), being duly authorized by and on behalf of ________________________________ (hereinafter "Contractor") after first being duly sworn hereby swears or affirms as follows:

1. Contractor understands that E-Verify is the federal E-Verify program operated by the United States Department of Homeland Security and other federal agencies, or any successor or equivalent program used to verify the work authorization of newly hired employees pursuant to federal law in accordance with Article 2 of Chapter 64 of the North Carolina General Statutes; and

2. Contractor understands that an “Employer”, as defined in NCGS§64-25(4), is required by law to use E-Verify to verify the work authorization of its employees through E-Verify in accordance with NCGS§64-26(a). The term “Employer” does not include State agencies, counties, municipalities, or other governmental bodies.

3. Contractor is a person, business entity, or other organization that transacts business in this State and that employs 25 or more employees in the state of North Carolina. (Mark Yes or No)
   a. Yes _____
   b. No _____

4. Contractor will ensure compliance with E-Verify to the extent applicable and will ensure compliance by any subcontractors subsequently hired by Contractor to perform work under Contractor’s contract with Alliance.

This ____ day of ________________, 201__.

Signature of Affiant

Print or Type Name: __________________________________________

State of ______________________________
County of ____________________________

Signed and sworn to (or affirmed) before me, this the _____ day of ________________, 201__.

My Commission Expires: _______________________

___________________
Notary Public

(Affix Official/Notarial Seal)
This page intentionally left blank.
The Committee Substitute for Senate Biil No. 78, passed by 1961 Legislature, requires that contractors pay North Carolina Sales Tax on materials and equipment purchased for construction of municipal work, and further provides that those taxes on certain items are refundable to municipalities under submission of proper evidence by the Owner to the North Carolina Department of Revenue. Reference is made to “Sales and Use Tax Regulation 42”.

**BIDDER WILL NOT INCLUDE REFUNDABLE NORTH CAROLINA SALES TAX IN HIS OR HER LUMP-SUM BID.**

The Contractor will be reimbursed at the time each monthly estimate is paid for refundable North Carolina Sales Taxes paid during any preceding month, provided he or she submits to the Owner information which will make it possible to show the sales tax as a separate item on the estimate. The tax may be shown at the bottom of the estimate in the following manner.

“Total of refundable N.C. Sales Tax paid on the estimate amounted to $_____________ (Bid Amount).”

To substantiate the payment of the sales tax indicated, the CONTRACTOR SHALL IN ADDITION,

Submit a SWORN NOTARIZED statement itemizing the tax, showing each amount and to whom paid, and certifying that the articles purchased were used in the work performed for the Owner. Receipts for these amounts shall be included with the estimate. Such receipts should include all taxes paid by the prime contractor and any of his subcontractors.

The above shall accompany each estimate for payment and is required by the Owner in making claims for tax refunds.

Every person/business who purchases any taxable tangible personal property, taxable services or certain digital property for storage, use, or consumption in North Carolina (NC) for business use from out-of-state vendors upon which the tax has not been fully paid shall register with the NC Department of Revenue and remit the balance of tax due on such purchases based on NC’s sales and use tax rate. Out-of-state contractors are required to register for sales and use tax purposes with the State of NC. Registration Application, Form NC-BR, shall be completed and mailed to the NC Department of Revenue. Out-of-state contractors should also seek a Certificate of Exemption or Certificate of Resale Form from their state’s Department of Revenue office when purchasing taxable tangible personal property from their local state to be stored, used, or consumed in NC provided their state participates in the Streamlined Sales Tax Agreement. Out of state sales tax is not reimbursable by the state of North Carolina. For additional information on North Carolina regarding sales and use tax, please contact the NC Department of Revenue.
This page intentionally left blank.
Form E-589CI, Affidavit of Capital Improvement, is generally required to substantiate that a contract, or a portion of work to be performed to fulfill a contract, is to be taxed for sales and use tax purposes as a real property contract with respect to a capital improvement to real property.

- This affidavit may not be used to purchase building materials, other tangible personal property, or digital property to fulfill a real property contract exempt from sales and use tax.
- A person who willfully attempts, or a person who aids or abets a person to attempt in any manner, to evade or defeat a tax imposed by the Sales and Use Tax Laws, or the payment thereof, shall be guilty of a Class H felony. If there is a deficiency or delinquency in payment of any tax due to fraud with intent to evade the tax, there shall be assessed a penalty equal to 50% of the total deficiency.

Section I. Single Use (Complete this section to issue the affidavit for a single capital improvement.)

<table>
<thead>
<tr>
<th>A</th>
<th>Owner, Tenant, or Real Property Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Address</td>
</tr>
<tr>
<td></td>
<td>City State Zip Code</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
<th>Real Property Contractor (General Contractor or Subcontractor)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Address</td>
</tr>
<tr>
<td></td>
<td>City State Zip Code</td>
</tr>
</tbody>
</table>

Describe capital improvement to be performed:

Project Name:

Project Address (where the work is to be performed):

City State Zip Code

I certify that, to the best of my knowledge, this affidavit is accurate and complete and that the transaction described to be performed by the Real Property Contractor (General Contractor or Subcontractor identified in box “B”) shall be treated as a real property contract with respect to a capital improvement to real property for sales and use tax purposes.

Signature of Authorized Person: ____________________ Title: ____________________ Date: _____________

Section II. Blanket Use (Complete this section to execute a blanket affidavit.)

<table>
<thead>
<tr>
<th>C</th>
<th>Real Property Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Address</td>
</tr>
<tr>
<td></td>
<td>City State Zip Code</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D</th>
<th>Real Property Contractor or Subcontractor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Address</td>
</tr>
<tr>
<td></td>
<td>City State Zip Code</td>
</tr>
</tbody>
</table>

To be completed by the Real Property Contractor identified in Box C.

I certify that I am a Real Property Contractor who performs capital improvements to real property and all transactions with the real property contractor (subcontractor) identified in box “D” shall be treated as real property contracts with respect to capital improvements for real property for sales and use tax purposes.

Signature of Authorized Person: ____________________ Title: ____________________ Date: _____________
This page intentionally left blank.
BID BOND - SAMPLE

KNOW ALL MEN BY THESE PRESENTS THAT WE, __________ (Name & address) __________, as Principal, and __________ (Name & address) __________, as Surety, who is duly licensed to act as surety in North Carolina, are held and firmly bound unto the County of Durham, North Carolina as Oblige, in the penal sum of __________ Dollars, lawful money of the United States of America, for the payment of which, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Signed, sealed and dated this ___ day of __________ 20__,

WHEREAS, the said principal is herewith submitting proposal for __________

and the principal desires to file this bid bond in lieu of making the cash deposit as required by G.S. 143-129.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION is such, that if the principal shall be awarded the contract for which the bid is submitted and shall execute the contract and give bond for the faithful performance thereof within ten days after the award of same to the principal, then this obligation shall be null and void; but if the principal fails to so execute such contract and give performance bond as required by G.S. 143-129, the surety shall, upon demand, forthwith pay to the obligee the amount set forth in the first paragraph hereof. Provided further, that the bid may be withdrawn as provided by G.S. 143-129.1

IN WITNESS WHEREOF, the undersigned Principle and Surety have caused this bond to be sealed and executed by the duly authorized officers this the ___ day of __________, 201__

Contractor: (name) __________

___________________________
WITNESS
(Printed Name, Title) __________

___________________________
PRINCIPAL (Owner-Partnership)
(Printed Name, Title) __________

___________________________
Insurance company: (name) __________

(SEAL) __________
(Printed Name, Title) __________
This page intentionally left blank.
POWER OF ATTORNEY - SAMPLE

This Power of Attorney limits the acts of those named herein, and they have no authority to bind the Company except in the manner and to the extent herein stated. Not valid for Mortgage, Note, Loan, Letter of Credit, Bank Deposit, Currency Rate, Interest Rate or Residential Value Guarantees.

Know All Persons By These Presents:

That the ____________ Insurance Company, a corporation organized and existing under the laws of the State of ____________, having its principal administrative offices in ____________ (hereinafter referred to as the "Company") does hereby appoint:

_________________________________________

(each)

Its true and lawful Attorney(s) in Fact, to make, execute, seal, and deliver from the date of issuance of this power for and on its behalf as surety, and as its act and deed.

Any and all bonds, undertakings, recognizes and other surety obligations, in the penal sum not exceeding ____________________________ Dollars ($_________00).

This authority does not permit the same obligation to be split into two or more bonds in order to bring each such bond within the dollar limit of authority as set forth herein.

The execution of such bonds, undertakings, recognitions and other surety obligations in pursuance of these presents shall be as binding upon the said Company as fully and amply to all intents and purposes, as if the same had been duly executed and acknowledged by its regularly elected officers at its principal administrative office in ____________.

This Power of Attorney is executed by authority of resolutions adopted by unanimous consent of the Board of Directors of the Company on ____________, true and accurate copies of which are hereinafter set forth and are hereby certified to by the undersigned Secretary as being in full force and effect:

"VOTED, That the Chairperson of the Board, the President, or the Executive Vice President, or any Senior Vice President, of the Surety Business Division, or their appointees designated in writing and filed with the Secretary, or the Secretary shall have the power and authority to appoint agents and attorneys-in-fact and to authorize them subject to the limitations set forth in their respective powers of attorney, to execute on behalf of the Company, and attach the seal of the Company thereto, bonds undertakings, recognizes and other surety obligations obligatory in the nature thereof; and any such officers of the Company may appoint agents for acceptance of process."

This Power of Attorney is signed, sealed and certified by facsimile or email under and by authority of the following resolution adopted by the unanimous consent of the Board of Directors of the Company on ____________.

VOTED, That the signature of the Chairman of the Board, the President, or the Executive Vice President, or any Senior Vice President of the Surety Business Division, or their appointees designated in writing and filed with the Secretary, and the signature of the Secretary, the seal of the Company, and certifications by the Secretary, may be affixed by facsimile or email on any power of attorney or bond executed pursuant to the resolution adopted by the Board of Directors on ____________, and any such power so executed, sealed and certified with respect to any bond or undertaking the which it is attached, shall continue to be valid binding upon the Company.

In Testimony Whereof, the Company has caused this instrument to be signed and its corporate seal affixed by their authorized officers, this ___ day of ____________, 201__.

Attested and Certified (SEAL) ____________ Insurance Company

Name, Title

STATE OF _________________________________
COUNTY OF _______________________________
This page intentionally left blank.
APPENDIX E

MINORITY BUSINESS ENTERPRISE (MBE) DOCUMENTATION FOR CONTRACT PAYMENTS

DO NOT SUBMIT WITH PROPOSAL - SUBMIT WITH EACH PAY REQUEST & FINAL PAYMENT

Prime Contractor: _________________________________________________________________
Address & Phone: __________________________________________________________________
Project Name: ___________________________________________________________________
Pay Application #: __________________ Period: ______________________________

The following is a list of payments made to Minority Business Enterprises on this project for the abovementioned period.

<table>
<thead>
<tr>
<th>Business Name &amp; Telephone Number</th>
<th>*Minority Category</th>
<th>**HUB Certified Yes/No</th>
<th>Work Description</th>
<th>Dollar Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The total value of minority business contracting will be

*Minority categories: Black, African American (B), Hispanic (H), Asian American (A), American Indian (I), Female (F), Disabled (D), and Socially and Economically Disadvantaged (S & E.D.)

Date: ________________  Approved/Certified By: _______________________________________

Name

Title

Signature
This page intentionally left blank.
DOCUMENT 003126 - EXISTING HAZARDOUS MATERIAL INFORMATION

1.1 PROJECT CONDITIONS
   A. Hazardous material reports have been prepared by an independent agency and are attached to this Document.

1.2 ATTACHMENTS

END OF DOCUMENT 003126
maintenance activities, which could disturb ACM, and specifies work practices and precautions, which employers must follow when engaging in each class of regulated work.

5.2 Lead Paint

The lead paint sampling activities were conducted in general accordance with the EPA’s work practice standards for conducting lead paint activities (40 CFR 745, and State and local regulations) to meet informational needs to comply with the OSHA Lead in Construction Standard. Lead is regulated by the Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA).

The Resource Conservation and Recovery Act (RCRA) gave the USEPA authority to regulate the waste status of demolition or renovation debris, including lead-containing materials. Specific notification and testing requirements must be addressed prior to transporting, treating, storing, or disposing of hazardous wastes. Lead containing wastes are considered hazardous waste under RCRA if Toxicity Characteristic Leaching Procedure (TCLP) results exceed 5 milligrams per liter (mg/L). EPA exempts from most RCRA requirements those generators whose combined hazardous waste generation is less than 100 kilograms (kg) per month.

Detectable lead quantities may constitute a lead dust hazard during renovation/demolition activities. Personnel performing renovation/demolition activities that may disturb painted components with concentrations of lead above the stated analytical detection limit should comply with all current OSHA regulations in order to minimize employee exposure. OSHA defines lead-based paint as a paint, which contains lead, regardless of the concentration. Currently, any proposed renovation/demolition is subject to the OSHA standard (29 CFR 1926.62 – Lead in Construction). The OSHA standard defines specific training requirements, engineering controls and working practices for construction personnel subject to this standard. Occupational exposure to lead occurring in the course of construction work, including maintenance activities, painting, alteration and repairs is subject to the OSHA Lead in Construction standard.

Construction work covered by 29 CFR 1926.62 includes any repair or renovation activities or other activities that disturb in-place lead-containing materials, but does not include routine cleaning and repainting where there is insignificant damage, wear, or corrosion of existing lead-containing coatings or substrates. Employers must assure that no employee will be exposed to lead at concentrations greater than 50 micrograms per cubic meter ($\mu g/m^3$) averaged over an eight-hour period without adequate protection. The OSHA Standard also establishes an action level of 30 $\mu g/m^3$ which if exceeded triggers the requirement for medical monitoring.

The above overview is not intended to be inclusive of all potentially pertinent regulatory information. The relevant EPA and OSHA standards should be consulted prior to undertaking
activities involving the demolition, renovation, or maintenance of surfaces coated with lead-based paints.

5.3 Hazardous Building Materials

Materials such as heavy metals (e.g., mercury and lead), CFCs, PCBs, and various other chemicals/hazardous substances may be found at commercial/industrial facilities. These materials may be located in containers or be contained in various building materials, fixtures, or equipment. These materials, if improperly managed, may be considered environmental hazards and, therefore, require special handling and disposal considerations prior to, or in conjunction with, renovation or demolition efforts to prevent their entry into the environment. Hazardous materials are regulated under different federal and state statutes including the Toxic Substances Control Act (TSCA) and RCRA.

6.0 FINDINGS AND RECOMMENDATIONS

6.1 Asbestos Containing Materials (ACMs)

Asbestos was identified in samples of the following materials collected from the site:

- Black sink mastic in original building and addition;
- 12” x 12” off-white with brown specks floor tile and black mastic (mastic only) in service corridor 158 and room 157;
- Gray rolled asphalt flashing at addition skylights, vents, and assumed present under the roof membrane at addition roof penetrations;
- Flashing on canopy roof and assumed present under the roof membrane at addition roof perimeter;
- Duct insulation in mechanical room 134 (assumed positive based on previous data);
- Brown sink mastic in storage room 130B (assumed positive based on previous data);
- Gray/black flashing mastic at roof penetrations on the original roof and assumed to be present under the roof membrane at the roof penetrations and perimeter (assumed positive based on previous data);
- Gray flashing mastic at canopy perimeter and assumed to be under the roof membrane at the roof penetrations and perimeter of addition roof (assumed positive based on previous data); and,
- Black mastic on fiberglass pipe insulation in crawlspace (assumed positive based on previous data).

If the above materials are impacted by renovations, Terracon recommends a licensed asbestos abatement contractor remove the identified and assumed asbestos-containing material from the site.
Previous laboratory analysis in the Matrix Health & Safety Consultants report identified asbestos in the hard TSI elbow/mudded pipe fitting samples obtained from the building in concentrations less than 1% asbestos. However, this material was identified not to contain asbestos as part of Terracon’s sampling event. Since previous sampling identified asbestos in hard TSI elbows/mudded pipe fittings, Terracon recommends the removal of the fittings be considered Class II asbestos work by OSHA and be done under controlled conditions by trained personnel in accordance with the requirements of OSHA Standard 29 CFR 1926.1101.

If additional suspect material is found during renovation activities, they should be assumed to contain asbestos until laboratory analysis can confirm or deny their asbestos content.

6.2 Limited Lead Paint Sampling

Lead was detected above laboratory detection limit in the paint chip samples collected from the following surfaces:

- Gray on Metal Duct, Mechanical Room 134;
- White on Metal Door Frame, Original Building; and,
- Gray on Metal Door Frame, Addition.

OSHA defines Lead Paint as a paint, which contains lead, regardless of the concentration. Currently, any proposed renovation/demolition is subject to the OSHA regulations (29 CFR 1926.62 – Lead in Construction). The OSHA standard defines specific training requirements, engineering controls and working practices for construction personnel subject to this standard. There are also federal and state regulations, which require characterization of demolition debris to determine the proper disposal procedures. Caution should always be used during demolition or renovation operations to prevent potential lead exposure. Additionally, Terracon recommends that mechanical disturbance (sanding, grinding) of the lead paint be avoided.

6.3 Limited Visual for Hazardous Building Materials

6.3.1 PCBs in Light Ballasts

Terracon conducted a representative visual assessment of light fixtures to characterize PCB content. Typically, ballasts manufactured prior to 1979 are presumed to contain PCBs unless clearly marked as containing “No PCBs”. Ballasts that do not contain a “No PCBs” label are presumed to be PCB containing.

During the visual survey, Terracon only observed ballast labeling indicating that ballasts were non-PCB containing per manufacturer label. It is possible some ballasts not observed during our survey may contain PCBs. If ballasts are found to contain PCBs, Terracon recommends that the light ballasts be removed and properly disposed of prior to demolition activities in accordance with federal, state, and local regulations.
6.3.2 Mercury

Metallic mercury is a silver-white liquid at room temperature. Elemental and inorganic mercury compounds are used in manufacturing scientific instruments, thermostats, electric equipment, mercury vapor lamps and high intensity discharge (HID) lights. Mercury is considered a hazardous material due to its ability to bioaccumulate within the environment. Recycling mercury-containing components reduces the load of mercury entering the environment.

Terracon identified approximately two suspect mercury-containing thermostats during the visual survey. Approximately 1,000 fluorescent light bulbs were also observed during the visual survey. Terracon recommends that any suspect mercury-containing thermostats and fluorescent light bulbs be removed and properly disposed or recycled prior to renovation and/or demolition activities in accordance with federal, state, and local regulations. Prior to renovation and/or demolition, these items should be removed intact, packaged to prevent breakage and transferred to an approved recycling facility that recovers mercury.

In addition, due to the historical medical use of the building, mercury may be present in sink traps. Terracon recommends that the sink traps be tested using a mercury vapor analyzer or other appropriate method to determine if mercury is present prior to removal of the traps. If identified, the traps should be properly disposed or recycled prior to renovation and/or demolition activities in accordance with federal, state, and local regulations.

6.3.3 Radioactive Materials

Radioactive materials in low levels are typically used in smoke detectors (typically americium-241) and exit signs (tritium). Most smoke detectors sold today use one microcurie or less of americium-241. A 2001 Nuclear Regulatory Commission (NRC) study found people with two of these smoke detector units in their homes receive less than 0.002 millirems of radiation dose each year. That dose can be compared to the "background radiation" that people receive from space and the earth. EXIT signs that glow in the dark often contain a radioactive gas called tritium. Tritium, also known as 3H or H-3, is a radioactive isotope of hydrogen. In EXIT signs the gas is contained in sealed glass tubes lined with a light-emitting compound. The tritium gives off low-energy beta radiation that causes the lining to glow. This type of radiation cannot penetrate a sheet of paper or clothing. If inhaled, it leaves the body relatively quickly. Tritium gas is odorless, colorless and tasteless, and is lighter than air.

Terracon identified approximately 26 smoke detectors during the visual survey that may contain radioactive materials. Suspect tritium EXIT signs were not observed. Terracon recommends the removal and proper disposal or recycling of ionizing radiation smoke detectors from the building prior to demolition activities in accordance with federal, state, and local regulations.
6.3.4 CFCs

A CFC is an organic compound that consists of carbon, hydrogen, chlorine, and fluorine. Many CFCs have been widely used as refrigerants, propellants, and solvents. Chlorofluorocarbons are believed to cause depletion of the atmospheric ozone layer.

Equipment (air conditioners) which may contain CFCs were observed at each patient room and the exterior. If this equipment will be disturbed during the planned renovation, CFCs (refrigerants) should be removed by a qualified recycling firm that recovers CFCs.

6.3.5 Lead in Batteries

Terracon observed approximately 20 ‘EXIT’ signs, which may contain lead-acid batteries, at the facility. Terracon recommends that any suspect lead-acid batteries be removed and properly disposed or recycled prior to demolition activities in accordance with federal, state, and local regulations.

6.3.6 Fire Suppression Systems

Terracon did not observe fire extinguishers during our survey. However, if found Terracon recommends these be removed from the site prior to any renovation or demolition activities.

7.0 GENERAL COMMENTS

These hazardous materials survey services were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions in the same locale. The results, findings, conclusions and recommendations expressed in this report are based on conditions observed during our survey of the building. The information contained in this report is relevant to the date on which this survey was performed, and should not be relied upon to represent conditions at a later date. This report has been prepared on behalf of and exclusively for use by LS3P Associates LTD for specific application to their project as discussed. This report is not a bidding document. Contractors or consultants reviewing this report must draw their own conclusions regarding further investigation or remediation deemed necessary. Terracon does not warrant the work of regulatory agencies, laboratories or other third parties supplying information, which may have been used in the preparation of this report. No warranty, expressed or implied is made.
This page intentionally left blank.
Terracon Consultants, Inc. (Terracon) is pleased to submit this summary of the underground storage tanks (USTs) associated with the above referenced project. LS3P Associates (Client) requested an evaluation of previous UST activities at the project site.

1.0 PROJECT INFORMATION

Terracon understands that the project will include a full renovation of the approximately 28,000 square-foot subject building, which was constructed in the 1960s with additions made in 1981 and 1988. The subject building is slated to be utilized as a behavioral health facility.

2.0 UST CONSULTING

Terracon reviewed the following documents associated with the project site, copies of which are attached:

- **Free Phase Petroleum Product Removal and Soil Cleanup Report with Site Closure Request**, prepared by East Coast Environmental, P.A. (ECE), dated January 25, 2016 (Soil Cleanup Report / Site Closure Request)

- **Notice of No Further Action**, prepared by the North Carolina Department of Environmental Quality (NCDEQ), Division of Waste Management (DWM), dated March 6, 2017 (NFA).

According to the Soil Cleanup Report / Site Closure Request, two (2) underground storage tanks (USTs) were removed from the western side of the site in 1999. Both USTs contained fuel oil for the emergency generator. During the UST removal, a release was discovered associated with the 270-gallon UST. The 2,000 gallon UST was removed and closed without incident.
Additional assessment and remediation activities were conducted to evaluate and cleanup the soil and groundwater contamination.

According to the most recent groundwater sampling data from July 2015, the depth to groundwater ranged from 7 feet to over 13 feet below the land surface, and petroleum-related compounds remain in the groundwater on the west/northwest side of the project site at concentrations that exceed the NC 2L Groundwater Standards but are below the NCDEQ’s Gross Contaminant Levels (GCL).

During the July 2015 sampling event, ECE detected free-phase petroleum product in the groundwater in two of the recovery wells located in the source area. In December 2015, ECE removed additional petroleum contaminated soils from the source area in order to remove the free-phase product that was contained in these soils. Subsequent sampling of the residual soils indicated petroleum compounds above the NCDEQ’s Residential Maximum Soil Contaminant Concentrations (MSCCs) but below the Industrial / Commercial MSCCs.

On March 6, 2017, the NCDEQ issued a Notice of No Further Action (NFA), based on a risk-based closure. This means that the NCDEQ determined that the residual soil and groundwater contamination does not present an unacceptable risk to human health or the environment based on the non-residential use of the site. Please note that the NFA does not mean the site has been cleaned up to an unrestricted use standard.

As part of the NFA, the site has a Notice of Residual Petroleum (NORP) on the deed, which indicates that there is residual soil contamination under the emergency generator building / foundation. Soils in this area can only be excavated for remediation. Also, groundwater from the site cannot be used for a drinking water source. The NORP also states that the property is suitable only for industrial / commercial use or restricted residential use (the term “residential” is inclusive of, but not limited to, private houses, apartment complexes, schools, nursing homes, parks, recreational areas and day care centers).

3.0 SUMMARY

Based on the information presented in the Soil Cleanup Report / Site Closure Request and the NFA, Terracon provides the following summary and recommendations associated with the renovation activities for Alliance Health:

- Based on the depth to groundwater, the residual contaminant concentrations, and our understanding of the proposed renovations, residual groundwater contamination is not anticipated to impact the renovation of the existing building.
If excavation, drilling, or utility work is anticipated to occur below 5 feet, Terracon recommends implementing a Materials Management Plan (MMP). The intent of the MMP is to provide guidance for soil and groundwater management during construction activities. It is important to note that the NORP prohibits the use of groundwater as a source of drinking water.

- Residual soil contamination is not anticipated to impact the renovation of the existing building. If soil excavation is required adjacent to or beneath the emergency generator building, Terracon recommends preparing a MMP and remediating the residual petroleum contaminated soils prior to other excavation activities. Please note that removal of the contaminated soils may require the removal of the existing emergency generator building.

- The NFA issued by NCDEQ applies to non-residential use of the facility. Residential use of the facility is not currently allowed under the existing NORP.

If you have any questions or comments regarding this evaluation or require additional services, please give us a call at (919) 873-2211.

Sincerely,

Terracon Consultants, Inc.

[Signatures]

Joseph E. Starr, PE
Senior Environmental Engineer

Michael Dail, PG
Authorized Project Reviewer

Attachments:
- Notice of No Further Action
- Soil Cleanup Report / Site Closure Request
March 6, 2017

Mr. David R. Edwards, MSHA
Manager, Facilities
WakeMed Health and Hospitals – Property Services
3000 New Bern Avenue
Raleigh, North Carolina 27610-1231

Re: Notice of No Further Action
15A NCAC 2L .0407(d)
Risk-based Assessment and Corrective Action
for Petroleum Underground Storage Tanks

Southern Wake Hospital
400 Ransom Street, Fuquay-Varina
Wake County
Incident Number: 21007
Risk Classification: Low

Dear Mr. Edwards:

The Soil Cleanup Report/ Site Closure Request received by the UST Section, Division of Waste Management, Raleigh Regional Office on January 26, 2016 has been reviewed. The review indicates that soil contamination exceeds the residential maximum soil contaminant concentrations (MSCCs) established in Title 15A NCAC 2L .0411 and groundwater contamination meets the cleanup requirements for a low-risk site but exceeds the groundwater quality standards established in Title 15A NCAC 2L .0202.

The UST Section determines that no further action is warranted for this incident. All required actions have been completed. On November 15, 2016, the UST Section received a certified copy of the Notice of Residual Petroleum which is filed with the Register of Deeds. On January 24, 2017, the UST Section was provided with proof of receipt of the conditional Notice of No Further Action letter or of refusal by the addressee to accept delivery of the letter or with a description of the manner in which the letter was posted.

This determination shall apply unless the UST Section later finds that the discharge or release poses an unacceptable risk or a potentially unacceptable risk to human health or the environment. Pursuant to Title 15A NCAC 2L .0407(a) you have a continuing obligation to notify the Department of Environmental Quality of any changes that might affect the risk or land use classifications that have been assigned.

Be advised that as groundwater contamination exceeds the groundwater quality standards established in Title 15A NCAC 2L .0202, groundwater within the area of contamination or within the area where groundwater contamination is expected to migrate is not suitable for use as a water supply. Be advised that as soil contamination exceeds the residential MSCCs, the property containing the contamination is suitable only for industrial/commercial use or restricted residential use (The term...
residential is inclusive of, but not limited to, private houses, apartment complexes, schools, nursing homes, parks, recreation areas and day care centers), as stipulated in the Notice of Residual Petroleum (attached).

Interested parties may examine the Soil Cleanup Report/ Site Closure Request by contacting this regional office and may submit comments on the site to the regional office at the address or telephone number listed below.

This No Further Action determination applies only to the subject incident; for any other incidents at the subject site, the responsible party must continue to address contamination as required.

If you have any questions regarding this notice, please contact me at the address or telephone number listed below.

Sincerely,

Mark R. Powers
Regional Supervisor
Raleigh Regional Office
UST Section, Division of Waste Management, NCDEQ

Attachments: Notice of Residual Petroleum

cc: East Coast Environmental, P.A., 3815 Junction Boulevard, Raleigh, NC 27603
Paul A. Arena, 301 S. College Street, Suite 2300, Charlotte, NC 28202
RRO UST Incident File/RMR

Raleigh Regional Office | 1628 Mail Service Center | Raleigh, NC 27699-1628 | (919) 791-4200
NOTICE OF RESIDUAL PETROLEUM

Former Southern Wake Hospital, Wake County, North Carolina

The property that is the subject of this Notice (hereinafter referred to as the “Site”) contains residual petroleum and is an Underground Storage Tank (UST) incident under North Carolina’s Statutes and Regulations, which consist of N.C.G.S. 143-215.94 and regulations adopted thereunder. This Notice is part of a remedial action for the Site that has been approved by the Secretary (or his/her delegate) of the North Carolina Department of Environmental Quality (or its successor in function), as authorized by N.C.G.S. Section 143B-279.9 and 143B-279.11. The North Carolina Department of Environment Quality shall hereinafter be referred to as “DEQ”.

NOTICE

Petroleum product was released and/or discharged at the Site. Petroleum constituents remain on the site, but are not a danger to public health and the environment, provided that the restrictions described herein, and any other measures required by DEQ pursuant to N.C.G.S. Sections 143B-279.9 and 143B-279.11, are strictly complied with. This "Notice of Residual Petroleum" is composed of a description of the property, the location of the residual petroleum and the land use restrictions on the Site. The Notice has been approved and notarized by DEQ pursuant to N.C.G.S. Sections 143B-279.9 and 143B-279.11 and has/shall be recorded at the Wake County Register of Deeds’ office Book ________, Page ________.

Source Property

Wakemed a North Carolina non profit corporation is the owner in fee simple of all or a portion of the Site, which is located in the County of Wake, State of North Carolina, and is known and legally described as:
Beginning at a point on the Southern Line of the Northstar Realty Company Property said point being located S 83 degrees 46 minutes 03 seconds East from an existing iron pipe marking the Southwest corner of the Northstar Realty Company property; Thence runs S 09 Degrees 03 Minutes 25 Seconds W, 485.60 Feet, to a point on the Western Line with Millcrest Apartments; Thence runs S 09 Degrees 24 Minutes 57 Seconds W, 162.38 Feet, to a Concrete Monument, a common corner with Millcrest Apartments, Wake County Hospital System and J. N. Jones; Thence runs N 83 Degrees 15 Minutes 01 Seconds W, 336.08 Feet to a Concrete Monument; Thence runs with the Jones Property N 09 Degrees 25 Minutes 00 Seconds E, 645.00 Feet, to an Existing Iron Pipe on the Jones Line; Thence runs N 83 Degrees 47 Minutes 34 Seconds E, 196.77 Feet, to an Existing Iron Pipe; Thence runs S 83 Degrees 46 Minutes 02 Seconds E, 138.41 Feet, to the Point and Place of Beginning. Said Described Tract contains 4.995 Acres and is known as: 400 W. Ransom St., Fuquay Varina, North Carolina, County of Wake. Said Tract is described pursuant to As Built Survey entitled “Wake County Hospital System, Inc., 400 W. Ransom Street, Fuquay Varina, N.C.” dated 3-7-97 prepared by R. L. Scott & Co., Registered Land Surveyors. See deed recorded in Book 1263, Page 121, Wake County Registry.

For protection of public health and the environment, the following land use restrictions required by N.C.G.S. Section 143B-279.9(b) shall apply to all of the above-described real property. These restrictions shall continue in effect as long as residual petroleum remains on the site in excess of unrestricted use standards and cannot be amended or cancelled unless and until the Wake County Register of Deed receives and records the written concurrence of the Secretary (or his/her delegate) of DEQ (or its successor in function).

Additional Affected Property Not Subject to Restrictions

Additionally residual petroleum is also located on the following property. The following property is not subject to land use restrictions pursuant to N.C.G.S. Section 143B-279.9(b). The following property is known and legally described as:

BEGINNING at an iron stake located at the northeast corner of the Ragdale Land; also being the southwest corner of the extreme end of Sunset Boulevard, Fuquay, North Carolina, and being the northeast corner of the property herein described; runs thence South 9 degrees 28 minutes West 232.3 feet to an iron stake, corner of the Ragdale land; runs thence South 83 degrees 09 minutes East 36.0 feet to an iron stake, corner of the property of the Wake County Memorial Hospital; runs thence South 9 degrees 25 minutes West 645.0 feet to a concrete post, also a corner of the Wake County Memorial Hospital; runs thence South 83 degrees 09 minutes East 336.0 feet to a concrete post in the line of S. L. Lane; runs thence North 8 degrees 00 minutes East 820.0 feet to an iron stake, corner of C. W. Jones; runs thence South 84 degrees 12 minutes East 100.0 feet to an existing iron pipe, also a corner of C. W. Jones; runs thence North 8 degrees 45 minutes West 200.0 feet to a stake in the line of C. W. Jones and in the south line of a fifteen-foot easement; runs thence South 04 degrees 30 minutes East along said easement 268.71 feet to an iron stake, corner of the M. S. Closer property; runs thence South 08 degrees 45 minutes West 120.0 feet to an iron stake; runs thence South 84 degrees 20 minutes West 139.0 feet to an iron stake; runs thence along the Closer property North 8 degrees 45 minutes East 120.0 feet to an iron stake; runs thence South 84 degrees 20 minutes East 100.0 feet to the point and place of beginning, and containing 16.06 acres according to a map and survey made by C. W. Reasum, Registered Land Surveyor on April 24, 1962.

Recorded at Wake County Register of Deeds Book 2253 Page 41
PERPETUAL LAND USE RESTRICTIONS

Soil: Soil containing residual petroleum contamination above applicable regulatory standards remain on the site in the area identified in the attached Figure 1. No soil shall be excavated or disturbed within 3 feet of the area identified in Figure 1 except to remediate the soil in accordance with all applicable state and federal statutes, regulations and guidelines.

Groundwater: Groundwater from the site is prohibited from use as a water supply. Water supply wells of any kind shall not be installed or operated on the site.

ENFORCEMENT

The above land use restriction(s) shall be enforced by any owner, operator, or other party responsible for the Site. The above land use restriction(s) may also be enforced by DEQ through any of the remedies provided by law or by means of a civil action, and may also be enforced by any unit of local government having jurisdiction over any part of the Site. Any attempt to cancel this Notice without the approval of DEQ (or its successor in function) shall be subject to enforcement by DEQ to the full extent of the law. Failure by any party required or authorized to enforce any of the above restriction(s) shall in no event be deemed a waiver of the right to do so thereafter as to the same violation or as to one occurring prior or subsequent thereto.

IN WITNESS WHEREOF, Thomas Cavender has caused this Notice to be executed pursuant to N.C.G.S. Sections 143B-279.9 and 143B-279.11, this 27th day of October, 2016.

WakeMed, a North Carolina non-profit Corporation

By:

(name of responsible party if a person is signing)

Signature of responsible party, attorney or other agent if there is one

(Vice President)

(Title of agent for responsible party if there is one)

Signatory’s name typed or printed: Thomas Cavender

NORTH CAROLINA
Wake COUNTY

I, Patricia J. Margiotta, a Notary Public for said County and State, do hereby certify that Thomas Cavender, a W.P. of WakeMed and acknowledged, on behalf of WakeMed, the grantor the due execution of the foregoing instrument.

WITNESS my hand and official seal, this the 27th day of October, 2016.

(Official Seal)

Patricia J. Margiotta
Notary Public

My commission expires: 2/24/21

Revised January 15, 2013
Approved for the purposes of N.C.G.S. 143B-279.11

Mark R. Powers
Raleigh Regional Supervisor

Raleigh Regional Office
UST Section
Division of Waste Management
Department of Environment Quality

NORTH CAROLINA
WAKE COUNTY

I certify that the following person(s) personally appeared before me this day, each acknowledging to me that he or she signed the foregoing document: Mark R. Powers

Date: 11/21/16

(Official Seal)

Nathaniel B. Strain
Notary Public

My commission expires: 01/17/2018

Revised January 15, 2013
Figure 1
Aerial Photograph With Residual Petroleum Contaminated Soil
Former Southern Wake Hospital
Ransom Street Fuquay Varina, North Carolina

Approximate Extent of Remaining Petroleum Contaminated Soil
East Coast Environmental, P.A.
3815 Junction Boulevard Raleigh, NC 27603
(919) 772-0268  F (919) 772-0468

FREE PHASE PETROLEUM PRODUCT REMOVAL AND SOIL CLEANUP REPORT WITH SITE CLOSURE REQUEST PREPARED IN RESPONSE TO A LEAKING UNDERGROUND STORAGE TANK SYSTEM REMOVED FROM

FORMER SOUTHERN WAKE HOSPITAL
400 RANSOM STREET ST
FUQUAY-VARINA, WAKE CO, NC
NCDENR GROUNDWATER INCIDENT # 21007
RISK CLASSIFICATION: H161D

January 25, 2016

Responsible Party/Current Property Owner:
Mr. David R. Edwards, MSHA
Manager, Facilities
WakeMed Health and Hospitals – Property Services

Office:
3128 Smoketree Ct
Raleigh, NC 27604-1014

Mail:
3000 New Bern Avenue
Raleigh, NC 27610-1231
(919) 350-7829, office
(919) 630-2673, cell

Consultant:
East Coast Environmental, P.A.
3815 Junction Blvd.
Raleigh, North Carolina 27603
(919) 772-0268

Release Discovery Date: October 5, 1999
Cause of Release: Leaking Fuel Oil UST System
UST Size and Contents: (1) 270-gallon heating oil UST
Latitude: 35° 34’40”  Longitude: 78° 48’ 11”
FREE PHASE PETROLEUM PRODUCT REMOVAL AND SOIL CLEANUP REPORT WITH SITE CLOSURE REQUEST

A. SITE IDENTIFICATION

A.1 Site Identification
Date of Report: January 25, 2016
Facility I.D.: N/A
Site Name: Former Southern Wake Hospital
Site Address: 400 Ransom Street
Nearest City/Town: Fuquay-Varina
Location Method: GPS
Latitude: N 35° 34’ 40”

A.2 Contact Information
UST Owner/Operator: Wake-Med Health and Hospitals
Address: 3000 New Bern Avenue, Raleigh, NC 27610-1231

Last UST Owner/Operator: Wake-Med Health and Hospitals
Address: 3000 New Bern Avenue, Raleigh, NC 27610-1231

Property Owner: Wake-Med Health and Hospitals
Address: 3000 New Bern Avenue, Raleigh, NC 27610-1231

Property Occupants: Vacant
Address:

Consultant/Contractor: East Coast Environmental, P.A.
Address: 3815 Junction Blvd., Raleigh, NC 27603

Analytical Laboratory: ENCO Laboratories
Address: 102-A Woodwinds Industrial Court, Cary, NC 27511

A.3 Release Information
Date Discovered: October 6, 1999
Estimated Quantity of Release: Unknown
Cause of UST Release: Holes in 270 gallon tank
Source of Release (e.g., Piping/UST): Holes in 270 gallon tank
Sizes and contents of UST system(s) from which the release occurred: One 270-gallon fuel oil UST

I, Thomas R. Will a Licensed Geologist for East Coast Environmental, P.A. do certify that the information contained in this report is correct and accurate to the best of my knowledge.

[Signature]

East Coast Environmental, P.A.
3709 Junction Blvd.
Raleigh, North Carolina, 27603
1.0 EXECUTIVE SUMMARY

At the request of Wake Med Health and Hospitals and in accordance with the provisions of North Carolina Administrative Code, Title 15A, Subchapter 2L, East Coast Environmental, P.A. (ECE), of Raleigh, North Carolina, has prepared this, "Free Phase Petroleum Product Removal and Soil Cleanup Report With Site Closure Request" after the excavation of 253.25 tons of petroleum contaminated soils and free phase petroleum product removed from 400 Ransom Street, located within the town limits of Fuquay-Varina, Wake County, North Carolina (hereinafter referred to as the "Site"). See Section A, Figure 1 for Site location.

1.1 Source Information

The Site consists of an approximately 5.0-acre parcel of land and includes buildings once associated with Southern Wake Hospital’s assisted living operations. Currently, the Site is vacant and owned by WakeMed Health and Hospitals (WakeMed) of Cary, NC, and was last used as an assisted-living facility. The Site also once contained two (2) underground storage tanks (USTs), which were permanently closed by removal on October 5 & 6, 1999. The UST that is the source of the oil targeted for cleanup was 270-gallons in capacity, and was once utilized for the storage of fuel oil for use with an emergency generator system. An additional 2,000-gallon tank (located in a different part of the Site) was also closed at that time. The 2,000-gallon UST was also utilized for the storage of fuel oil for use by an emergency generator system. The former locations of the 270-gallon and 2,000-gallon USTs are depicted in Figure 2 at the end of the text.

The USTs were closed between October 5 and 6, 1999 by C&A Equipment Company, Inc., of Raleigh, NC. East Coast Environmental, P.A (ECE) was subcontracted to provide environmental oversight for the UST removals and was present for closure of the tanks. After removal, both tanks were inspected by ECE. The 270-gallon tank was found to be of steel construction and was in poor condition, with numerous holes along its bottom. The other tank (2,000-gallon capacity) was found to be of fiberglass co-tated steel construction, and in very good condition. Groundwater infiltrated the 2,000-gallon UST area during closure activities.

One groundwater sample (T-1 S-1) was obtained from a temporary groundwater monitoring well installed adjacent to the 2,000-gallon tank excavation. This sample was submitted for chemical analysis by EPA Methods 602 and 625, as well as the Massachusetts Department of Environmental Protection (MADEP) Volatile Petroleum Hydrocarbon (VPH) and Extractable Petroleum Hydrocarbon (EPH) analyses. Analytical data for the groundwater sample did not show any targeted compounds at levels in excess of the Maximum Allowable Concentration(s) defined by NCAC Title 15A, Subchapter 2L, Section 0.202 (Water Quality Standards for Class GA Groundwater). Data for the EPA-625 also did not reveal the presence of targeted chemical compounds at levels above the method detection limit.

Two soil samples (T-2 S-1 and T-2 S-2) were obtained from beneath the former location of the 270-gallon tank and submitted for chemical analysis by EPA Methods 5030 and 3550. Analysis of samples T-2 S-1 and T-2 S-2 by EPA Method 3550 indicated the presence of diesel range TPH at levels of 15,000 and 7,900-mg/kg, respectively. Analysis of samples T-2 S-1 and T-2 S-2 by EPA Method 5030 revealed the presence of gasoline range TPH at levels of 290 and 35-mg/kg, respectively. Levels of both diesel and gasoline range TPH in these samples exceeded the minimum reportable concentrations for these compounds of 10-mg/kg as defined by the North Carolina Department of Environmental Quality (NCDEQ) - Division of Waste Management (DWM).

---

1.2 Nature and Extent of Release

ECE returned to the Site in order to complete a Comprehensive Site Assessment (CSA) and later a Comprehensive Site Assessment-Addendum (CSA-A) during 2002. A summary of the sampling activities completed in order to characterize the horizontal and vertical extent of groundwater contamination at the Site is as follows.

Investigative activities related to the groundwaters of the Site were first conducted on March 07, 2000, and included the installation of monitoring wells MW-1, 2, 3, and 4. In addition, four recovery wells designated as RW-1, RW-2, RW-3 and RW-4 were also installed at this date. All of the recovery wells (RW-1 through RW-4) were advanced to a depth of 13-feet beneath surface grade. Monitoring wells MW-2 and 3 were advanced to 12-feet beneath surface grade, while wells MW-1 and 4 were advanced to depths of 15 and 13-feet beneath grade, respectively.

Recovery wells RW-1 through RW-4 were placed in locations through which recovery of free product could be performed. Wells MW-1 through MW-4 were placed in locations in order to provide information related to groundwater hydraulic gradient and the (potential) migration of contaminants through the surficial aquifer beneath the Site.

Additional monitoring wells MW-5, MW-6, MW-7 and MW-8 were installed on September 12, 2000. Finally, the groundwater CSA was completed with the installation of DW-1 during October 3-4, 2000.

In order to satisfy additional CSA-A investigation activities required by the NC-DEQ-DWM, monitoring wells MW-9, MW-10, and MW-11 were installed on March 19, 2002, while temporary wells TMW-1 and TMW-2 were installed on May 22, 2002.

Finally, in order to complete an update of free product conditions prior to commencing with free product removal and petroleum contaminated soil excavation activities ECE returned to the Site on November 10, 2015 in order to install two additional temporary groundwater monitoring wells (TMW-4A and TMW-4B) near the former location of MW-4 as MW-4 had been destroyed at some time after 2008. These locations were chosen as MW-4 has historically found to contain measurable free product thickness in monitoring events as recently as July 2008.

Section A, Figure 2 displays all of the monitoring/temporary well locations installed to date. Finally, Section B, Table 5 is a summary of monitoring well construction data for all wells installed to date.

1.3 Receptor Update

While completing the CSA-A during 2002 one potable water supply well identified to be servicing a private residence located at 521 Sunset Drive was located within 1,000-feet of the source area. However, findings from the July 2015 receptor survey update indicate that this well is no longer in use so there are no longer any potable water supply wells within a 1,000-foot radius of the Site. The one remaining operating well within a 1,000 foot radius is located at 517 Sunset Drive. This is a non-potable supply well located approximately 410 feet north of the former UST area. ECE contacted the property owner (Ms. Jack Jones (919-552-6626). In a telephone conversation on August 20, 2015, Mrs. Jones confirmed the well was still in use at her greenhouse for irrigation. However, she stated that their potable water supply is provided by the Town of Fuquay-Varina.

In summary, no potable water supply wells were confirmed within 1,000 feet of the source area and all properties within this radius have access to the Town of Fuquay-Varina water supply.
No surface water bodies were found to be located within 500-feet of the source area and no water supply wells used for non-potable purposes are within a 250-foot radius of the source area.

The source area is not located within a wellhead protection area or within the Coastal Plain Physiographic province. Finally, land use at the Site and surrounding areas is primarily residential.

After completion of the well survey update it was possible to re-rank the incident from “high risk” to “intermediate risk” based on the removal of the potable water supply well and the continued presence of a measurable free product thickness in three monitoring wells.

1.4 Groundwater Sampling/Investigation Results (July 2015 Groundwater Monitoring Event)

The most recent July 2015 groundwater sampling event was completed in order to obtain data regarding changes in the extent and concentrations of groundwater contamination as well as complete the previously described receptor update since the previous groundwater monitoring event in 2008. As stated earlier, twelve groundwater monitoring wells were installed between 2000 and 2002 in order to monitor the possible effects of this release on the water-table aquifer. Six recovery wells were also installed in order to remove free product from the water-table aquifer.

The most recent groundwater monitoring activities included collecting groundwater level measurements, free product measurements and the collection of representative groundwater samples from on-site monitoring and recovery wells. Samples were collected from wells MW-1, 8, 9, 10, 11, DW-1, and RW-3. Samples were not collected from wells RW-1B and RW-2 as they contained a measurable free phase petroleum product thickness. Further, wells MW-2, 3, 4, 5, 6, 7, and RW-1 have been removed or destroyed and could not be sampled. Former and existing well locations are shown in Section A Figure 2.

1.4.1 Free Product

All monitoring wells and recovery wells at the Site were gauged for the presence of free petroleum product prior to initiating sampling procedures. A petroleum sheen was noted in all of the recovery wells while measurable product was present in RW-1B (0.05 ft) and RW-2 (0.02 ft). In accordance with NCDENR guidelines, the wells with observed petroleum product were not sampled during the monitoring event.

1.4.2 Groundwater Sample Results

Groundwater samples were collected for analysis from monitoring wells MW-1, 8, 9, 10, 11, and DW-1 on July 15, 2015. A sample was also collected from source area recovery well RW-3 because it contained no measurable thickness of free product and also provide a “worse case scenario” for dissolved phase groundwater contamination. All samples were collected using disposable PVC bailers after the monitoring wells were purged of either a minimum of three volumes of water calculated to be standing in them or they were purged to dryness (whichever came first). Samples collected from all wells were submitted for chemical analysis by EPA Methods 624, 625 as well as the Massachusetts Department of Environmental Protection – Volatile Petroleum Hydrocarbons (MADEP VPH) method and Extractible Petroleum Hydrocarbons (MADEP EPH) method.

Results of chemical analysis by EPA Methods 624, 625 and the MADEP VPH/EPH test showed detectable levels of contamination in three of the seven wells which were sampled. These three wells included MW-8, MW-10, and RW-3. Further, contaminants exceeding NCDENR 2L ground water standards, established by 15A NCAC 2L .0202 are summarized below:
MW-8  benzene, 1.5 ug/l
MW-10 benzene, 11 ug/l, 1-methylnaphthalene, 2.7 ug/l;
RW-3 benzene, 28 ug/l; 1-methylnaphthalene, 53 ug/l; 2-methylnaphthalene, 64 ug/l; naphthalene, 50 ug/l; C5-C8 aliphatics, 5,690 ug/l; C9-C18 aliphatics, 25,600 ug/l; C19-C36 aliphatics, 15,000; C9-C22 aromatics, 12,900 ug/l

Analysis by EPA Methods 624 and 625 showed no compounds above NCDENR Gross Contaminant Levels (GCLs). Additionally, dissolved phase contaminant levels in MW-8 and MW-10 have shown an overall decline since the previous monitoring event in 2008. In particular benzene levels have decreased in both wells from 44 to 1.5 ug/l in MW-8 and 100 to 11 ug/l in MW-10. In MW-8, the previously detected low levels of MTBE, xylenes, 1- and 2-methylnaphthalene and naphthalene were all absent in July 2015. Both MW-8 and MW-10 showed slight increases of less than 10 ug/l in certain aromatic and aliphatic ranges were none had been present in 2008. Still, all four ranges of aromatics and aliphatics were below 2L standards in both wells. The overall decline in contaminant levels in MW-10 included a reduction in MTBE from 14 to 1.5 ug/l, and in naphthalene from 15 to 5.4 ug/l since 2008. A summary of the laboratory results can be found in Section B, Table 1. Section B, Table 3 includes a summary of historical groundwater analytical results since 2000. Figure 3 in Section A depicts the approximate lateral extent of total BTEX contamination on the Site based on the most recent July 15, 2015 sampling event.

1.4.3 Current Plume Information

Based on analytical data for the July 15, 2015 monitoring event, dissolved phase groundwater plume constituents exceeding 2L standards consist of: benzene, 1-methylnaphthalene, 2-methylnaphthalene, naphthalene, and the four ranges of aliphatics and aromatics while no contaminants were detected at levels in excess of their GCLs.

In addition, free petroleum product was observed in the recovery wells with measurable levels in RW-1B of 0.05 ft and RW-2 of 0.02 ft. Based on the analytical data, the BTEX plume in the surficial aquifer currently measures approximately 13,000 square feet (0.3 acre) and is centered where the former UST was located.

1.4.4 Summary of Remedial Activities

Historically, free product thickness has been measured in RW-1, RW-2, RW-3, RW-4 and MW-4. The results of ECE’s CSA-A from 2002 revealed the presence of a thickness as great as 1.74-feet of free phase petroleum product in recovery well RW-2 during a gauging event completed on March 16, 2000. In response, WakeMed contracted with ECE in order to proceed with the removal of free phase petroleum product through two Aggressive Fluid Vapor Recovery (AFVR) events completed at the Site on March 16, 2000 and again on July 27, 2000.

**AFVR Activities - March 16, 2000**

ECE mobilized to the Site on March 16, 2000, for the purpose of implementing the first AFVR event. Shortly after arriving at the Site, ECE opened wells RW-1 through RW-4 and MW-4 and allowed the water levels to stabilize. Product thicknesses of 0.04, 1.74, 1.02, 0.02 and 0.22-feet were measured in recovery wells RW-1, RW-2, RW-3, RW-4 and MW-4, respectively. The initial depth to product in the recovery wells ranged from 4.08 to 6.55-feet below the top of casing in MW-4 and RW-3, respectively. A total of 220-gallons of fuel/water mix were recovered from RW-1 through RW-4 during this AFVR event. Of this quantity a total of 30 gallons were determined to be free phase petroleum product.
AFVR Activities – July 27, 2000

ECE mobilized to the Site on July 27, 2000, for the purpose of implementing the second AFVR event. Shortly after arriving at the Site, ECE opened wells RW-1 through RW-4 to allow the water levels to stabilize. Product thicknesses of 1.15, 1.40, 0.02 and 1.30-feet were measured in recovery wells RW-2, RW-3, RW-4 and monitoring well MW-4, respectively. The initial depth to product in the recovery wells ranged from 10.35 to 12.35-feet below the top of casing in MW-4 and RW-2, respectively. At the completion of the AFVR event, the liquids storage tank on the AFVR truck was opened and determined to contain 60-gallons of oil/water mix. The truck operator measured the total liquids in the truck and determined that almost the entire 60-gallons of recovered liquids were free phase petroleum product.

Free Product Recovery Trench Installation

ECE’s report entitled Comprehensive Site Assessment-Addendum was prepared and submitted to the NCDENR dated May 31, 2002. In this report a free product recovery trench was proposed in order to address the remaining free product at the Site. This course of action was approved by the NCDENR, so ECE mobilized to the Site on April 4-5, 2004 in order to install the free product recovery trench. The recovery trench was installed to an average depth of 12-feet below land surface using a 2-foot wide backhoe bucket. At the conclusion of excavation activities, approximately 1-foot of wash stone was placed throughout the bottom of the trench followed by 4-inch diameter PVC well screen which was positioned horizontally throughout the excavation and directly on top of the wash stone base. A section of vertical 4-inch solid PVC pipe was connected to the horizontal PVC well screen at the eastern end of the trench for later connection to the MMPE equipment. This pipe location is illustrated in attached Figure 2 as recovery well RW-1B. Next, wash stone was placed on top of the PVC pipe to a depth of approximately 7 to 8-feet below land surface. Finally, the trench was backfilled to land surface with clean clay soil.

Due to the presence of an transformer pole guide wire that could not be moved the trench could not be extended all the way back to the former UST area. Therefore, the former UST area was excavated to the extent allowable by Site constraints (i.e. adjacent generator building, chimney, stabilizing wires and the buried concrete slab to which the subject tank was once bolted) and then backfilled with permeable wash stone to a depth of 7-feet below land surface. A 4-inch diameter PVC well screen was placed into the pit prior to backfilling so that this area could act as a sump for collecting product remaining in close proximity to the former UST location for subsequent extraction during the upcoming MMPE event. Section A Figure 4 is an “as-built” drawing of the recovery trench and the locations of all recovery wells.

MMPE Activities – August 16-20, 2004

ECE mobilized to the Site on August 16, 2004, for the purpose of implementing a Mobile Multi Phase Extraction (MMPE) event. Shortly after arriving at the Site, ECE opened wells RW-1A, RW-1B, RW-2, RW-3, RW-4 and MW-4 to allow the water levels to stabilize. Product thicknesses of 0.6, 0.8, and 1.0-feet were measured in recovery wells RW-2, RW-3 and monitoring well MW-4, respectively. The initial depth to product in the recovery wells ranged from 9.5 to 11.6-feet below the top of casing in MW-4 and RW-2, respectively. The MMPE event commenced at 11:30 A.M on August 16 and continued until 12:00 P.M. on August 20, 2004. At the completion of the MMPE event, the liquids storage tank on the tanker truck was opened and determined to contain 5,000-gallons of oil/water mix. While the majority of the liquids in the truck were water there was some oil observed on top of the water. Based on our observations made at the conclusion of the MMPE event ECE believes that that tanker contained approximately 25-gallons of free phase petroleum product and an undetermined amount of dissolved phase petroleum constituents.
ECE returned to the Site on September 8, 2004 in order to gauge recovery wells RW-1A, RW-1B, RW-2, RW-3, RW-4 and monitoring well MW-4 for the presence of free phase petroleum product. Free product was found only in monitoring well MW-4 at a thickness of 0.30-feet. This data indicated that the MMPE event had been successful in removing most of the free phase petroleum product from the Site.

As stated previously, ECE also returned to the Site on July 15, 2015 in order to complete an update of groundwater conditions. Unfortunately, after arrival it was found that monitoring well MW-4 had been destroyed at some time since 2008. Therefore, all available remaining monitoring and recovery wells at the Site were gauged for the presence of free petroleum product prior to initiating sampling procedures. Only a petroleum sheen was noted in recovery well RW-4 while measurable product was present in RW-1B (0.05 ft) and RW-2 (0.02 ft). See Table 3 in Section B for a summary of historical free product thickness and groundwater elevation measurements for the most recent July 18, 2008 and July 15, 2015 gauging events.

Finally, in order to complete an update of free product conditions prior to commencing with free product removal and petroleum contaminated soil excavation activities ECE returned to the Site on November 10, 2015 in order to install two additional temporary groundwater monitoring wells (MW-4A and MW-4B) near the former location of MW-4. MW-4A was installed near the former location of MW-4 and into native soils and immediately adjacent to the recovery trench while MW-4B was installed directly into the recovery trench. See Section A, Figures 2 and 4 for well locations. These locations were chosen as MW-4 has historically found to contain measurable free product thickness in monitoring events and as recently as July 2008 before it was destroyed.

1.5 Site Specific Conditions Related to Risk Classification

As stated previously, there are no longer any potable water supply wells located within a 1,000 foot radius of the Site. However, the continued presence of free phase petroleum product thickness in two wells resulted in the incident to continue to be ranked as "intermediate risk". Therefore, in order to lower the incident risk the free phase petroleum product will have to be successfully removed and dissolved phase groundwater contaminant cleanup levels will be their GCLs as set forth by the NC-DEQ UST Section.

1.6 Remedial Activities

Because the incident is ranked as "intermediate risk" due solely to the presence of free phase petroleum product ECE determined that future remedial activities should concentrate on the removal of free product and the soils containing the free product. Further, ECE determined the most time and cost efficient method for remediation of the free product was through free product and petroleum contaminated soils excavation followed by transport and disposal at a NCDENR permitted soil treatment and disposal facility. This decision was made based on the shallow water table measured throughout the course of the assessment and the accessibility of the soils for excavation after Duke Energy relocated the power pole guide wire. As stated previously, historically the main obstacle for excavation was a guide wire located within the proposed excavation area that was being used to support three nearby pole mounted transformers. Duke Energy was contacted prior to beginning the excavation activities and the wire was moved during early December 2015 allowing for total access to the petroleum contaminated soils.

After the guide wire was moved ECE returned to the Site on December 21-22, 2015 for the purpose excavating the remaining free product and petroleum contaminated soils, followed by their loading, hauling and transportation to an NCDENR permitted facility for treatment and disposal. The excavation was advanced vertically to a depth of approximately 2-feet below the static groundwater table which equaled to a depth of approximately 12-feet below land surface in order to insure that free product trapped in the "smear zone" located within the measured seasonal low and high groundwater table was also removed. The excavation was advanced in the horizontal direction to the east to the edge of the
adjacent mechanical room building, to the south to the edge of a retaining wall and to the west and north until ECE was confident that all of the free phase petroleum product and the majority of the petroleum contaminated soils were removed. Due to the proximity of the mechanical room building to the petroleum contaminated soils some petroleum stained soils had to remain in the eastern sidewall of the excavation. In response, a soil sample was collected from this sidewall at the conclusion of petroleum contaminated soils excavation activities in order to characterize soil conditions in this area. ECE also collected a soil sample from the extreme western end of the excavation on the adjacent Jones property in order to characterize soil conditions at this offsite location as well. See Section A, Figure 6 for soil sample locations.

Therefore, at the conclusion of soil excavation activities two soil samples were collected from the eastern and western side limits of the excavation at a depth of 6-feet below land surface and submitted to ENCO of Cary NC for laboratory analysis by EPA 8260, 8270 and the MADEP-VPH/EPH method.

Upon laboratory analysis the soil sample collected from the eastern limits of the excavation were found to contain various concentrations of the hydrocarbon chains targeted by EPA methods 8260, 8270 and the MADEP-VPH/EPH methods. While C9-C18 aliphatics and C9-C22 aromatics were detected at concentrations in excess of their Residential Maximum Soil Contaminant Concentrations (MSCCs) none of these were at levels in excess of their Industrial Commercial MSCCs.
2.0  EVALUATION OF REMEDIAL ALTERNATIVES

Evaluation of the proposed free product and soil remediation activities at the Site required consideration of the following:

1) Contaminant type and potential extent(s) of contamination;
2) Subsurface soil conditions;
3) Site area land usage;
4) Cost-effectiveness.

Fuel oil is the contaminant for which this Free Phase Petroleum Product and Soil Cleanup Report With Site Closure Request has been prepared. Upon review of the historical free product assessment investigations along with the results for the most recent 2015 free product investigation, ECE believes that the extent of free product and soils containing free product has been adequately characterized. Based on the results for the free product investigation the volume of soil targeted for remediation was estimated to be on the order of 250 tons or 170-cubic yards. **Section A, Figure 4** displays the area targeted for soil remediation. Overall, cleanup effectiveness and cost were the major considerations for choosing any remedial option, while timeliness and secondary maintenance play major roles in the overall cost of the type of treatment selected as well. It should be noted that groundwater remediation to the 2L standards is not a goal for this cleanup and incident closeout as there have never been any exceedence of a GCL noted during assessment activities and there are no longer any supply wells located within a 1,000 foot radius of the Site. Finally, the remaining residual dissolved phase groundwater contamination will be addressed through a Notice of Residual Petroleum now that there are no longer any supply wells located within a 1,000 foot radius of the release area.

2.1  Feasibility of Various Alternatives

The in-situ remediation technology considered by ECE for the removal of the remaining free product and contaminated soil at the Site included one or more additional MMPE events while the other treatment considered for the free product and petroleum contaminated soil removal was through excavation and treatment at an offsite location. The advantages/disadvantages of each of these are as follows:

**MMPE (MMPE)**

MMPE is a remedial technology that involves the removal of free product from the subsurface soils, causing a phase transfer of hydrocarbons from the subsurface to the atmosphere. The advantage of this technology is that depending on Site conditions it can remediate soils in areas that are not otherwise assessable for excavation. The disadvantages of this alternative are unknowns such as: 1) the actual length of time required to operate the MMPE system until the free product is removed; 2) the expenses associated with operating the MMPE system until remediation goals have been achieved; 3) Site soil conditions such as clay content and permeability that can prohibit effective product removal; and 4) the fact that the Site is located near a residential area where noise and odors could possibly be a nuisance to Site residents and neighbors.

**Excavation and Offsite Treatment and Disposal**

If determined to be suitable, excavation and offsite treatment of free product and contaminated soil is almost always the quickest and most effective method of free product removal. The effectiveness of this technology depends on several factors including: 1) accessibility of the free product and soils for excavation in that surface structures such as buildings and buried utilities must not be situated such that
they hinder any part of the excavation; 2) the groundwater table and free product is not located at such a depth below land surface that makes excavation too costly; and 3) groundwater does not have to be remediated to the 2L standards. This option became feasible during December 2015 after Duke Energy relocated the guide wire used to support three pole mounted transformers to a location outside of the area targeted for excavation. Technically, this remediation process is relatively simple and involves mobilizing to the Site with an excavator and physically removing the free product and contaminated soil to such a depth that the free product can be removed and then the excavation expanded horizontally in all directions until the free product and petroleum contaminated soils have been successfully removed. The disadvantage of this option is that it must be completed in its entirety in order to be effective in that all of the free product must be removed in order to achieve incident closeout.

In order to apply this technology to the subject incident the excavation would have to be extended to a maximum depth of 12-feet vertically and as much as 35 x 15-feet horizontally including 10-feet into the neighboring Jones property. The excavation would include the areas represented by RW-1A, RW-1B, RW-1, RW-2, RW-3, RW-4 and temporary wells, MW-4A and MW-4B down to a depth of as much as 12-feet in order to insure that free product located within the “smear zone” and below the groundwater table is successfully removed. After ECE personnel are satisfied that the free product has been removed through the completion of soil excavation activities one or more confirmation soil samples are to be collected from the side limits of the excavation, followed by backfilling the excavation with clean material. Further, the contaminated soils would be loaded directly onto dump trucks for transportation and final disposal at an offsite permitted soil disposal facility.

Cost Estimates

MMPE

The cost associated with performing an MMPE event would be approximately $10,000.00. However, base on the results for the MMPE event completed during 2004 more than one MMPE event will be required in order to successfully remove all of the remaining product. Therefore, the cost to complete up to 3 MMPE events over approximately 6 months could total $30,000.00 with no guarantee that additional MMPE vents would be required.

Excavation and Offsite Disposal

The cost associated with the excavation, hauling and offsite disposal of approximately 250 tons of petroleum contaminated soils including ECE Geologist oversight, confirmation soil sampling and preparation of the Soil Cleanup Report and Site Closure Request would also be in the order of $30,000.00 over a 30 day period.

Recommendation and Rationale for Selection

Based on the advantages and known limitations of the treatment technologies described above, the most timely and cost-effective treatment to pursue at this Site was the excavation and offsite disposal of the contaminated soils at a permitted offsite facility. Further, due to time restraints set forth by Wake Med, the shallow depth to product (historically, between 6 and 10-feet below land surface in the area targeted for remediation), and accessibility of the area targeted for remediation, excavation and offsite disposal of the free product and contaminated soils were chosen as the most timely and effective alternative. See Section A, Figure 4 for area targeted for remediation.
3.0 SITE REMEDIATION

Based on the groundwater and free product assessment results dating back to 2000 and the results for the most recent free product gauging, the estimated volume of soil required to be removed in order address the remaining free phase petroleum product was in the order of 170 cubic yards or 250 tons. After receipt of a December 9, 2015 acknowledgment letter from the NCDEQ-RRO approving the free product and soil excavation option, ECE and our subcontractor mobilized to the Site on December 21, 2015 in order to proceed with the free product and petroleum contaminated soil excavation activities.

The excavation activities began in the areas represented by RW-1A, RW-1B, RW-2 and temporary well, MW-4A and proceeded down to a depth of as much as 12-feet in order to insure that free product located within the “smear zone” and below the groundwater table is successfully removed. Then the excavation was extended horizontally in all directions to a maximum depth of 12-feet vertically and as much as 35 x 15-feet horizontally including 10-feet into the neighboring Jones property. After ECE personnel were satisfied that the free product had been removed excavation activities were ceased. 253.25-tons of soil as measured by an NC-DOT approved truck scale were eventually excavated from around the areas targeted for excavation on December 21-22, 2015. The excavation was extended in all directions until petroleum odors and staining diminished in the excavation sidewalls and bottom when groundwater water was observed to be entering the excavation. Some petroleum stained soils remained in the eastern sidewall due to the presence of the mechanical room located in that direction, however recent gauging of recovery well RW-3 located closest to the building foundation showed no measurable product thickness in that well. Excavation activities proceeded in the south, west and north directions unimpeded until the ECE geologist was satisfied that no free product and only minimally contaminated soils remained in these directions.

The oil contaminated soils removed from the excavation were transported by Carlisle Farms for treatment and disposal at their Autryville, NC facility. Carlisle Farms is an NCDEQ-DWQ permitted (DWQ permit # SR0600035) petroleum contaminated soil treatment facility. Carlisle Farms treats the soil through land application at their facility along with fertilizing and tilling. No special permit or permit modification was required to be obtained by Soilworks prior to accepting the subject soils removed from the Site. Copies of the hauling weigh tickets and Carlisle Farms soil disposal manifest are included as attachments in the back of Section D.

Section A, Figure 6 indicates the final extent of the petroleum contaminated soils excavation at the conclusion of petroleum contaminated soils excavation activities on December 22, 2015.

4.0 POST REMEDIATION SAMPLING

As stated previously, due to the proximity of the mechanical room building to the petroleum contaminated soils some petroleum stained soils remained in the eastern sidewall of the excavation so a soil sample (Side 1) was collected from this sidewall at the conclusion of petroleum contaminated soils excavation activities in order to characterize soil conditions in this area. ECE also collected a soil sample (Side 2) from the extreme western end of the excavation on the adjacent Jones property in order to characterize soil conditions at this offsite location as well. See Section A, Figure 6 for soil sample locations.

In summary, at the conclusion of soil excavation activities soil samples Side 1 and Side 2 were collected from the western and eastern side limits of the excavation at a depth of 6-feet below land surface and submitted to ENCO of Cary NC for laboratory analysis by EPA 8260, 8270 and the MADEP-VPH/EPH method.

Upon laboratory analysis soil sample Side 1 collected from the eastern limits of the excavation were found to contain various concentrations of the hydrocarbon chains targeted by EPA methods 8260, 8270...
and the MADEP-VPH/EPH methods. While C9-C18 aliphatics and C9-C22 aromatics were detected at concentrations in excess of their Residential Maximum Soil Contaminant Concentrations (MSCCs) none of these were at levels in excess of their Industrial Commercial MSCCs. In comparison, the analytical results for soil sample S-2 collected from the western most edge of the excavation was found to contain only toluene at a concentration of 0.0014 mg/kg. Section A, Figure 6 indicates the final extent of the petroleum contaminated soils excavation and the soil sample locations. A summary of the sample results pertaining to the soil sample collected on December 22, 2015 at the conclusion of petroleum contaminated soil excavation activities can be found in Section B on Table 4 while the laboratory report is included in Section C.

5.0 CONCLUSIONS

Based on ECE's observations made at the conclusion of petroleum contaminated soil excavation activities, the laboratory results for samples collected from the sidewalls of the excavation at the conclusion of petroleum contaminated soils excavation activities, ECE believes that no free phase petroleum product remains in the subsurface of the Site or the neighboring Jones Property. Further, the remaining petroleum contaminated soils containing contaminants at concentrations in excess of their Residential MSCCs and groundwater in excess of its 2L standards will be addressed through the successful completion of a Notice of Residual Petroleum and public notice.

Finally, on behalf of the WakeMed Health and Hospitals, ECE is petitioning the NCDEQ UST Section for issuance of a conditional Notice of No Further Action and a final Notice of No Further Action after completion of the Notice of Residual Petroleum and public notice.

6.0 LIMITATIONS

This report has been prepared for the exclusive use of Wake Med Health and Hospitals and/or their designees, successors or assigns. It has been prepared in accordance with generally accepted environmental practices. No other warranty, expressed or implied, is made. ECE's conclusions and recommendations are based on information supplied by others, together with ECE's own site observations. Although ECE cannot be responsible for the accuracy of data supplied by others, ECE has no reason to suspect that any of the information is inaccurate. The observations described herein are based upon conditions readily visible on the site at the time of ECE's visit(s).

ECE cannot assume responsibility for the person(s) in charge of the site, nor otherwise undertake responsibility for reporting to any local, state or federal public agencies any conditions at the site that may present a potential danger to public health, safety or the environment. It is the responsibility of Wake Med Health and Hospitals to notify the appropriate local, state or federal public agencies as required by law, or otherwise to disclose, in a timely manner, any information that may be necessary to prevent any danger to public health, safety or the environment.
FIGURE 3
ESTIMATED EXTENT OF ZL EXCEEDENCES
JULY 15, 2015
Former Southern Wake Hospital
400 Ransom Street
Fuquay-Varina, Wake County, NC

Scale:
As Shown

Filename:
CW 12-2003

Drawn:
K. Buchanan

Reviewed:
T. W
NOTE:
RECOVERY TRENCH CONSTRUCTED 12-FEET DEEP WITH 4-INCH HORIZONTAL WELL SCREEN PLACED ONE FOOT OFF BOTTOM AND CONNECTED AT "T" INTERSECTION. VERTICAL PRODUCT REMOVAL PIPE RW-1B LOCATED AS SHOWN. VERTICAL WELL RW-1A INSTALLED IN EXPANDED SOILS EXCAVATION LOCATED IN CLOSE PROXIMITY TO FORMER UST AREA.
<table>
<thead>
<tr>
<th>Analytical Method &gt;</th>
<th>Benzene</th>
<th>Ethylbenzene</th>
<th>MTBE</th>
<th>Toluene</th>
<th>Total Xylenes</th>
<th>Acenaphthene</th>
<th>Anthracene</th>
<th>Chrysene</th>
<th>1-Methylnaphthalene</th>
<th>2-Methylnaphthalene</th>
<th>Naphthalene</th>
<th>Phenanthrene</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW-1</td>
<td>MW-1</td>
<td>7/15/15</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>MW-2</td>
<td>MW-2</td>
<td>Destroyed</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>MW-3</td>
<td>MW-3</td>
<td>Destroyed</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>MW-4</td>
<td>MW-4</td>
<td>Destroyed</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>MW-5</td>
<td>MW-5</td>
<td>Destroyed</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>MW-6</td>
<td>MW-6</td>
<td>Destroyed</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>MW-7</td>
<td>MW-7</td>
<td>Destroyed</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>MW-8</td>
<td>MW-8</td>
<td>7/15/15</td>
<td>1.5</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>MW-9</td>
<td>MW-9</td>
<td>7/15/15</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>MW-10</td>
<td>MW-10</td>
<td>7/15/15</td>
<td>11</td>
<td>ND</td>
<td>1.5</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>2.7</td>
<td>3.7</td>
</tr>
<tr>
<td>MW-11</td>
<td>MW-11</td>
<td>7/15/15</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>DW-1</td>
<td>DW-1</td>
<td>7/15/15</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>RW-3</td>
<td>RW-3</td>
<td>7/15/15</td>
<td>28</td>
<td>17</td>
<td>1</td>
<td>2.6</td>
<td>100</td>
<td>5</td>
<td>ND</td>
<td>53</td>
<td>64</td>
<td>50</td>
</tr>
<tr>
<td>RW-4</td>
<td>RW-4</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>2L Standard (ug/l)</td>
<td>1</td>
<td>600</td>
<td>20</td>
<td>600</td>
<td>500</td>
<td>80</td>
<td>2,000</td>
<td>5</td>
<td>1</td>
<td>1,000</td>
<td>12,500</td>
<td>6,000</td>
</tr>
<tr>
<td>GCL (ug/l)</td>
<td>5,000</td>
<td>84,500</td>
<td>200,000</td>
<td>260,000</td>
<td>85,500</td>
<td>2,120</td>
<td>2,000</td>
<td>5</td>
<td>1</td>
<td>1,000</td>
<td>12,500</td>
<td>6,000</td>
</tr>
</tbody>
</table>

Results are in ug/l
Bold Results indicate exceedence of 2L Standards
Bold and shaded results indicate exceedence of GCL.

NS – Not Sampled
ND – Not Detected
<table>
<thead>
<tr>
<th>Contaminant of Concern</th>
<th>MADEP-VPH</th>
<th>MADEP-VPH/EPH</th>
<th>MADEP-EPH</th>
<th>MADEP-VPH/EPH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well ID</td>
<td>Sample ID</td>
<td>Date Collected (m/dd/yy)</td>
<td>C5-C8 Aliphatics</td>
<td>C9-C18 Aliphatics</td>
</tr>
<tr>
<td>MW-1</td>
<td>MW-1</td>
<td>7/15/15</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>MW-2</td>
<td>MW-2</td>
<td>Destroyed</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>MW-3</td>
<td>MW-3</td>
<td>Destroyed</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>MW-4</td>
<td>MW-4</td>
<td>Destroyed</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>MW-5</td>
<td>MW-5</td>
<td>Destroyed</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>MW-6</td>
<td>MW-6</td>
<td>Destroyed</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>MW-7</td>
<td>MW-7</td>
<td>Destroyed</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>MW-8</td>
<td>MW-8</td>
<td>7/15/15</td>
<td>6.9</td>
<td>ND</td>
</tr>
<tr>
<td>MW-9</td>
<td>MW-9</td>
<td>7/15/15</td>
<td>ND</td>
<td>100</td>
</tr>
<tr>
<td>MW-10</td>
<td>MW-10</td>
<td>7/15/15</td>
<td>38.1</td>
<td>ND</td>
</tr>
<tr>
<td>MW-11</td>
<td>MW-11</td>
<td>7/15/15</td>
<td>5.5</td>
<td>ND</td>
</tr>
<tr>
<td>DW-1</td>
<td>DW-1</td>
<td>7/15/15</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>RW-3</td>
<td>RW-3</td>
<td>7/15/15</td>
<td>5,690</td>
<td>25,600</td>
</tr>
<tr>
<td>RW-4</td>
<td>RW-4</td>
<td>NS</td>
<td>400</td>
<td>700</td>
</tr>
<tr>
<td>2L Standard (ug/l)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GCL (ug/l)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Results are in ug/l
Bold Results indicate exceedence of 2L Standards
Bold and shaded results indicate exceedence of GCL

NS – Not Sampled
ND – Not Detected
## Table 2

Historical Analytical Data  
Southern Wake Hospital  
Fuquay-Varina, Wake County, North Carolina

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>624/625</td>
<td>MW-1</td>
<td>18</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>1</td>
<td>5,000</td>
</tr>
<tr>
<td>Benzene</td>
<td>MW-1</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>600</td>
<td>84,500</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>MW-1</td>
<td>34</td>
<td>5</td>
<td>nd</td>
<td>nd</td>
<td>20</td>
<td>200,000</td>
</tr>
<tr>
<td>MTBE</td>
<td>MW-1</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>600</td>
<td>200,000</td>
</tr>
<tr>
<td>Toluene</td>
<td>MW-1</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>500</td>
<td>85,500</td>
</tr>
<tr>
<td>Xylenes (Total)</td>
<td>MW-1</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>80</td>
<td>2,120</td>
</tr>
<tr>
<td>Acenaphthene</td>
<td>MW-1</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>5</td>
<td>2,000</td>
</tr>
<tr>
<td>Anthracene</td>
<td>MW-1</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>2000</td>
<td>2,000</td>
</tr>
<tr>
<td>Chrysene</td>
<td>MW-1</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>1-Methylnaphthalene</td>
<td>MW-1</td>
<td>1.6</td>
<td>1.6</td>
<td>nd</td>
<td>nd</td>
<td>10</td>
<td>1,000</td>
</tr>
<tr>
<td>2-Methylnaphthalene</td>
<td>MW-1</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>6</td>
<td>6,000</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>MW-1</td>
<td>1.9</td>
<td>1.9</td>
<td>nd</td>
<td>nd</td>
<td>200</td>
<td>410</td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>MW-1</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Total BTEX</td>
<td>MW-1</td>
<td>18</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>MADEP VPH/EPH Method</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C5-C8 Aliphatics</td>
<td>MW-1</td>
<td>nd</td>
<td>na</td>
<td>nd</td>
<td>nd</td>
<td>400</td>
<td>NRS</td>
</tr>
<tr>
<td>C9-C18 Aliphatics</td>
<td>MW-1</td>
<td>nd</td>
<td>na</td>
<td>nd</td>
<td>nd</td>
<td>700</td>
<td>NRS</td>
</tr>
<tr>
<td>C19-C36 Aliphatics</td>
<td>MW-1</td>
<td>nd</td>
<td>na</td>
<td>nd</td>
<td>nd</td>
<td>10,000</td>
<td>NRS</td>
</tr>
<tr>
<td>C9-C22 Aromatics</td>
<td>MW-1</td>
<td>nd</td>
<td>na</td>
<td>nd</td>
<td>nd</td>
<td>200</td>
<td>NRS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>624/625</td>
<td>MW-2</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>1</td>
<td>5,000</td>
</tr>
<tr>
<td>Benzene</td>
<td>MW-2</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>600</td>
<td>84,500</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>MW-2</td>
<td>2</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>20</td>
<td>200,000</td>
</tr>
<tr>
<td>MTBE</td>
<td>MW-2</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>600</td>
<td>200,000</td>
</tr>
<tr>
<td>Toluene</td>
<td>MW-2</td>
<td>4</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>500</td>
<td>85,500</td>
</tr>
<tr>
<td>Xylenes (Total)</td>
<td>MW-2</td>
<td>16</td>
<td>8</td>
<td>nd</td>
<td>ns</td>
<td>80</td>
<td>2,120</td>
</tr>
<tr>
<td>Acenaphthene</td>
<td>MW-2</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>2000</td>
<td>2,000</td>
</tr>
<tr>
<td>Anthracene</td>
<td>MW-2</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Chrysene</td>
<td>MW-2</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>1</td>
<td>1,000</td>
</tr>
<tr>
<td>1-Methylnaphthalene</td>
<td>MW-2</td>
<td>2.7</td>
<td>2.8</td>
<td>nd</td>
<td>ns</td>
<td>10</td>
<td>12,500</td>
</tr>
<tr>
<td>2-Methylnaphthalene</td>
<td>MW-2</td>
<td>1.6</td>
<td>1.8</td>
<td>nd</td>
<td>ns</td>
<td>6</td>
<td>6,000</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>MW-2</td>
<td>1.5</td>
<td>1.5</td>
<td>nd</td>
<td>ns</td>
<td>200</td>
<td>410</td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>MW-2</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Total BTEX</td>
<td>MW-2</td>
<td>22</td>
<td>8</td>
<td>nd</td>
<td>ns</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>MADEP VPH/EPH Method</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C5-C8 Aliphatics</td>
<td>MW-2</td>
<td>nd</td>
<td>na</td>
<td>nd</td>
<td>ns</td>
<td>400</td>
<td>NRS</td>
</tr>
<tr>
<td>C9-C18 Aliphatics</td>
<td>MW-2</td>
<td>55</td>
<td>na</td>
<td>nd</td>
<td>ns</td>
<td>700</td>
<td>NRS</td>
</tr>
<tr>
<td>C19-C36 Aliphatics</td>
<td>MW-2</td>
<td>nd</td>
<td>na</td>
<td>nd</td>
<td>ns</td>
<td>10,000</td>
<td>NRS</td>
</tr>
<tr>
<td>C9-C22 Aromatics</td>
<td>MW-2</td>
<td>nd</td>
<td>na</td>
<td>nd</td>
<td>ns</td>
<td>200</td>
<td>NRS</td>
</tr>
</tbody>
</table>

Note: Results are in ug/l  
nd = not detected  
ns = not sampled  
GCL = Groundwater Cleanup Level  
Bold values indicate exceedence of 2L Standards.  
Shaded values indicate exceedence of GCL.
### Table 2
#### Historical Analytical Data
Southern Wake Hospital
Fuquay-Varina, Wake County, North Carolina

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>624/625</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzene</td>
<td>MW-3</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>1</td>
<td>5,000</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>MW-3</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>600</td>
<td>84,500</td>
</tr>
<tr>
<td>MTBE</td>
<td>MW-3</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>20</td>
<td>200,000</td>
</tr>
<tr>
<td>Toluene</td>
<td>MW-3</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>600</td>
<td>260,000</td>
</tr>
<tr>
<td>Xylenes (Total)</td>
<td>MW-3</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>580</td>
<td>85,500</td>
</tr>
<tr>
<td>Acenaphthene</td>
<td>MW-3</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>50</td>
<td>2,120</td>
</tr>
<tr>
<td>Anthracene</td>
<td>MW-3</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Chrysene</td>
<td>MW-3</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-Methylnaphthalene</td>
<td>MW-3</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>1</td>
<td>1,000</td>
</tr>
<tr>
<td>2-Methylnaphthalene</td>
<td>MW-3</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>30</td>
<td>12,500</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>MW-3</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>6</td>
<td>6,000</td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>MW-3</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>200</td>
<td>410</td>
</tr>
<tr>
<td>Total BTEX</td>
<td>MW-3</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MADEP VPH/EPH Method**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C5-C8 Aliphatics</td>
<td>MW-3</td>
<td>nd</td>
<td>na</td>
<td>ns</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C9-C18 Aliphatics</td>
<td>MW-3</td>
<td>na</td>
<td>na</td>
<td>ns</td>
<td>ns</td>
<td>400</td>
<td>NRS</td>
</tr>
<tr>
<td>C19-C36 Aliphatics</td>
<td>MW-3</td>
<td>na</td>
<td>na</td>
<td>ns</td>
<td>ns</td>
<td>200</td>
<td>NRS</td>
</tr>
<tr>
<td>C37-C77 Aromatics</td>
<td>MW-3</td>
<td>na</td>
<td>na</td>
<td>ns</td>
<td>ns</td>
<td>200</td>
<td>NRS</td>
</tr>
</tbody>
</table>

results are in ug/l
nd = not detected
na = not sampled
ns = not analyzed

bold values indicate exceedance of 2L Standards
bold and shaded values indicate exceedance of GCL
## Table 2
Historical Analytical Data
Southern Wake Hospital
Fuquay-Varina, Wake County, North Carolina

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>624/625</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzene</td>
<td>MW-5</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>1</td>
<td>5,000</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>MW-5</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>600</td>
<td>84,500</td>
</tr>
<tr>
<td>MTBE</td>
<td>MW-5</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>20</td>
<td>200,000</td>
</tr>
<tr>
<td>Toluene</td>
<td>MW-5</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>600</td>
<td>260,000</td>
</tr>
<tr>
<td>Xylenes (Total)</td>
<td>MW-5</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>500</td>
<td>85,500</td>
</tr>
<tr>
<td>Acenapthene</td>
<td>MW-5</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>80</td>
<td>2,120</td>
</tr>
<tr>
<td>Anthracene</td>
<td>MW-5</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Chrysene</td>
<td>MW-5</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-Methylnaphthalene</td>
<td>MW-5</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>1</td>
<td>1,000</td>
</tr>
<tr>
<td>2-Methylnaphthalene</td>
<td>MW-5</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>30</td>
<td>12,500</td>
</tr>
<tr>
<td>Napthalene</td>
<td>MW-5</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>6</td>
<td>6,000</td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>MW-5</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>200</td>
<td>410</td>
</tr>
<tr>
<td>Total BTEX</td>
<td>MW-5</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>MADEP VPH/EPH Method</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C5-C8 Aliphatics</td>
<td>MW-5</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>400</td>
<td>NRS</td>
</tr>
<tr>
<td>C9-C18 Aliphatics</td>
<td>MW-5</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>700</td>
<td>NRS</td>
</tr>
<tr>
<td>C19-C36 Aliphatics</td>
<td>MW-5</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>10,000</td>
<td>NRS</td>
</tr>
<tr>
<td>C9-C22 Aromatics</td>
<td>MW-5</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>200</td>
<td>NRS</td>
</tr>
<tr>
<td>624/625</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzene</td>
<td>MW-6</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>1</td>
<td>5,000</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>MW-6</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>600</td>
<td>84,500</td>
</tr>
<tr>
<td>MTBE</td>
<td>MW-6</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>20</td>
<td>200,000</td>
</tr>
<tr>
<td>Toluene</td>
<td>MW-6</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>600</td>
<td>260,000</td>
</tr>
<tr>
<td>Xylenes (Total)</td>
<td>MW-6</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>500</td>
<td>85,500</td>
</tr>
<tr>
<td>Acenapthene</td>
<td>MW-6</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>80</td>
<td>2,120</td>
</tr>
<tr>
<td>Anthracene</td>
<td>MW-6</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Chrysene</td>
<td>MW-6</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-Methylnaphthalene</td>
<td>MW-6</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>1</td>
<td>1,000</td>
</tr>
<tr>
<td>2-Methylnaphthalene</td>
<td>MW-6</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>30</td>
<td>12,500</td>
</tr>
<tr>
<td>Napthalene</td>
<td>MW-6</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>6</td>
<td>6,000</td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>MW-6</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>200</td>
<td>410</td>
</tr>
<tr>
<td>Total BTEX</td>
<td>MW-6</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>MADEP VPH/EPH Method</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C5-C8 Aliphatics</td>
<td>MW-6</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>400</td>
<td>NRS</td>
</tr>
<tr>
<td>C9-C18 Aliphatics</td>
<td>MW-6</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>700</td>
<td>NRS</td>
</tr>
<tr>
<td>C19-C36 Aliphatics</td>
<td>MW-6</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>10,000</td>
<td>NRS</td>
</tr>
<tr>
<td>C9-C22 Aromatics</td>
<td>MW-6</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>200</td>
<td>NRS</td>
</tr>
</tbody>
</table>

**Notes:**
- nd=not detected, ns=not sampled, na=not analyzed
- Bold values indicate exceedence of 2L Standards
- Bold and shaded values indicate exceedence of GCL
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>MW-7</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>1</td>
<td>5,000</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>MW-7</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>600</td>
<td>84,500</td>
</tr>
<tr>
<td>MTBE</td>
<td>MW-7</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>20</td>
<td>200,000</td>
</tr>
<tr>
<td>Toluene</td>
<td>MW-7</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>600</td>
<td>260,000</td>
</tr>
<tr>
<td>Xylenes (Total)</td>
<td>MW-7</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>500</td>
<td>85,500</td>
</tr>
<tr>
<td>Acenapthene</td>
<td>MW-7</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>80</td>
<td>2,120</td>
</tr>
<tr>
<td>Anthracene</td>
<td>MW-7</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Chrysene</td>
<td>MW-7</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-Methylnaphthalene</td>
<td>MW-7</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>1</td>
<td>1,000</td>
</tr>
<tr>
<td>2-Methylnaphthalene</td>
<td>MW-7</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>30</td>
<td>12,500</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>MW-7</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>6</td>
<td>6,000</td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>MW-7</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>200</td>
<td>410</td>
</tr>
<tr>
<td>Total BTEx</td>
<td>MW-7</td>
<td>nd</td>
<td>nd</td>
<td>ns</td>
<td>ns</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

MADEP VPH/EHP Method

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>MW-8</td>
<td>7.6</td>
<td>17</td>
<td>44</td>
<td>1.5</td>
<td>1</td>
<td>5,000</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>MW-8</td>
<td>nd</td>
<td>nd</td>
<td>2.4</td>
<td>nd</td>
<td>600</td>
<td>84,500</td>
</tr>
<tr>
<td>MTBE</td>
<td>MW-8</td>
<td>nd</td>
<td>nd</td>
<td>2.4</td>
<td>nd</td>
<td>20</td>
<td>200,000</td>
</tr>
<tr>
<td>Toluene</td>
<td>MW-8</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>600</td>
<td>260,000</td>
</tr>
<tr>
<td>Xylenes (Total)</td>
<td>MW-8</td>
<td>nd</td>
<td>nd</td>
<td>1.4</td>
<td>nd</td>
<td>500</td>
<td>85,500</td>
</tr>
<tr>
<td>Acenapthene</td>
<td>MW-8</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>80</td>
<td>2,120</td>
</tr>
<tr>
<td>Anthracene</td>
<td>MW-8</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Chrysene</td>
<td>MW-8</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-Methylnaphthalene</td>
<td>MW-8</td>
<td>nd</td>
<td>nd</td>
<td>1.3</td>
<td>nd</td>
<td>1</td>
<td>1,000</td>
</tr>
<tr>
<td>2-Methylnaphthalene</td>
<td>MW-8</td>
<td>nd</td>
<td>nd</td>
<td>1.2</td>
<td>nd</td>
<td>30</td>
<td>12,500</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>MW-8</td>
<td>1.4</td>
<td>1.7</td>
<td>2.8</td>
<td>nd</td>
<td>6</td>
<td>6,000</td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>MW-8</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>200</td>
<td>410</td>
</tr>
<tr>
<td>Total BTEx</td>
<td>MW-8</td>
<td>7.6</td>
<td>17</td>
<td>45.4</td>
<td>1.5</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

MADEP VPH/EHP Method

- Results are in ug/l
- nd = not detected, ns = not sampled, na = not analyzed
- Bold values indicate exceedance of 2L Standards
- Bold and shaded values indicate exceedance of GCL
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>624/625 Benzene</td>
<td>MW-9</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>1</td>
<td>5,000</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>MW-9</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>600</td>
<td>84,500</td>
</tr>
<tr>
<td>MTBE</td>
<td>MW-9</td>
<td>2.8</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>20</td>
<td>200,000</td>
</tr>
<tr>
<td>Toluene</td>
<td>MW-9</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>600</td>
<td>160,000</td>
</tr>
<tr>
<td>Xylenes (Total)</td>
<td>MW-9</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>500</td>
<td>85,500</td>
</tr>
<tr>
<td>Acenaphthene</td>
<td>MW-9</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>80</td>
<td>2,120</td>
</tr>
<tr>
<td>Anthracone</td>
<td>MW-9</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Chrysene</td>
<td>MW-9</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-Methylnaphthalene</td>
<td>MW-9</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>1</td>
<td>1,000</td>
</tr>
<tr>
<td>2-Methylnaphthalene</td>
<td>MW-9</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>50</td>
<td>12,500</td>
</tr>
<tr>
<td>Napthalene</td>
<td>MW-9</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>6</td>
<td>6,000</td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>MW-9</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>200</td>
<td>410</td>
</tr>
<tr>
<td>Total BTEX</td>
<td>MW-9</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MADEP VPH/EPH Method</td>
<td></td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C5-C8 Aliphatics</td>
<td>MW-9</td>
<td>nd</td>
<td>na</td>
<td>nd</td>
<td>nd</td>
<td>400</td>
<td>NRS</td>
</tr>
<tr>
<td>C9-C18 Aliphatics</td>
<td>MW-9</td>
<td>nd</td>
<td>na</td>
<td>nd</td>
<td>nd</td>
<td>700</td>
<td>NRS</td>
</tr>
<tr>
<td>C19-C36 Aliphatics</td>
<td>MW-9</td>
<td>nd</td>
<td>na</td>
<td>nd</td>
<td>nd</td>
<td>10,000</td>
<td>NRS</td>
</tr>
<tr>
<td>C9-C22 Aromatics</td>
<td>MW-9</td>
<td>nd</td>
<td>na</td>
<td>nd</td>
<td>nd</td>
<td>200</td>
<td>NRS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>624/625 Benzene</td>
<td>MW-10</td>
<td>140</td>
<td>28</td>
<td>100</td>
<td>11.0</td>
<td>1</td>
<td>5,000</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>MW-10</td>
<td>3.4</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>600</td>
<td>84,500</td>
</tr>
<tr>
<td>MTBE</td>
<td>MW-10</td>
<td>40</td>
<td>6.8</td>
<td>14</td>
<td>1.5</td>
<td>20</td>
<td>200,000</td>
</tr>
<tr>
<td>Toluene</td>
<td>MW-10</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>600</td>
<td>160,000</td>
</tr>
<tr>
<td>Xylenes (Total)</td>
<td>MW-10</td>
<td>27</td>
<td>3.5</td>
<td>7.2</td>
<td>nd</td>
<td>500</td>
<td>85,500</td>
</tr>
<tr>
<td>Acenaphthene</td>
<td>MW-10</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>80</td>
<td>2,120</td>
</tr>
<tr>
<td>Anthracone</td>
<td>MW-10</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Chrysene</td>
<td>MW-10</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-Methylnaphthalene</td>
<td>MW-10</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>1</td>
<td>1,000</td>
</tr>
<tr>
<td>2-Methylnaphthalene</td>
<td>MW-10</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>50</td>
<td>12,500</td>
</tr>
<tr>
<td>Napthalene</td>
<td>MW-10</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>6</td>
<td>6,000</td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>MW-10</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>200</td>
<td>410</td>
</tr>
<tr>
<td>Total BTEX</td>
<td>MW-10</td>
<td>170.4</td>
<td>31.5</td>
<td>107.2</td>
<td>11.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MADEP VPH/EPH Method</td>
<td></td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C5-C8 Aliphatics</td>
<td>MW-10</td>
<td>190</td>
<td>na</td>
<td>46</td>
<td>38.1</td>
<td>400</td>
<td>NRS</td>
</tr>
<tr>
<td>C9-C18 Aliphatics</td>
<td>MW-10</td>
<td>71</td>
<td>na</td>
<td>nd</td>
<td>8.1</td>
<td>700</td>
<td>NRS</td>
</tr>
<tr>
<td>C19-C36 Aliphatics</td>
<td>MW-10</td>
<td>nd</td>
<td>na</td>
<td>nd</td>
<td>nd</td>
<td>10,000</td>
<td>NRS</td>
</tr>
<tr>
<td>C9-C22 Aromatics</td>
<td>MW-10</td>
<td>67</td>
<td>na</td>
<td>nd</td>
<td>nd</td>
<td>200</td>
<td>NRS</td>
</tr>
</tbody>
</table>

*nd=not detected, na=not sampled, na=not analyzed
Bold values indicate exceedence of 2L Standards
Bold and shaded values indicate exceedence of GCL
<table>
<thead>
<tr>
<th>Analyte</th>
<th>Well #</th>
<th>3/2/12/001</th>
<th>3/2/12/002</th>
<th>12/12/003</th>
<th>12/12/004</th>
<th>GC1</th>
<th>GC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>624625</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>Benzene</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>MTBE</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>Toluene</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>Xylenes (Total)</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>Anthracene</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>Chrysene</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>1-Methylanthracene</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>2-Methylanthracene</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>Total BTEX</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>MADEP VPH/EP Method</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>CS-C8 Aliphatics</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>CS-C9-C18 Aliphatics</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>C9-C22 Aromatics</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>Total BTEX</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>MADEP VPH/EP Method</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>CS-C8 Aliphatics</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>CS-C9-C18 Aliphatics</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
<tr>
<td>C9-C22 Aromatics</td>
<td>MW-11</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
</tr>
</tbody>
</table>

Table 2: Historical Analytical Data
Southern Wake Hospital
Fauquier-Virginia, Wake County, North Carolina
7/15/2015

*ND* indicates not detected, *NRA* indicates not reported, *R* indicates results are in ng/L.
Table 3
Groundwater Elevation Measurements (ft)
7/18/2008 and 07/15/15 Guaging Events
Southern Wake Hospital
400 Ransom Street
Fuquay-Varina, NC

<table>
<thead>
<tr>
<th>WELL ID</th>
<th>TOC Elevation</th>
<th>Depth to Water</th>
<th>GW Elevation</th>
<th>Depth to Product</th>
<th>Product Thickness</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW-1</td>
<td>96.7</td>
<td>11.9</td>
<td>82.76</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>7/15/2015</td>
</tr>
<tr>
<td>MW-2</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
</tr>
<tr>
<td>MW-3</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
</tr>
<tr>
<td>MW-4</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
</tr>
<tr>
<td>MW-5</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
</tr>
<tr>
<td>MW-6</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
</tr>
<tr>
<td>MW-7</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Destroyed</td>
</tr>
<tr>
<td>MW-8</td>
<td>98.26</td>
<td>13.62</td>
<td>84.89</td>
<td>NA</td>
<td>0</td>
<td>7/15/2015</td>
</tr>
<tr>
<td>MW-9</td>
<td>94.9</td>
<td>12.25</td>
<td>81.76</td>
<td>NA</td>
<td>0</td>
<td>7/15/2015</td>
</tr>
<tr>
<td>MW-10</td>
<td>95.67</td>
<td>13.33</td>
<td>84.09</td>
<td>NA</td>
<td>0</td>
<td>7/15/2015</td>
</tr>
<tr>
<td>MW-11</td>
<td>94.3</td>
<td>7.93</td>
<td>80.8</td>
<td>NA</td>
<td>0</td>
<td>7/15/2015</td>
</tr>
<tr>
<td>DW-1</td>
<td>94.85</td>
<td>12.33</td>
<td>Destroyed</td>
<td>Destroyed</td>
<td>Sheen</td>
<td>7/15/2015</td>
</tr>
<tr>
<td>RW-1</td>
<td>Destroyed</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>0</td>
<td>7/15/2015</td>
</tr>
<tr>
<td>RW-1A</td>
<td>-</td>
<td>-</td>
<td>NA</td>
<td>9.8</td>
<td>0.02</td>
<td>7/15/2015</td>
</tr>
<tr>
<td>RW-1B</td>
<td>-</td>
<td>-</td>
<td>NA</td>
<td>9.8</td>
<td>0</td>
<td>7/15/2015</td>
</tr>
<tr>
<td>RW-2</td>
<td>-</td>
<td>-</td>
<td>9.8</td>
<td>NA</td>
<td>0</td>
<td>7/15/2015</td>
</tr>
<tr>
<td>RW-3</td>
<td>-</td>
<td>-</td>
<td>9.8</td>
<td>NA</td>
<td>Sheen</td>
<td>7/15/2015</td>
</tr>
<tr>
<td>RW-4</td>
<td>-</td>
<td>-</td>
<td>10.48</td>
<td>NA</td>
<td>6.8</td>
<td>12/3/2015</td>
</tr>
<tr>
<td>MW-4A</td>
<td>-</td>
<td>-</td>
<td>6.8</td>
<td>NA</td>
<td>0.03</td>
<td>12/3/2015</td>
</tr>
<tr>
<td>MW-4B</td>
<td>-</td>
<td>-</td>
<td>6.8</td>
<td>NA</td>
<td>Sheen</td>
<td>12/3/2015</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WELL ID</th>
<th>TOC Elevation</th>
<th>Depth to Water</th>
<th>GW Elevation</th>
<th>Depth to Product</th>
<th>Product Thickness</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW-1</td>
<td>96.7</td>
<td>13.94</td>
<td>82.76</td>
<td>-</td>
<td>-</td>
<td>7/18/2008</td>
</tr>
<tr>
<td>MW-2</td>
<td>94.53</td>
<td>11.72</td>
<td>83.21</td>
<td>-</td>
<td>-</td>
<td>7/18/2008</td>
</tr>
<tr>
<td>MW-3</td>
<td>94.78</td>
<td>10.87</td>
<td>84.07</td>
<td>0.04</td>
<td>-</td>
<td>7/18/2008</td>
</tr>
<tr>
<td>MW-4</td>
<td>94.91</td>
<td>10.87</td>
<td>84.07</td>
<td>0.04</td>
<td>-</td>
<td>7/18/2008</td>
</tr>
<tr>
<td>MW-5</td>
<td>97.25</td>
<td>10.87</td>
<td>84.07</td>
<td>0.04</td>
<td>-</td>
<td>7/18/2008</td>
</tr>
<tr>
<td>MW-6</td>
<td>97.25</td>
<td>10.87</td>
<td>84.07</td>
<td>0.04</td>
<td>-</td>
<td>7/18/2008</td>
</tr>
<tr>
<td>MW-7</td>
<td>97.71</td>
<td>10.87</td>
<td>84.07</td>
<td>0.04</td>
<td>-</td>
<td>7/18/2008</td>
</tr>
<tr>
<td>MW-8</td>
<td>98.26</td>
<td>15.78</td>
<td>82.48</td>
<td>-</td>
<td>-</td>
<td>7/18/2008</td>
</tr>
<tr>
<td>MW-9</td>
<td>94.9</td>
<td>13.33</td>
<td>81.57</td>
<td>-</td>
<td>-</td>
<td>7/18/2008</td>
</tr>
<tr>
<td>MW-10</td>
<td>95.67</td>
<td>13.91</td>
<td>81.57</td>
<td>-</td>
<td>-</td>
<td>7/18/2008</td>
</tr>
<tr>
<td>MW-11</td>
<td>94.3</td>
<td>10.21</td>
<td>84.09</td>
<td>-</td>
<td>-</td>
<td>7/18/2008</td>
</tr>
<tr>
<td>DW-1</td>
<td>94.85</td>
<td>14.05</td>
<td>80.8</td>
<td>-</td>
<td>-</td>
<td>7/18/2008</td>
</tr>
<tr>
<td>RW-1</td>
<td>Destroyed</td>
<td>14.66</td>
<td>14.64</td>
<td>0.02</td>
<td>-</td>
<td>7/18/2008</td>
</tr>
<tr>
<td>RW-1A</td>
<td>-</td>
<td>14.66</td>
<td>Dry</td>
<td>-</td>
<td>-</td>
<td>7/18/2008</td>
</tr>
<tr>
<td>RW-1B</td>
<td>-</td>
<td>12.32</td>
<td>Dry</td>
<td>-</td>
<td>-</td>
<td>7/18/2008</td>
</tr>
<tr>
<td>RW-2</td>
<td>-</td>
<td>12.20</td>
<td>12.22</td>
<td>0.1</td>
<td>7/18/2008</td>
<td></td>
</tr>
<tr>
<td>RW-3</td>
<td>-</td>
<td>12.20</td>
<td>12.15</td>
<td>0.05</td>
<td>7/18/2008</td>
<td></td>
</tr>
<tr>
<td>RW-4</td>
<td>-</td>
<td>12.20</td>
<td>-</td>
<td>-</td>
<td>7/18/2008</td>
<td></td>
</tr>
</tbody>
</table>

* Elevations adjusted for free product thickness using the following formula: Top of casing - depth to product - (product thickness x specific gravity of gas (.60)) = Adjusted Water Level Elevation
| Sample ID | Contaminant of Concern | Date Collected m/dd/yy | Sample Depth (ft) | Analytical Method | 8260 | 8260 | 8260 | 8260 | 8260 | 8260 | 8260 | 8260 | 8260 | 8260 |
|-----------|------------------------|------------------------|------------------|------------------|------|------|------|------|------|------|------|------|------|------|------|
| Side-1    |                        | 12/15                  | 6'               |                  | 0.075| 0.019| 0.0058| 0.0051| 0.0031| 0.110| 0.0062| 0.0086| 0.012 | 0.0055| 0.0019| 0.082 | 0.0055|
| Side-2    |                        | 12/15                  | 6'               |                  | ND   | ND   | ND   | ND   | ND   | ND   | ND   | ND   | ND   | ND   | ND   | ND   |

Soil to Groundwater MSCC: 8.5 8.3 0.12 4.9 1.7 0.16 NRS 1.7 4.3 3.3 4.3 24 4.6
Residential MSCC: 782 782 100 1,560 1,560 313 NRS 626 626 626 1,200 14,000 3,129
Industrial/Commercial MSCC: 20440 20440 4,000 40000 40880 8176 NRS 16,350 16,350 16350 32,000 360000 81760

Results are in mg/kg
Bold results indicate exceedence of Soil to Groundwater MSCC
ND – Not Detected   NT – Not Tested
Table 4 (continued)
Summary of Analytical Data – Soil
MADEP Methods VPH/EPH
Southern Wake Hospital
Fuquay-Varina, Wake County, North Carolina

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Date Collected m/dd/yy</th>
<th>Sample Depth (ft)</th>
<th>Fluorene</th>
<th>Phenanthrene</th>
<th>Pyrene</th>
<th>1-Methylbenzene</th>
<th>2-Methylbenzene</th>
<th>Bis (2-ethylhexyl)phthalate</th>
<th>C5-C8 Aliphatics</th>
<th>C9-C18 Aliphatics</th>
<th>C19-C36 Aliphatics</th>
<th>C9-C22 Aromatics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side-1</td>
<td>12/15</td>
<td>6'</td>
<td>0.490</td>
<td>1.30</td>
<td>0.500</td>
<td>1.30</td>
<td>1.70</td>
<td>ND</td>
<td>0.424</td>
<td>3,633.2</td>
<td>710</td>
<td>2,723.7</td>
</tr>
<tr>
<td>Side-2</td>
<td>12/15</td>
<td>6'</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>0.083</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
</tbody>
</table>

Soil to Groundwater MSCC | 47 | 56 | 270 | 0.004 | 3.6 | 6.6 | 68 | 540 | None | 31 |
Residential MSCC | 620 | 469 | 469 | 20 | 63 | 46 | 939 | 1500 | 31,000 | 469 |
Industrial/Commercial MSCC | 16400 | 12264 | 12264 | 100 | 1635 | 410 | 24,258 | 40,000 | 810,000 | 12,264 |

Results are in mg/kg
Bold results indicate exceedance of Soil to Groundwater MSCC
ND = Not Detected  NT = Not Tested
<table>
<thead>
<tr>
<th>Well ID</th>
<th>Date Installed</th>
<th>Well Casing Depth</th>
<th>Screened Interval</th>
<th>Top of Casing Elevation</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW-1</td>
<td>3/9/00</td>
<td>0-5</td>
<td>2-12</td>
<td>96.70</td>
<td>Destroyed</td>
</tr>
<tr>
<td>MW-2</td>
<td>3/9/00</td>
<td>0-2</td>
<td>2-12</td>
<td>94.93</td>
<td>Destroyed</td>
</tr>
<tr>
<td>MW-3</td>
<td>3/9/00</td>
<td>0-2</td>
<td>2-12</td>
<td>94.78</td>
<td>Destroyed</td>
</tr>
<tr>
<td>MW-4</td>
<td>3/9/00</td>
<td>0-3</td>
<td>3-13</td>
<td>94.91</td>
<td>Destroyed</td>
</tr>
<tr>
<td>MW-5</td>
<td>9/1/2000</td>
<td>0-3</td>
<td>3-18</td>
<td>97.25</td>
<td>Destroyed</td>
</tr>
<tr>
<td>MW-6</td>
<td>9/1/2000</td>
<td>0-3</td>
<td>3-18</td>
<td>97.75</td>
<td>Destroyed</td>
</tr>
<tr>
<td>MW-7</td>
<td>9/1/2000</td>
<td>0-3</td>
<td>3-18</td>
<td>97.26</td>
<td>destroyed</td>
</tr>
<tr>
<td>MW-8</td>
<td>9/1/2000</td>
<td>0-3</td>
<td>3-23</td>
<td>94.67</td>
<td>.03 Product</td>
</tr>
<tr>
<td>MW-9</td>
<td>3/19/02</td>
<td>0-5</td>
<td>25</td>
<td>94.90</td>
<td>.05 Product</td>
</tr>
<tr>
<td>MW-10</td>
<td>3/19/02</td>
<td>0-5</td>
<td>25</td>
<td>95.67</td>
<td>Dry .02 Product</td>
</tr>
<tr>
<td>DW-1</td>
<td>10/3/00</td>
<td>0-3</td>
<td>25-30</td>
<td>94.85</td>
<td>.03 Product</td>
</tr>
<tr>
<td>RW-1</td>
<td>3/9/00</td>
<td>0-3</td>
<td>2-12</td>
<td>91.27</td>
<td>Unknown</td>
</tr>
<tr>
<td>RW-1A</td>
<td>8/20/04</td>
<td>0-2</td>
<td>2-12</td>
<td>93.26</td>
<td>Unknown</td>
</tr>
<tr>
<td>RW-2</td>
<td>3/9/00</td>
<td>0-3</td>
<td>3-13</td>
<td>93.26</td>
<td>Unknown</td>
</tr>
<tr>
<td>RW-2A</td>
<td>3/9/00</td>
<td>0-3</td>
<td>3-13</td>
<td>93.26</td>
<td>Unknown</td>
</tr>
<tr>
<td>MW-4A</td>
<td>11/7/15</td>
<td>0-5</td>
<td>5-10</td>
<td>93.26</td>
<td>Unknown</td>
</tr>
<tr>
<td>MW-4B</td>
<td>11/7/15</td>
<td>0-5</td>
<td>5-10</td>
<td>93.26</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supply Well Information</th>
<th>Date Installed</th>
<th>Location</th>
<th>40 feet</th>
<th>285 feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ms Jack Jones</td>
<td>1984</td>
<td>517 Sunset Drive</td>
<td>10 feet</td>
<td>285 feet</td>
</tr>
</tbody>
</table>

This well is for nonpotable use only.
DOCUMENT 003132 - GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

B. A Geotechnical Engineering Report for Project, prepared by S&ME, Inc., dated November 5, 2018, is appended to this Document.

END OF DOCUMENT 003132
This page intentionally left blank.
November 5, 2018

LS3P Associates, Ltd.
434 Fayetteville Street, Suite 1700
Raleigh, North Carolina 27601

Attention: Ms. Eileen McDonough

Reference: **Geotechnical Exploration Report**

**Alliance Health**
Fuquay-Varina, North Carolina
S&ME Project No. 1305-18-107

Dear Ms. McDonough:

This report presents the results of our geotechnical exploration performed for the referenced project. Our services were completed in general accordance with our Proposal No. 13-1800360, dated July 31, 2018. The purpose of our exploration was to explore and evaluate surface and subsurface conditions as they relate to planned improvements and development at the Alliance Behavioral Healthcare center located at 400 West Ransom Street in Fuquay-Varina, North Carolina.

This report describes our understanding of the project, presents the results of our field exploration, and our conclusions and recommendations. A Boring Location Plan, Boring Logs, and laboratory test records are appended.

S&ME appreciates the opportunity to provide our professional engineering services on this project. Should you have any questions concerning this report or if we may be of further assistance, please contact us at your convenience.

Sincerely,

**S&ME, Inc.**

Alyson K. Yetman, P.E.
Project Engineer

J. Adam Browning, P.E.
Senior Engineer
Registration No. 034984
Table of Contents

1.0 Project Information ........................................................................................................... 1
2.0 Field Exploration ................................................................................................................ 1
3.0 Laboratory Testing ............................................................................................................. 1
4.0 Surface Conditions ............................................................................................................ 2
5.0 Subsurface Conditions ...................................................................................................... 2
6.0 Laboratory Test Results .................................................................................................... 3
7.0 Conclusions and Recommendations .................................................................................. 3
  7.1 Pavement Repair Recommendations .............................................................................. 4
  7.2 Vestibule Extension and Security Fence ......................................................................... 5
    7.2.1 Earthwork .................................................................................................................. 5
    7.2.2 Structural Fill ........................................................................................................... 5
    7.2.3 Subgrade Repair and Improvement Methods ........................................................... 5
    7.2.4 Foundation Recommendations .............................................................................. 6
    7.2.5 Floor Slabs ............................................................................................................... 6
8.0 Limitations of Geotechnical Report .................................................................................. 7

Appendices
Appendix I – Figures
Appendix II – Boring Logs
Appendix III – Core Photographs
Appendix IV – Laboratory Test Data
1.0  Project Information

We understand that pavement and building improvements are planned at the existing office development at 400 West Ransom Street in Fuquay-Varina, North Carolina. Existing pavements are showing signs of fatigue including age (block) cracking, raveling, and exposed aggregate. We understand pavement improvements being considered include replacing the existing asphalt surface with 2 inches of S-9.5B asphalt over existing ABC stone.

We also understand an extension of the existing vestibule is planned at the building entrance. We anticipate the vestibule extension will have maximum column and wall loads on the order of 50 kips and 2 kips per foot.

Finally, we understand a security fence is planned at the back of the building. The type and height of the proposed fence was unknown at the time of this report.

2.0  Field Exploration

The subsurface exploration included the performance of six (6) cores and eight (8) soil test borings. Six (6) of the borings (C-1 through C-6) were performed in existing pavement areas and required coring prior to the soil boring, which were performed to a depth of 10 feet below the existing grade. Boring B-1 was performed in the area of the proposed vestibule extension at the entrance of the building. Boring B-2 was performed in the courtyard behind the building for the proposed security fence. The approximate boring locations are shown on the Boring Location Plan (Figure 2) in the Appendix.

The borings were drilled using a CME 75 drill rig mounted on an ATV carrier. The borings were advanced using auger drilling techniques. Standard penetration testing (SPT) and split-spoon soil sampling were performed in general accordance with ASTM D1586-11 at 2½-foot intervals to a depth of 10 feet and then at 5-foot intervals until termination of the boring. Standard penetration testing was conducted with a safety hammer. A bulk sample of auger cuttings was obtained from 1 to 5 feet in boring C-3. The boreholes were backfilled with auger cuttings and borehole closure devices. Where pavement was cored, the borings were patched with asphalt cold patch. The split-spoon and bulk samples were returned to our office for visual classification and laboratory testing.

Generalized Subsurface Conditions profiles (Figure 3) along with individual Boring Logs are included in the Appendix. The ground surface elevations presented on the profile and boring logs were interpolated from Google Earth and should be considered approximate.

3.0  Laboratory Testing

Representative split-spoon and bulk samples were returned to S&ME’s Raleigh laboratory for visual classification in general accordance with the Unified Soil Classification System (USCS) by a geotechnical professional. The soil samples were visually examined to estimate the distribution of grain sizes, plasticity, organic content, moisture condition, color, presence of lenses and seams, and apparent geological origin. Similar soils were grouped into strata on the logs. The strata contact lines represent approximate boundaries between the soil types; the actual transition between the soil types in the field may be gradual in both the horizontal and vertical directions.
In addition to visual classification, select samples were submitted for further laboratory testing. Laboratory testing included natural moisture content, Atterberg limits, standard Proctor, and California Bearing Ratio (CBR) tests. All laboratory testing was performed in general accordance with applicable ASTM standards. Individual laboratory test results are contained in Appendix III.

4.0 Surface Conditions

At the time of our site reconnaissance, existing asphalt pavement was exhibiting signs of moderate to severe distress in the forms of age (block) cracking, raveling, and exposed aggregate. Existing pavement thicknesses are summarized in Table 1 below. Asphalt thicknesses ranged from about 2.25 to 3.25 inches. ABC stone underlying the asphalt ranged in thicknesses from about 0 to 6 inches.

<table>
<thead>
<tr>
<th>Location</th>
<th>Asphalt (in)</th>
<th>Stone (in)</th>
<th>Location</th>
<th>Asphalt (in)</th>
<th>Stone (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-1</td>
<td>3.25</td>
<td>2.75</td>
<td>C-4</td>
<td>2.5</td>
<td>5</td>
</tr>
<tr>
<td>C-2</td>
<td>2.5</td>
<td>N/E*</td>
<td>C-5</td>
<td>2.25</td>
<td>4</td>
</tr>
<tr>
<td>C-3</td>
<td>2.75</td>
<td>4.5</td>
<td>C-6</td>
<td>2.75</td>
<td>6</td>
</tr>
</tbody>
</table>

*N/E – not encountered

The exploration also encountered approximately 5 to 6 inches of topsoil in borings B-1 and B-2. The topsoil depths provided in this report are based on measurements made during drilling and should be considered approximate. We note that the transition from topsoil to underlying natural soils may be gradual.

5.0 Subsurface Conditions

General descriptions of encountered soils are presented below. More detailed information is available on individual boring logs. Please note that changes in soil type in both the horizontal and vertical directions is often gradual.

Fill soils were encountered at each of the locations to approximate depths of 3 feet. Fill material consisted of sand with relatively low amounts of clay (USCS classification SP-SC) and were visually observed to be moist. SPT N-value ranged from 6 to 34 blows per foot (bpf) indicating loose to dense relative density. Moderately to well compacted fill soils typically have an N-value of over 8 bpf; therefore, locations C-2 and C-6 indicate moderately compacted fill beneath the existing surface material.

Coastal Plain (natural) soils were encountered beneath the fill soils to termination depths between 10 and 20 feet. Natural soils consisted of clayey sands (SC) and low and high plasticity clays (CL, CH). Natural soils were visually observed to be relatively dry to moist. SPT N-values in the sands ranged from 6 to 22 bpf indicating loose to medium dense relative densities, and in the clays from 11 to 28 indicating stiff to very stiff consistencies.
Groundwater level measurements were attempted at all locations at completion of drilling. All locations were observed to be dry. Water levels tend to fluctuate with seasonal and climatic variations. Therefore, groundwater or perched water may be encountered during construction at depths not indicated by the borings.

6.0 Laboratory Test Results

Laboratory testing was performed on selected split-spoon and bulk samples. Laboratory testing consisted of natural moisture content, Atterberg limits, standard Proctor, and California Bearing Ratio (CBR) testing.

Laboratory testing indicated natural moistures ranged from 7.9 to 19.6 percent.

Atterberg limits testing revealed liquid limits ranging from 28 to 55 percent, plastic limits ranging from 15 to 22 percent, and plasticity indices ranging from 13 to 34 percent.

Standard Proctor testing was performed on bulk sample obtained from location C-3. Testing revealed a maximum dry density of 124.6 pounds per cubic foot (pcf), with respective optimum moisture content of 9 percent. The natural moisture content of the bulk sample from C-3 was 7.9 percent, indicating the soils to be about 1.1 percent dry of optimum.

California Bearing Ratio (CBR) testing was performed on a recompacted specimen from the C-3 bulk sample. The specimen was recompacted to approximately 98 percent of its standard Proctor maximum dry density near its optimum moisture content. The sample was then soaked for approximately 96 hours with an applied surcharge loading of about 100 pounds per square foot (psf). Testing revealed a corrected CBR value of 45.5 percent. During soaking no swelling was apparent.

7.0 Conclusions and Recommendations

The following sections provide geotechnical engineering recommendations regarding pavement support conditions, pavement thickness design, foundations, and subgrade preparation. The recommendations presented herein are based upon review of our field and laboratory test data, our understanding of the proposed construction, our engineering analyses, and experience with similar projects and subsurface conditions. If conditions different from those indicated herein are discovered during construction or if development plans change, we should be provided the opportunity to review and comment upon the recommendations of this report so that they may be confirmed, extended, or modified as necessary.

When reviewing the following recommendations, please note that the site has been previously developed and fill was encountered within borings. Past experience with previously developed sites indicates that unforeseen conditions often exist. These may include areas of poorly compacted fill, deeper deposits of fill, debris within fill, active and abandoned utilities and others.
7.1 Pavement Repair Recommendations

We understand pavement improvements being considered include replacing the existing asphalt surface with 2 inches of S-9.5B asphalt over the existing ABC stone. Anticipated traffic information was not provided at the time of this report. We have assumed design traffic over a 20-year design life will consist of up to 30,000 18-kip equivalent-single-axle loads (ESALs).

Pavement distresses observed in the existing asphalt included age (block) cracking, raveling, and exposed aggregate. We recommend the existing asphalt pavement be removed due to the signs of fatigue observed. Existing asphalt thicknesses measured at the core locations ranged from 2.25 to 3.25 inches. We do not recommend overlaying the existing asphalt due to the potential for reflective cracking through the new asphalt.

ABC stone ranging in thickness from 0 to 5 inches was encountered in each of the coreholes except C-6 where 6 inches of ABC stone as encountered. Thus, after removal of the asphalt, less than 6 inches of ABC stone is anticipated to be encountered in a majority of the parking lot. Replacing the removed asphalt with a minimum of 2 inches of S-9.5B asphalt will not be sufficient over less than 6 inches of ABC stone. However, the sandy subgrade soils have a relatively high CBR value and are relatively free-draining. Thus, we recommend the removed asphalt be replaced with a full-depth asphalt pavement section consisting of a minimum of 3 inches of S-9.5B (placed in two, 1.5-inch lifts) overtop the exposed ABC stone and/or subgrade soils. Note that removal of a portion of the ABC stone and/or subgrade soils may be required in order to place the 3 inches of new asphalt and match the existing curb elevation.

The exposed ABC stone and/or subgrade soils should be properly prepared prior to new asphalt placement. We recommend that the exposed ABC stone and/or subgrade soils be densified using a 10 to 15-ton vibratory roller. The upper 12 inches of ABC stone or subgrade soil should be compacted to 98 percent of its maximum dry density (standard Proctor for soil and modified Proctor of ABC stone). After compacting, we recommend the final subgrade be proofrolled with a loaded, tandem-axle dump truck. Any areas exhibiting movement should be repaired. Repair measures required will be dependent on conditions observed, but will likely require undercut and replacement with compacted ABC stone, use of a geogrid, or some combination of these.

Three inches of S-9.5B asphalt may be placed and compacted in two, 1.5-inch lifts over the approved subgrade. All materials and construction methods should conform to the 2018 edition of the NCDOT “Standard Specifications for Roads and Structures.” The aggregate base course (ABC) stone should consist of stone meeting the requirements under Section 520. ABC stone should be compacted to at least 100 percent of the maximum dry density as determined by the modified Proctor compaction test, AASHTO T-180 as modified by NCDOT. To confirm that the base course stone has been uniformly compacted, in-place density tests should be performed by a qualified soils technician and the area should be thoroughly proofrolled under his observation.

Asphaltic concrete should conform to Section 610 in the 20182 edition of the NCDOT “Standard Specifications for Roads and Structures.” Sufficient testing and observation should be performed during pavement construction to confirm that the required thickness, density, and quality requirements of the specifications are achieved.

Although our analysis was based on traffic loading for a 20-year design life, our experience indicates that pavement maintenance is necessary due to normal weathering of the asphaltic concrete. Normal weathering (i.e.,
oxidation) causes asphalt to become more brittle resulting in loss of tensional strength. This loss in strength can cause minor cracking which provides access for water infiltration into the stone base and subgrade. As the degree of saturation of the subgrade increases, the strength of the subgrade decreases leading to pavement failure. Routine maintenance in the form of sealing, patching, and maintaining proper drainage is required to increase pavement life. It is not uncommon for overlays to be required after 10 to 12 years.

7.2 Vestibule Extension and Security Fence

7.2.1 Earthwork

Exposed subgrade of areas to receive fill and areas near final grades should be evaluated by the geotechnical engineer or their representative. This evaluation should include proofrolling with a fully loaded tandem-axle dump truck or similar rubber-tired construction equipment. Any areas that deflect excessively and cannot be densified by further rolling should be undercut to suitable soils. Some in-place densification and/or undercutting should be anticipated. Depending on the time of year earthwork is performed, subgrade repair may be required due to the near-surface soils’ potential to soften in wet conditions.

Site grading will be difficult during periods of extended rainfall that generally occur during the winter and early spring months. Near-surface soils are moisture sensitive, and when wet, will soften and tend to rut and pump under rubber-tired traffic and provide poor subgrade support for structures and pavements. To reduce potential earthwork problems, site preparation and grading should be scheduled during the typically drier months of May through November, if possible. If winter or early spring grading is attempted, repair of near-surface soils and possible use of select off-site borrow will be necessary to adequately prepare subgrades for new construction. Heavy rubber-tired construction equipment should not be allowed to operate on exposed subgrades during wet conditions. Even during drier periods of the year, we recommend that exposed subgrades be sloped and sealed at the end of each day to promote runoff and reduce infiltration from rainfall.

7.2.2 Structural Fill

Structural fill should consist of soils having Unified soil classifications of SW, SM, SC, SP, or ABC stone. These materials should have standard Proctor maximum dry unit weights of at least 100 pcf and a maximum plasticity index of 25 percent. Structural fill should be free of trash and debris and contain less than 3 percent organic material.

Structural fill should be compacted to at least 98 percent of the standard Proctor maximum dry density. Structural fill should be compacted within 3 percent of its optimum moisture content.

7.2.3 Subgrade Repair and Improvement Methods

The exposed subgrade of both cut and fill areas can deteriorate and lose support when exposed to construction traffic and adverse weather conditions. Deterioration can occur in the form of rutting, pumping, freezing, or erosion. We recommend that, during construction, exposed subgrade surfaces be sealed at the end of each day or when wet weather is forecast. Water should not be allowed to pond in fill or cut areas. Immediately prior to slab construction, exposed subgrade soils should be evaluated by proofrolling to determine their stability. Soils
which rut, pump, or deflect under proofrolling should be repaired prior to ABC stone placement. Repair measures may include scarifying/drying/recompacting, undercutting, placement of geotextiles, or some combination of these. Actual repair measures will be influenced by project schedule and weather conditions and can only be determined in the field.

7.2.4 Foundation Recommendations

We have assumed maximum column and wall loads for the new vestibule extension at the entrance of the building will be up to 50 kips and 2 kips per linear foot, respectively. We assume the security fence will have maximum wall loads of 2 kips per linear foot or less. Please let us know if assumed structural loads are different than our assumptions.

Foundations can be supported on shallow spread footings designed for an allowable net bearing pressure of 3,000 pounds per square foot (psf). This bearing pressure assumes that footings will bear in compacted structural fill or natural soils, and that the site is prepared as recommended above.

Footings should bear at least 18 inches below exterior grade to avoid frost penetration and develop the design bearing capacity. Continuous wall footings should be at least 18 inches wide, and isolated column footing should be at least 24 inches wide. This recommendation is made to prevent a localized or “punching” shear failure condition which can occur with very narrow footings.

Based on encountered subsurface conditions and assumed structural loads, we estimate that total settlement of building foundations will be 1 inch or less. A detailed foundation layout with structural loads is required to estimate differential settlement; however, based on the maximum column load and subsurface conditions encountered, we would estimate differential settlements of one half of the total settlement between adjacent columns.

The bottom of all footing excavations for the structures should be evaluated by the project geotechnical engineer or a soils technician working under the direction of the geotechnical engineer using a hand auger and dynamic cone penetrometer (DCP) to gauge the consistency of subgrade soils. Footing subgrades that are unstable should be overexcavated and replaced with compacted NCDOT #57 stone or lean concrete. Due to the inconsistency of the existing fill materials, some undercut and replacement of foundation subgrades is anticipated.

7.2.5 Floor Slabs

A slab-on-grade floor system can be adequately supported on newly placed and compacted structural fill or approved natural soils, provided the site preparation and fill placement procedures outlined in this report are implemented. A design modulus of subgrade reaction (k) of 150 psi can be used provided the floor slabs are directly supported on a 6-inch thick layer of crushed stone (NCDOT ABC). The crushed stone should be compacted to at least 95 percent of its modified Proctor maximum dry density. This layer of ABC stone will also help to provide a construction working surface.

Immediately prior to constructing the floor slabs, we recommend that the floor slab areas be proofrolled to detect any softened, loosened or disturbed areas that may have been exposed to wet weather or construction traffic. Areas that are found to be disturbed or indicate pumping action during the proofrolling should be undercut and
replaced with adequately compacted structural fill. Proofrolling should be observed by the geotechnical engineer or a senior soil technician working under his/her direction. Proofrolling procedures are outlined in previous sections of this report.

Based on the results of our exploration and the assumed finish floor elevation, the floor slab will not be below the exterior grade and will not be subjected to hydrostatic pressure from groundwater. However, water vapor transmission through the slab is still a design consideration. Evaluating the need for and design of a vapor retarder or vapor barrier for moisture control is outside our scope of services and should be determined by the project architect/structural engineer based on the planned floor coverings and the corresponding design constraints, as outlined in ACI 302.1R-04 Guide for Concrete Floor and Slab Construction. Further, health and environmental considerations with respect to any potentially harmful vapor transmission are also outside of our scope.

8.0 Limitations of Geotechnical Report

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other representation or warranty either express or implied, is made.

We relied on project information given to us to develop our preliminary conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information if necessary.

Our conclusions and recommendations are based on data from a field exploration program. Subsurface conditions can vary widely outside the explored area. Some variations may not become evident until construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants. If there is a concern about these items, other studies should be performed. S&ME can provide a proposal and perform these services if requested.

S&ME should be provided the opportunity to review the final plans and specifications to confirm that our recommendations are properly interpreted and implemented. The recommendations in this report are contingent on S&ME’s review of final plans and specifications followed by observation and monitoring during construction activities.
Appendices
Appendix I – Figures
LEGEND:  ◯ Soil Test Boring Location

NOTE: The aerial photograph from Google Earth was modified by S&ME. Drawing is for general information only and should not be used for the measurement or estimation of quantities or distances.

TEST LOCATION PLAN

ABH CHILD CRISIS CENTER
400 WEST RANSOM
FUQUAY-VARINA, NORTH CAROLINA

SCALE: AS SHOWN
DATE: 10/30/2018
PROJECT NUMBER 1305-18-107

FIGURE NO. 2
N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.
Appendix II – Boring Logs
# BORING LOG B-1

**PROJECT:** ABH Child Crisis Center  
**Fuquay-Varina, North Carolina**  
**S&ME Project No. 1305-18-107**

**DATE DRILLED:** 10/23/18  
**ELEVATION:** 402.0 ft  
**NOTES:** Boring location and elevation are approximate.

**DRILL RIG:** CME 75  
**BORING DEPTH:** 15.0 ft

**DRILLER:** J&L Drilling  
**WATER LEVEL:** Caved dry @ 11.5

**HAMMER TYPE:** Safety  
**LOGGED BY:** A. Yetman

**SAMPLING METHOD:** Split spoon  
**NORTHING:**  
**EASTING:**

**DRILLING METHOD:** 2½” H.S.A.

<table>
<thead>
<tr>
<th>DEPTH (feet)</th>
<th>GRAPHIC LOG</th>
<th>MATERIAL DESCRIPTION</th>
<th>WATER LEVEL</th>
<th>ELEVATION (feet)</th>
<th>Sample No.</th>
<th>BLOW COUNT</th>
<th>CORE DATA</th>
<th>STANDARD PENETRATION TEST DATA (blows/ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topsoil (6 inches)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9</td>
<td>13</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Fill: Sand (SP-SC)</td>
<td></td>
<td>dense, light brown, fine to medium, moist</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coastal Plain: Clayey Sand (SC)</td>
<td></td>
<td>loose, brown, fine to medium, moist</td>
<td>4</td>
<td>6</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sandy Clay (CH)</td>
<td></td>
<td>very stiff, light brown, moist</td>
<td>8</td>
<td>12</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--- Gray red</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sandy Clay (CH)</td>
<td></td>
<td>stiff, gray, moist</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Boring terminated at 15 ft

1. THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.
# BORING LOG  B-2

**PROJECT:** ABH Child Crisis Center  
Fuquay-Varina, North Carolina  
S&ME Project No. 1305-18-107

<table>
<thead>
<tr>
<th>DATE DRILLED:</th>
<th>10/23/18</th>
<th>ELEVATION:</th>
<th>401.0 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRILL RIG:</td>
<td>CME 75</td>
<td>BORING DEPTH:</td>
<td>20.0 ft</td>
</tr>
<tr>
<td>DRILLER:</td>
<td>J&amp;L Drilling</td>
<td>WATER LEVEL:</td>
<td>Caved dry @ 16.5</td>
</tr>
<tr>
<td>HAMMER TYPE:</td>
<td>Safety</td>
<td>LOGGED BY:</td>
<td>A. Yetman</td>
</tr>
<tr>
<td>SAMPLING TYPE:</td>
<td>Split spoon</td>
<td>NORTING:</td>
<td>EASTING:</td>
</tr>
<tr>
<td>DRILLING METHOD:</td>
<td>2&quot; H.S.A.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DEPTH (feet)</th>
<th>GRAPHIC LOG</th>
<th>MATERIAL DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td><strong>TOPSOIL (5 INCHES)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fill: Sand (SP-SC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>medium dense, gray, trace wood pieces, fine to medium, moist</td>
</tr>
<tr>
<td>5-10</td>
<td></td>
<td><strong>COASTAL PLAIN: CLAYFY SAND (SC)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>loose, light brown, fine to medium, moist</td>
</tr>
<tr>
<td>10-15</td>
<td></td>
<td><strong>SANDY CLAY (CL)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>very stiff, light brown red, relatively dry</td>
</tr>
<tr>
<td>15-20</td>
<td></td>
<td><strong>SANDY CLAY (CH)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>very stiff, gray, moist</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>Boring terminated at 20 ft</td>
</tr>
</tbody>
</table>

**NOTES:**

1. THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.
**BOREHOLE LOG C-1**

**ABH Child Crisis Center**  
Fucquay-Varina, North Carolina

**PROJECT:**

**DATE DRILLED:** 10/23/18  
**ELEVATION:** 400.0 ft  
**NOTES:** Boring location and elevation are approximate.

**DRILL RIG:** CME 75  
**BORING DEPTH:** 10.0 ft

**DRILLER:** J&L Drilling  
**WATER LEVEL:** Caved dry @ 7'

**HAMMER TYPE:** Safety  
**LOGGED BY:** A. Yetman

**SAMPLING METHOD:** Split spoon

**NORTHING:**  
**EASTING:**

**DRILLING METHOD:** 2½" H.S.A.

<table>
<thead>
<tr>
<th>DEPTH (feet)</th>
<th>GRAPHIC LOG</th>
<th>MATERIAL DESCRIPTION</th>
<th>WATER LEVEL</th>
<th>ELEVATION (feet)</th>
<th>SAMPLE NO.</th>
<th>BLOW COUNT / CORE DATA</th>
<th>STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS</th>
<th>N VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 10</td>
<td></td>
<td>ASPHALT (3.25 INCHES)</td>
<td></td>
<td></td>
<td>SS-1</td>
<td>7 7 3</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>STONE (2.75 INCHES)</td>
<td></td>
<td></td>
<td></td>
<td>5 6 5</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FILL: SAND (SP SC)</td>
<td></td>
<td></td>
<td>HG</td>
<td>1 5 5</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>COASTAL PLAIN: CLAYEY SAND (SC)</td>
<td></td>
<td></td>
<td></td>
<td>7 10 9</td>
<td></td>
<td>19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CLAYEY SAND (SC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Boring terminated at 10 ft

**NOTES:**

1. THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.
**PROJECT:** ABH Child Crisis Center  
Fuquay-Varina, North Carolina  
S&M Project No. 1305-18-107

**BORING LOG C-2**

**DATE DRILLED:** 10/23/18  
**ELEVATION:** 400.0 ft

**DRILL RIG:** CME 75  
**BORING DEPTH:** 10.0 ft

**DRILLER:** J&L Drilling  
**WATER LEVEL:** Caved dry @ 6.5'

**HAMMER TYPE:** Safety  
**LOGGED BY:** A. Yetman

**SAMPLING METHOD:** Split spoon  
**NORTHING:**  
**EASTING:**

**DRILLING METHOD:** 2½" H.S.A.

<table>
<thead>
<tr>
<th>DEPTH (feet)</th>
<th>GRAPHIC LOG</th>
<th>MATERIAL DESCRIPTION</th>
<th>WATER LEVEL</th>
<th>ELEVATION (feet)</th>
<th>SAMPLE NO.</th>
<th>BLOW COUNT / CORE DATA</th>
<th>STANDARD Penetration TEST DATA (blows/ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>ASPHALT (2.5 INCHES)</td>
<td></td>
<td>395.0</td>
<td>2</td>
<td>2 2 4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>STONE (3 INCHES)</td>
<td></td>
<td>390.0</td>
<td>SS-2</td>
<td>5 11 17</td>
<td>6</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>FILL: SAND (SP-SC)</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>10 12</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>COASTAL PLAIN: SANDY CLAY (CL)</td>
<td>HG</td>
<td>6</td>
<td>3</td>
<td>8 12 16</td>
<td>28</td>
</tr>
</tbody>
</table>

**NOTES:**

1. THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.
### Boring Log C-3

**Project:** ABH Child Crisis Center  
**Location:** Fuquay-Varina, North Carolina  
**S&ME Project No.:** 1305-18-107

| Date Drilled: 10/23/18 | Elevation: 401.0 ft | Notes: Boring location and elevation are approximate.  
**Drill Rig:** CME 75  
**Driller:** J&L Drilling  
**Hammer Type:** Safety  
**Logging By:** A. Yetman  
**Sampling Method:** Split spoon  
**Drilling Method:** 2½" H.S.A.

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Material Description</th>
<th>Water Level</th>
<th>Elevation (feet)</th>
<th>Sample No.</th>
<th>Blown Count / Core Data</th>
<th>Standard Penetration Test Data (blows/ft) / Remarks</th>
<th>N Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Asphalt (2.75 inches)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stone (4.5 inches)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fill: Sand (SP SC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medium dense, gray, fine to medium, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Coastal Plain: Sandy Clay (CL)</td>
<td></td>
<td>396.0</td>
<td>4</td>
<td>4 6 7</td>
<td>[Graph]</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Very stiff, light brown, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Sandy Clay (CL)</td>
<td></td>
<td>391.0</td>
<td>6</td>
<td>6 10 15</td>
<td>[Graph]</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Stiff, gray red, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sandy Clay (CL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Very stiff, gray, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Boring Terminated at 10 ft**

**Notes:**

1. This log is only a portion of a report prepared for the named project and must only be used together with that report.
2. Boring, sampling and penetration test data in general accordance with ASTM D-1586.
3. Stratification and groundwater depths are not exact.
4. Water level is at time of exploration and will vary.
PROJECT: ABH Child Crisis Center  
Fuquay-Varina, North Carolina  
S&M Project No. 1305-18-107

BORING LOG C-4

DATE DRILLED: 10/23/18  
ELEVATION: 401.0 ft  
NOTES: Boring location and elevation are approximate.

DRILL RIG: CME 75  
BORING DEPTH: 10.0 ft  
HAMMER TYPE: Safety

DRILLER: J&L Drilling  
WATER LEVEL: Caved dry @ 6’  
LOGGED BY: A. Yetman

HAMMER TYPE: Safety  
LOGGED BY: A. Yetman

SAMPLING METHOD: Split spoon

NORTHING:  
EASTING:

DRILLING METHOD: 2½” H.S.A.

<table>
<thead>
<tr>
<th>DEPTH (feet)</th>
<th>GRAPHIC LOG</th>
<th>MATERIAL DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>ASPHALT (2.5 INCHES)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>STONE (5 INCHES)</td>
<td></td>
</tr>
</tbody>
</table>
| 5            | FILL: SAND (SP-SC)  
dense, gray, fine to medium, moist |
| 10           | COASTAL PLAIN: SANDY CLAY (CL)  
stiff, light brown, moist |
| 10           | SANDY CLAY (CL)  
very stiff, red gray, moist |
| 10           | --- Gray |
| 10           | Boring terminated at 10 ft |

NOTES:

1. THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.
<table>
<thead>
<tr>
<th>DEPTH (feet)</th>
<th>GRAPHIC LOG</th>
<th>MATERIAL DESCRIPTION</th>
<th>WATER LEVEL (feet)</th>
<th>ELEVATION</th>
<th>SAMPLE NO.</th>
<th>BLOW COUNT / CORE DATA</th>
<th>STANDARD PENETRATION TEST DATA (blows/ft)</th>
<th>N VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>ASPHALT (2.25 INCHES)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>STONE (4 INCHES)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>FILL: SAND (SP-SC)</td>
<td>medium dense, gray, fine to medium, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>COASTAL PLAIN: SANDY CLAY (CL)</td>
<td>stiff, light brown red, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>SANDY CLAY (CL)</td>
<td>very stiff, gray red, moist</td>
<td>HC</td>
<td>390.0</td>
<td>6 9 10</td>
<td>7 11 15</td>
<td>10 20 60 80</td>
</tr>
</tbody>
</table>

Boring terminated at 10 ft

NOTES:
1. THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.
**PROJECT:** ABH Child Crisis Center  
**Location:** Fuquay-Varina, North Carolina  
**S&ME Project No.:** 1305-18-107

**DATE DRILLED:** 10/23/18  
**ELEVATION:** 399.0 ft  
**NOTES:** Boring location and elevation are approximate.

**DRILL RIG:** CME 75  
**BORING DEPTH:** 10.0 ft

**DRILLER:** J&L Drilling  
**WATER LEVEL:** Caved dry 6'

**HAMMER TYPE:** Safety  
**LOGGED BY:** A. Yetman

**SAMPLING METHOD:** Split spoon  
**NORTHING:**  
**EASTING:**

**DRILLING METHOD:** 2" H.S.A.

<table>
<thead>
<tr>
<th>DEPTH (feet)</th>
<th>MATERIAL DESCRIPTION</th>
<th>WATER LEVEL (feet)</th>
<th>ELEVATION</th>
<th>SAMPLE NO.</th>
<th>BLOW COUNT / CORE DATA</th>
<th>STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ASPHALT (2.75 INCHES)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>STONE (6 INCHES)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FILL: CLAYEY SAND (SC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>loose, gray, fine to medium, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>COASTAL PLAIN: CLAYEY SAND (SC)</td>
<td>394.0</td>
<td></td>
<td>SS-1</td>
<td>7 4 3</td>
<td>10 20 30 6080</td>
</tr>
<tr>
<td></td>
<td>medium dense, light brown gray, fine to medium</td>
<td>388.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boring terminated at 10 ft</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**
1. **THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.**
2. **BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.**
3. **STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.**
4. **WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.**
<table>
<thead>
<tr>
<th>MAJOR DIVISIONS</th>
<th>SYMBOLS</th>
<th>TYPICAL DESCRIPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COARSE GRAINED SOILS</strong></td>
<td><strong>GRAVEL AND GRAVELLY SOILS</strong></td>
<td><strong>CLEAN GRAVELS</strong> (LITTLE OR NO FINES)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>GRAVELS WITH FINES</strong> (APPRECIABLE AMOUNT OF FINES)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>SAND AND SANDY SOILS</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>CLEAN SANDS</strong> (LITTLE OR NO FINES)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FINE GRAINED SOILS</strong></td>
<td><strong>SILTS AND CLAYS</strong></td>
<td><strong>LIQUID LIMIT LESS THAN 50</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>LIQUID LIMIT GREATER THAN 50</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HIGHLY ORGANIC SOILS</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FIELD TESTING PROCEDURES

Soil Test Borings

All boring and sampling operations were conducted in accordance with ASTM Designation D-1586. Initially, the borings were advanced by either mechanically augering or wash boring through the soils. Where necessary, a heavy drilling fluid is used below the water table to stabilize the side and bottom of the drill hole. At regular intervals soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-barrel sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140 pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated the “Standard Penetration Resistance.” The penetration resistance, when properly evaluated, is an index to the soil strength.

Soil Classifications

Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply his past experience to current problems. In our exploration, samples obtained during drilling operations are examined and visually classified according to color, texture, and relative density or consistency (based on standard penetration resistance). The consistency and relative density designations are as follows:

<table>
<thead>
<tr>
<th>SANDS</th>
<th>SILTS AND CLAYS</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (SPT)</td>
<td>Consistency</td>
</tr>
<tr>
<td>Relative Density</td>
<td></td>
</tr>
<tr>
<td>0 - 4</td>
<td>Very Soft</td>
</tr>
<tr>
<td>Very Loose</td>
<td>0 - 2</td>
</tr>
<tr>
<td>5 - 10</td>
<td>Soft</td>
</tr>
<tr>
<td>Loose</td>
<td>3 - 4</td>
</tr>
<tr>
<td>11 - 30</td>
<td>Firm</td>
</tr>
<tr>
<td>Medium Dense</td>
<td>5 - 8</td>
</tr>
<tr>
<td>9 - 15</td>
<td>Stiff</td>
</tr>
<tr>
<td>Dense</td>
<td>16 - 30</td>
</tr>
<tr>
<td>31 - 50</td>
<td>Very Stiff</td>
</tr>
<tr>
<td>Very Dense</td>
<td>31 - 50</td>
</tr>
<tr>
<td>50+</td>
<td>Hard</td>
</tr>
<tr>
<td></td>
<td>50+</td>
</tr>
<tr>
<td></td>
<td>Very Hard</td>
</tr>
</tbody>
</table>
Appendix III – Core Photographs
<table>
<thead>
<tr>
<th></th>
<th>Core from Location C-1</th>
<th></th>
<th>Core from Location C-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Core from Location C-3</td>
<td>4</td>
<td>Core from Location C-4</td>
</tr>
</tbody>
</table>

**ABH Child Crisis Center**  
400 West Ransom Street  
Fuquay-Varina, North Carolina

S&ME Project No.: 1305-18-107

Taken by: AKY  
Dates Taken: Oct. 25, 2018
5 Crack in Core C-5
6 Core from Location C-5
7 Core from Location C-6
8

ABH Child Crisis Center
400 West Ransom Street
Fuquay-Varina, North Carolina

S&ME Project No.: 1305-18-107
Taken by: AKY
Dates Taken: Oct. 25, 2018
Appendix IV – Laboratory Test Data
## LABORATORY DETERMINATION OF WATER CONTENT

**ASTM D 2216** □  **AASHTO T 265** □

---

<table>
<thead>
<tr>
<th>Method</th>
<th>A (1%)</th>
<th>B (0.1%)</th>
<th>Balance ID</th>
<th>Oven ID</th>
<th>Calibration Date</th>
<th>Percent Moisture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>20977</td>
<td>1454</td>
<td>4/9/18</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Sample No.</th>
<th>Sample Depth</th>
<th>Tare #</th>
<th>Tare Weight</th>
<th>Tare Wt. + Wet Wt</th>
<th>Tare Wt. + Dry Wt</th>
<th>Water Weight</th>
<th>Percent Moisture</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>SS-5</td>
<td>13.5 - 15</td>
<td></td>
<td>46.69</td>
<td>174.79</td>
<td>153.77</td>
<td>21.02</td>
<td>19.6%</td>
</tr>
<tr>
<td>B-2</td>
<td>SS-6</td>
<td>18.5 - 20</td>
<td></td>
<td>46.34</td>
<td>181.16</td>
<td>160.00</td>
<td>21.16</td>
<td>18.6%</td>
</tr>
<tr>
<td>C-1</td>
<td>SS-1</td>
<td>1 - 2.5</td>
<td></td>
<td>46.25</td>
<td>219.73</td>
<td>202.41</td>
<td>17.32</td>
<td>11.1%</td>
</tr>
<tr>
<td>C-2</td>
<td>SS-2</td>
<td>3.5 - 5</td>
<td></td>
<td>50.63</td>
<td>154.44</td>
<td>138.35</td>
<td>16.09</td>
<td>18.3%</td>
</tr>
<tr>
<td>C-3</td>
<td>Bulk</td>
<td>1 - 5</td>
<td></td>
<td>46.07</td>
<td>261.95</td>
<td>246.06</td>
<td>15.89</td>
<td>7.9%</td>
</tr>
<tr>
<td>C-6</td>
<td>SS-1</td>
<td>1 - 2.5</td>
<td></td>
<td>33.67</td>
<td>208.23</td>
<td>192.58</td>
<td>15.65</td>
<td>9.8%</td>
</tr>
</tbody>
</table>

---

**Notes / Deviations / References**

AASHTO T 265: Laboratory Determination of Moisture Content of Soils

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

---

**Mal Krajan, ET**  
Technical Responsibility  
Signature

**Laboratory Manager**  
Position

**10/26/2018**  
Date

This report shall not be reproduced, except in full, without the written approval of S&ME, Inc.
**LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX**

**ASTM D 4318**

**S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616**

<table>
<thead>
<tr>
<th>Project #:</th>
<th>1305-18-107</th>
<th>Report Date:</th>
<th>10/28/18</th>
</tr>
</thead>
</table>

| Project Name: | ABH Child Crisis Center | Test Date(s): | 10/25 - 10/28/18 |

<table>
<thead>
<tr>
<th>Client Name:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Client Address:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Boring #:</th>
<th>B-1</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Sample #:</th>
<th>SS-5</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Location:</th>
<th>Site-Borehole</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Offset:</th>
<th>N/A</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Depth (ft):</th>
<th>13.5 - 15 ft.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Sample Description:</th>
<th>Gray Sandy CLAY</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Type and Specification</th>
<th>S&amp;ME ID #</th>
<th>Cal Date:</th>
<th>Type and Specification</th>
<th>S&amp;ME ID #</th>
<th>Cal Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balance (0.01 g)</td>
<td>20977</td>
<td>4/9/2018</td>
<td>Grooving tool</td>
<td>S-1</td>
<td>5/18/2018</td>
</tr>
<tr>
<td>LL Apparatus</td>
<td>1803</td>
<td>7/5/2018</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oven</td>
<td>1454</td>
<td>11/21/2017</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pan #</th>
<th>Tare #:</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Tare Weight</td>
<td>13.35</td>
<td>12.39</td>
</tr>
<tr>
<td>B</td>
<td>Wet Soil Weight + A</td>
<td>25.06</td>
<td>23.94</td>
</tr>
<tr>
<td>C</td>
<td>Dry Soil Weight + A</td>
<td>20.98</td>
<td>19.80</td>
</tr>
<tr>
<td>D</td>
<td>Water Weight (B-C)</td>
<td>4.08</td>
<td>4.14</td>
</tr>
<tr>
<td>E</td>
<td>Dry Soil Weight (C-A)</td>
<td>7.63</td>
<td>7.41</td>
</tr>
<tr>
<td>F</td>
<td>% Moisture (D/E)*100</td>
<td>53.5%</td>
<td>55.9%</td>
</tr>
<tr>
<td>N</td>
<td># OF DROPS</td>
<td>32</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>LL = F * FACTOR</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| LL Ave. | Average | 21.3% |

**One Point Liquid Limit**

**Moisture Contents determined by ASTM D 2216**

<table>
<thead>
<tr>
<th>N</th>
<th>Factor</th>
<th>N</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>0.974</td>
<td>26</td>
<td>1.005</td>
</tr>
<tr>
<td>21</td>
<td>0.979</td>
<td>27</td>
<td>1.009</td>
</tr>
<tr>
<td>22</td>
<td>0.985</td>
<td>28</td>
<td>1.014</td>
</tr>
<tr>
<td>23</td>
<td>0.995</td>
<td>29</td>
<td>1.018</td>
</tr>
<tr>
<td>24</td>
<td>0.995</td>
<td>30</td>
<td>1.022</td>
</tr>
<tr>
<td>25</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Wet Preparation**

**Dry Preparation**

**Air Dried**

*Estimate the % Retained on the #40 Sieve:* 41%

---

**ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils**

**Mal Krajan, ET**

Technical Responsibility

**Signature**

Laboratory Manager

**Position**

**10/28/2018**

Date

This report shall not be reproduced, except in full, without the written approval of S&ME, Inc.
# S&ME, INC.

## Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616

### Project #: 1305-18-107

**Report Date:** 10/28/18

**Project Name:** ABH Child Crisis Center

**Client Name:**

**Client Address:**

**Boring #:** B-2

**Sample #:** SS-6

**Sample Date:** 10/23/18

**Location:** Site-Borehole

**Offset:** N/A

**Depth (ft):** 18.5 - 20 ft.

**Sample Description:** Gray Sandy CLAY

### Type and Specification

<table>
<thead>
<tr>
<th>Balance (0.01 g)</th>
<th>S&amp;ME ID #</th>
<th>Cal Date:</th>
<th>Type and Specification</th>
<th>S&amp;ME ID #</th>
<th>Cal Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>20977</td>
<td>4/9/2018</td>
<td>Grooving tool</td>
<td>5-1</td>
<td>5/18/2018</td>
<td></td>
</tr>
</tbody>
</table>

### LL Apparatus

<table>
<thead>
<tr>
<th>S&amp;ME ID #</th>
<th>Cal Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1803</td>
<td>7/5/2018</td>
</tr>
</tbody>
</table>

### Oven

<table>
<thead>
<tr>
<th>S&amp;ME ID #</th>
<th>Cal Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1454</td>
<td>11/21/2017</td>
</tr>
</tbody>
</table>

### Pan #

<table>
<thead>
<tr>
<th>Pan #</th>
<th>Tare #</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Tare Weight</td>
<td>13.23</td>
<td>13.68</td>
</tr>
<tr>
<td>B</td>
<td>Wet Soil Weight + A</td>
<td>25.84</td>
<td>25.02</td>
</tr>
<tr>
<td>C</td>
<td>Dry Soil Weight + A</td>
<td>23.18</td>
<td>22.55</td>
</tr>
<tr>
<td>D</td>
<td>Water Weight (B-C)</td>
<td>2.66</td>
<td>2.47</td>
</tr>
<tr>
<td>E</td>
<td>Dry Soil Weight (C-A)</td>
<td>9.95</td>
<td>8.87</td>
</tr>
<tr>
<td>F</td>
<td>% Moisture (D/E)*100</td>
<td>26.7%</td>
<td>27.8%</td>
</tr>
<tr>
<td>N</td>
<td># OF DROPS</td>
<td>31</td>
<td>22</td>
</tr>
</tbody>
</table>

**LL = F * FACTOR**

**Ave.**

**Average**

**Liquid Limit**

**Plastic Limit**

### One Point Liquid Limit

<table>
<thead>
<tr>
<th>N</th>
<th>Factor</th>
<th>N</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>0.974</td>
<td>26</td>
<td>1.005</td>
</tr>
<tr>
<td>21</td>
<td>0.979</td>
<td>27</td>
<td>1.009</td>
</tr>
<tr>
<td>22</td>
<td>0.985</td>
<td>28</td>
<td>1.014</td>
</tr>
<tr>
<td>23</td>
<td>0.99</td>
<td>29</td>
<td>1.018</td>
</tr>
<tr>
<td>24</td>
<td>0.995</td>
<td>30</td>
<td>1.022</td>
</tr>
<tr>
<td>25</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NP, Non-Plastic**

**Liquid Limit**

**Plastic Limit**

**Plastic Index**

**Group Symbol**

**Multipoint Method**

**One-point Method**

### Notes / Deviations / References:

**ASTM D 4318:** Liquid Limit, Plastic Limit, & Plastic Index of Soils

---

**Mal Krajan, ET**

**Technical Responsibility**

**Signature**

**Laboratory Manager**

**Position**

**Date:** 10/28/2018

---

This report shall not be reproduced, except in full, without the written approval of S&ME, Inc.
### LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX

**ASTM D 4318**  
**AASHTO T 89**  
**AASHTO T 90**

**S&ME, Inc.** Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616

<table>
<thead>
<tr>
<th>Project #</th>
<th>1305-18-107</th>
<th>Report Date</th>
<th>10/28/18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Name</td>
<td>ABH Child Crisis Center</td>
<td>Test Date(s)</td>
<td>10/25 - 10/28/18</td>
</tr>
<tr>
<td>Client Name</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client Address</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boring</td>
<td>C-2</td>
<td>Sample #: SS-2</td>
<td>Sample Date: 10/23/18</td>
</tr>
<tr>
<td>Location</td>
<td>Site-Borehole</td>
<td>Offset: N/A</td>
<td>Depth (ft): 3.5 - 5 ft.</td>
</tr>
<tr>
<td>Sample Description</td>
<td>Red-Gray Sandy CLAY</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Type and Specification

<table>
<thead>
<tr>
<th>Balance (0.01 g)</th>
<th>S&amp;ME ID #</th>
<th>Cal Date:</th>
<th>Type and Specification</th>
<th>S&amp;ME ID #</th>
<th>Cal Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>LL Apparatus</td>
<td>20977</td>
<td>4/9/2018</td>
<td>Grooving tool</td>
<td>5-1</td>
<td>5/18/2018</td>
</tr>
<tr>
<td>Oven</td>
<td>1803</td>
<td>7/5/2018</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1454</td>
<td>11/21/2017</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Pan 

<table>
<thead>
<tr>
<th>Pan</th>
<th>Tare #:</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Tare Weight</td>
<td>13.45</td>
<td>13.60</td>
</tr>
<tr>
<td>B</td>
<td>Wet Soil Weight + A</td>
<td>25.50</td>
<td>25.83</td>
</tr>
<tr>
<td>C</td>
<td>Dry Soil Weight + A</td>
<td>22.09</td>
<td>22.30</td>
</tr>
<tr>
<td>D</td>
<td>Water Weight (B-C)</td>
<td>3.41</td>
<td>3.53</td>
</tr>
<tr>
<td>D</td>
<td>Dry Soil Weight (C-A)</td>
<td>8.64</td>
<td>8.70</td>
</tr>
<tr>
<td>F</td>
<td>% Moisture (D/E)*100</td>
<td>39.5%</td>
<td>40.6%</td>
</tr>
<tr>
<td>N</td>
<td># OF DROPS</td>
<td>33</td>
<td>25</td>
</tr>
</tbody>
</table>

#### LL

<table>
<thead>
<tr>
<th>LL</th>
<th>LL = F * FACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>LL</td>
<td>22.0%</td>
</tr>
</tbody>
</table>

#### One Point Liquid Limit

<table>
<thead>
<tr>
<th>N</th>
<th>Factor</th>
<th>N</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>0.974</td>
<td>26</td>
<td>1.005</td>
</tr>
<tr>
<td>21</td>
<td>0.979</td>
<td>27</td>
<td>1.009</td>
</tr>
<tr>
<td>22</td>
<td>0.985</td>
<td>28</td>
<td>1.014</td>
</tr>
<tr>
<td>23</td>
<td>0.99</td>
<td>29</td>
<td>1.018</td>
</tr>
<tr>
<td>24</td>
<td>0.995</td>
<td>30</td>
<td>1.022</td>
</tr>
<tr>
<td>25</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NP, Non-Plastic  
Liquid Limit: 41  
Plastic Limit: 22  
Plastic Index: 19  
Group Symbol: CL

Wet Preparation:  
Dry Preparation:  
Air Dried:  

**Estimate the % Retained on the #40 Sieve:** 17%

**ASTM D 4318:** Liquid Limit, Plastic Limit, & Plastic Index of Soils

**Mal Krajan, ET**  
Technical Responsibility

**Laboratory Manager**  
Signature  
Position  
Date

This report shall not be reproduced, except in full, without the written approval of S&ME, Inc.

S&ME, INC. - Corporate  
3201 Spring Forest Road  
Raleigh, NC. 27616  
C-2 SS-2 (3.5 - 5 ft) PI.xls  
Page 1 of 1
**MOISTURE - DENSITY REPORT**

**Quality Assurance**

S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616

<table>
<thead>
<tr>
<th>S&amp;ME Project #:</th>
<th>1305-18-107</th>
<th>Report Date:</th>
<th>10/27/18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Name:</td>
<td>ABH Child Crisis Center</td>
<td>Test Date(s):</td>
<td>10/25 - 10/27/18</td>
</tr>
<tr>
<td>Client Name:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client Address:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boring #:</td>
<td>C-3</td>
<td>Sample #:</td>
<td>Bulk</td>
</tr>
<tr>
<td>Location:</td>
<td>Site-Borehole</td>
<td>Offset:</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Depth (ft):</td>
<td>1 - 5 ft.</td>
</tr>
</tbody>
</table>

**Sample Description:** Gray Brown Clayey SAND

<table>
<thead>
<tr>
<th>Maximum Dry Density</th>
<th>124.6 PCF.</th>
<th>Optimum Moisture Content</th>
<th>9.0%</th>
</tr>
</thead>
</table>

**ASTM D 698 - Method A**

**Soil Properties**

<table>
<thead>
<tr>
<th>Natural Moisture Content</th>
<th>Assumed Specific Gravity</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plastic Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.9%</td>
<td>2.650</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
</tbody>
</table>

**% Passing**

- 3/4" 100.0%
- 3/8" 100.0%
- #4 97.1%
- #10 ND
- #40 ND
- #60 ND
- #200 ND

**Oversize Fraction**

- Bulk Gravity
- % Moisture
- % Oversize
- MDD
- Opt. MC

**References / Comments / Deviations:** ND = Not Determined.

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

Mal Krajan, ET

Technical Responsibility

Signature

Laboratory Manager

Date: 10/27/2018

S&ME, Inc. - Corporate

3201 Spring Forest Road

Raleigh, NC 27616

C-3 Bulk (1 - 5 ft) Proctor.xls

Page 1 of 1
# CBR (California Bearing Ratio) of Laboratory Compacted Soil

**ASTM D 1883**

**Project #:** 1305-18-107  
**Report Date:** 11/1/2018

**Project Name:** ABH Child Crisis Center  
**Test Date(s):** 10/26 - 11/1/18

**Client Name:**  
**Location:** Site-Boreholw  
**Sample #:** Bulk  
**Sample Date:** 10/23/18

**Client Address:**  
**Offset:** N/A  
**Depth (ft):** 1 - 5 ft.

**Sample Description:** Gray-Brown Clayey SAND

**ASTM D 698 Method A**  
**Maximum Dry Density:** 124.6 PCF  
**Optimum Moisture Content:** 9.0%

Compaction Test performed on grading complying with CBR spec.  
% Retained on the 3/4" sieve: 0.0%

## Uncorrected CBR Values

<table>
<thead>
<tr>
<th>Stress (PSI)</th>
<th>Strain (inches)</th>
<th>CBR at 0.1 in.</th>
<th>CBR at 0.2 in.</th>
<th>CBR at 0.1 in.</th>
<th>CBR at 0.2 in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0.00</td>
<td>1000.0</td>
<td>1000.0</td>
<td>1000.0</td>
<td>1000.0</td>
</tr>
<tr>
<td>100.0</td>
<td>0.10</td>
<td>900.0</td>
<td>900.0</td>
<td>900.0</td>
<td>900.0</td>
</tr>
<tr>
<td>200.0</td>
<td>0.20</td>
<td>800.0</td>
<td>800.0</td>
<td>800.0</td>
<td>800.0</td>
</tr>
<tr>
<td>300.0</td>
<td>0.30</td>
<td>700.0</td>
<td>700.0</td>
<td>700.0</td>
<td>700.0</td>
</tr>
<tr>
<td>400.0</td>
<td>0.40</td>
<td>600.0</td>
<td>600.0</td>
<td>600.0</td>
<td>600.0</td>
</tr>
<tr>
<td>500.0</td>
<td>0.50</td>
<td>500.0</td>
<td>500.0</td>
<td>500.0</td>
<td>500.0</td>
</tr>
<tr>
<td>600.0</td>
<td>0.60</td>
<td>400.0</td>
<td>400.0</td>
<td>400.0</td>
<td>400.0</td>
</tr>
<tr>
<td>700.0</td>
<td>0.70</td>
<td>300.0</td>
<td>300.0</td>
<td>300.0</td>
<td>300.0</td>
</tr>
<tr>
<td>800.0</td>
<td>0.80</td>
<td>200.0</td>
<td>200.0</td>
<td>200.0</td>
<td>200.0</td>
</tr>
<tr>
<td>900.0</td>
<td>0.90</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>1000.0</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

## Corrected CBR Values

<table>
<thead>
<tr>
<th>Stress (PSI)</th>
<th>Strain (inches)</th>
<th>CBR at 0.1 in.</th>
<th>CBR at 0.2 in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0.00</td>
<td>1000.0</td>
<td>1000.0</td>
</tr>
<tr>
<td>100.0</td>
<td>0.10</td>
<td>900.0</td>
<td>900.0</td>
</tr>
<tr>
<td>200.0</td>
<td>0.20</td>
<td>800.0</td>
<td>800.0</td>
</tr>
<tr>
<td>300.0</td>
<td>0.30</td>
<td>700.0</td>
<td>700.0</td>
</tr>
<tr>
<td>400.0</td>
<td>0.40</td>
<td>600.0</td>
<td>600.0</td>
</tr>
<tr>
<td>500.0</td>
<td>0.50</td>
<td>500.0</td>
<td>500.0</td>
</tr>
<tr>
<td>600.0</td>
<td>0.60</td>
<td>400.0</td>
<td>400.0</td>
</tr>
<tr>
<td>700.0</td>
<td>0.70</td>
<td>300.0</td>
<td>300.0</td>
</tr>
<tr>
<td>800.0</td>
<td>0.80</td>
<td>200.0</td>
<td>200.0</td>
</tr>
<tr>
<td>900.0</td>
<td>0.90</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>1000.0</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

CBR Sample Preparation:

The entire gradation was used and compacted in a 6" CBR mold in accordance with *ASTM D1883, Section 6.1.1*

### Before Soaking

<table>
<thead>
<tr>
<th>Compactive Effort (Blows per Layer)</th>
<th>42</th>
<th>Final Dry Density (PCF)</th>
<th>123.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Dry Density (PCF)</td>
<td>122.7</td>
<td>Average Final Moisture Content</td>
<td>9.9%</td>
</tr>
<tr>
<td>Moisture Content of the Compacted Specimen</td>
<td>8.9%</td>
<td>Moisture Content (top 1&quot; after soaking)</td>
<td>10.1%</td>
</tr>
<tr>
<td>Percent Compaction</td>
<td>98.5%</td>
<td>Percent Swell</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

### After Soaking

| Soak Time: | 96 hrs. | Surcharge Weight | 20.0 | Surcharge Wt. per sq. Ft. | 101.9 |
| Liquid Limit | ND | Plastic Index | ND |

Notes/Deviations/References:

ND = Not Determined.

Test specimen compacted to 98% at optimum moisture.

---

**Mal Krajac, ET**

**Technical Responsibility**

**Laboratory Manager**

**Position**

**Date**

11/1/2018

---

S&amp;ME, Inc. - Corporate

3201 Spring Forest Road

Raleigh, NC. 27616

C-3 Bulk (1 - 5 ft) CBR.xls

Page 1 of 1
SECTION 006000 - PROJECT FORMS

1.1 FORM OF AGREEMENT AND GENERAL CONDITIONS

A. The following form of Owner/Contractor Agreement and form of the General Conditions shall be used for Project: As indicated in the Information for Bidders.

1.2 ADMINISTRATIVE FORMS

A. Administrative Forms: Additional administrative forms are specified in Division 01 General Requirements.

B. Copies of AIA standard forms may be obtained from the American Institute of Architects; www.aiacontractdocsaiacortracts.org; (800) 942-7732.

C. Preconstruction Forms:

1. Form of Performance Bond and Labor and Material Bond: AIA Document A312-2010 "Performance Bond and Payment Bond."

D. Information and Modification Forms:

1. Form for Requests for Information (RFIs): Document 006313 "Request for Information."
2. Form for Substitution Requests: Document 006325 "Document 006325 "Request for Substitution Form."

E. Payment Forms:


END OF SECTION 006000
DOCUMENT 006313 - REQUEST FOR INFORMATION FORM

Project: Alliance Health - Child Crisis Center
Renovation Phase D
Project No.: 8405-177070
RFI No.:_______

To: LS3P ASSOCIATES LTD.
434 Fayetteville Street, Suite 1700
Raleigh, NC 27601

Date: __________________________

Contractor: __________________________

Att: Christy Zeidler

Requested by: __________________________

Phone: 919.829.2799
Fax: 919.829.2730
Email: christyzeidler@ls3p.com

Contractor’s Inquiry: __________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Contractor’s Recommended Solution: _______________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

Related Section and Paragraph No.: _______________________________________
Related Sheet and Detail No.: ____________________________________________

Attachments: _______________________________________________________

Architect’s Response Requested By: ________________________________

Architect’s Response: _____________________________________________
________________________________________________________________
________________________________________________________________

Signed: ___________________________ Date: __________________________

Attachments: _______________________________________________________

Architect’s response will be formally issued by Addendum.

END OF DOCUMENT 006313

REQUEST FOR INFORMATION FORM 006313 - 1
This page intentionally left blank.
DOCUMENT 006325 - REQUEST FOR SUBSTITUTION FORM

Requests for Substitution are accepted from prime Bidders only. Subcontractors and suppliers shall submit requests through a prime Bidder. Bidders are required to submit this completed form with required attachments no later than 10 days prior to opening of Bids. Comply with requirements of the Instructions to Bidders.

Project: Alliance Health - Child Crisis Center
Renovation Phase D

To: LS3P
434 Fayetteville Street, Suite 1700
Raleigh, NC 27601

Attn: Christy Zeidler

Requested by: ____________________________

Spec. Section No.: ____________________________

Project No.: 8405-177070

Contractor: ____________________________

Reason for not providing specified item: ____________________________

Savings to Owner for accepting Substitution: ____________________________

Specified Product/Fabrication Method
(List name/description; model no., manufacturer):

Required Information for Specified Product:
Point by Point Comparative Product Data
Tests
Reports
Fabrication Drawings
Samples (Where Applicable)

Attached: [ ]

Proposed Product/Fabrication Method
(List name/description; model no., manufacturer):

Required Information for Proposed Product:
Point by Point Comparative Product Data
Tests

Attached: [ ] (Required)
Reports
Fabrication Drawings
Samples (Where Applicable)

List of Related Changes/Modifications:

Differences between proposed substitution and specified product:

Do proposed product/fabrication methods affect other parts of the Work?  □ No  □ Yes: Explain ____________________________

Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product as utilized for this project, except as noted herein.
- Qualifications of manufacturer, installer, and other specified parties meet the specified qualifications.
- Same special warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source for replacement parts, as applicable, is available as that specified.
- Proposed substitution does not affect dimensions and functional clearances, except as noted herein.

For the Bidder:

Submitted by: ________________________________
Signed: ________________________________
Firm: ________________________________
Telephone: ______________ Fax: ______________ Email: ______________

For the Contractor:

Submitted by: ________________________________
Signed: ________________________________
Firm: ________________________________
Telephone: ______________ Fax: ______________ Email: ______________

END OF DOCUMENT 006325

REQUEST FOR SUBSTITUTION FORM 006325 - 2
SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under separate contracts.
4. Access to site.
5. Work restrictions.

1.3 PROJECT INFORMATION

A. Project Identification: Alliance Health - Child Crisis Center Renovations – Phase D: Final Renovation.
   1. Project Location: 400 West Ransom Street, Fuquay-Varina, NC 27526.

B. Owner: Alliance Health.
   1. Owner's Representative: Steven Price, 919-753-4183; Email: sprice@alliancehealthplan.org

C. Architect: LS3P ASSOCIATES LTD., 434 Fayetteville Street, Suite 1700, Raleigh, NC 27601.
   1. Architect Contact: Christy Zeidler, christyzeidler@ls3p.com

D. Project Information Management System: A web-based Project Information Management System administered by Architect used for purposes of managing communication, documentation, and submittals through Final Completion.
   1. Refer to Section 013100 – Project Management and Coordination for Project Information Management System requirements.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. Building is a Type I-2 Occupancy. Renovation work includes selective demolition, architectural, mechanical, electrical, plumbing, and fire protection as required to renovate and fit out an existing shell building into a new Facility Based Crisis Center and Health Urgent care for Children and Adolescents.
B. Type of Contract:
   1. Project will be constructed under a single prime contract.

C. The Work shall be conducted in a single phase, with the date of Substantial Completion to be as indicated in the Invitation for Bids.

D. Project meetings and contract administration will begin immediately upon award of contract.

1.5 WORK UNDER SEPARATE CONTRACTS

A. Concurrent Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
   1. Interior Signage.
   2. Telephone and Data Systems.

1.6 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor’s use of Project site is limited only by Owner’s right to perform work or to retain other contractors on portion of Project.

B. Firearms: No firearms, concealed or otherwise, are permitted on site. Post notice at entrance to site.

1.7 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to normal business working hours of 7:00 a.m. to 7:00 p.m., Monday through Friday, except as otherwise indicated.
   1. Weekend Hours: Coordinate weekend work requests with Alliance Health at least 48 hours in advance.
   2. Early Morning Hours: Coordinate early morning work requests with Alliance Health at least 48 hours in advance.
   3. Noise: Comply with Town of Fuquay-Varina requirements for hours of construction operations that may result in excessive noise.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the CSI/CSC’s "MasterFormat 2004" numbering system.
B. The Specifications are directed to the Contractor. Requirements expressed as directions are to be performed by Contractor or by sub-contractors under his direction. Occasionally, for clarity, requirements for Work to be performed by Contractor, indirectly by the Contractor, or by Others will be so stated.

C. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular context. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

D. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

E. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000
This page intentionally left blank.
SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to the Contractor. If necessary, additional requirements will be issued by Change Order. Include defined costs associated with allowances in base bid.

B. Types of allowances include the following:

1. Quantity allowances.

C. Related Sections:

1. Division 01 Section "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

2. Divisions 02 through 49 Sections for items of Work covered by allowances.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.4 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
D. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. Unused Materials:
   1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.7 QUANTITY ALLOWANCES

A. Quantity Allowance: An estimated quantity or extent of a product, assembly, or portion of the Work that cannot be measured prior to construction but is reasonably anticipated.

B. All costs for performing the work described under the quantity allowance are included in the allowance. These costs include materials, delivery, installation, taxes, insurance, equipment rental, and similar costs and Contractor's overhead and profit.

C. When work is performed and actual quantity or extent is measured, the Contract Sum will be adjusted by Change Order based on Unit Cost indicated in the Agreement.

1.8 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

   1. Include installation costs in purchase amount only where indicated as part of the allowance.
   2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
   3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

5. Unused amounts of moneys that define the value of the allowances, included integrally in the work and materials allowances, shall be credited to the Owner by deduct change order prior to approval of Final Application for Payment.

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

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.

2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

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

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Access Doors
   1. Include allowance of 20 additional 2’x 2’ fire rated access doors in addition to those shown on Drawings. Additional access doors shall be located as field-directed by Architect.

B. Allowance No. 2: Additional Slab Infill
   1. Include allowance of additional 15 cubic yards of lightweight, fiber-mesh reinforced concrete to infill existing concrete slab depressions, in addition to the quantity indicated on the drawings. Include clean out and preparation of existing concrete surfaces and finishing of final concrete infill to be smooth and flush with adjacent surfaces.

C. Allowance No. 3: Removal of existing piping
   1. Include allowance to remove 200 linear feet of existing piping in existing crawl space.

D. Allowance No. 4: Removal of existing ductwork
   1. Include allowance to remove 200 linear feet of existing ductwork in existing crawl space.
END OF SECTION 012100
SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

1. Section 012100 "Allowances" for procedures for using unit prices to adjust quantity allowances.
2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

Retain subparagraph below only if unit prices may be employed as a result of special testing and inspecting procedures required by local codes and specified in Division 01.

3. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

1.3 DEFINITIONS

Retain terms below that remain after this Section has been edited for a project.

Definition in this article expands that contained in AIA Document A701 and revises the definition for the Contract.

A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.
1.4 PROCEDURES

Retain first paragraph below unless the Supplementary Conditions include similar requirements. EJCDC Document C-700 stipulates that unit prices include overhead and profit; AIA Document A201 does not.

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

Usually retain "Measurement and Payment" Paragraph below. It will suffice for all but the most complex projects. Revise below if many unit prices are anticipated and if methods for measuring work-in-place are complex. A special article or additional paragraphs outlining procedures for measurement and payment might be needed to define responsibilities for complex situations.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

Usually first retain paragraph below with AIA Document A201. It protects Owner in case of dispute. Revise below if using EJCDC Document C-700. EJCDC Document C-700 gives engineer authority to determine actual quantity of work. Revise to suit Owner's requirements.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

Retain "List of Unit Prices" Paragraph below and revise to suit Project.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the Part 3 "Schedule of Unit Prices" Article contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

The sample schedule of unit prices in this article illustrates several types of common occurrences where unit prices allow indeterminate work elements to be bid under lump-sum contracts. See the Evaluations for additional examples and discussion of application of unit prices. Revise paragraphs below to suit Project.

Sample unit prices in "Unit Price 1," "Unit Price No. 2," and "Unit Price No. 3" paragraphs below illustrate three of the many approaches to applying unit prices to work that cannot be measured before bidding, but can be reasonably anticipated.
A. Unit Price No. 1: Additional Access Doors.
   1. Description: 20 additional 2’x 2’ fire rated access doors in addition to those shown on Drawings. Additional access doors shall be located as field-directed by Architect.
   2. Unit of Measurement: Each door.
   3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

B. Unit Price No. 2: Additional Slab Infill.
   1. Description: 15 cubic yards of lightweight, fiber-mesh reinforced concrete to infill existing concrete slab depressions, in addition to the quantity indicated on the drawings. Include clean out and preparation of existing concrete surfaces and finishing of final concrete infill to be smooth and flush with adjacent surfaces.
   2. Unit of Measurement: Cubic yard.
   3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

C. Unit Price No. 3: Removal of Existing Pipe.
   1. Description: Remove 200 linear feet of existing piping in existing crawl space.
   2. Unit of Measurement: Linear feet.
   3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

D. Unit Price No. 4: Removal of Existing Ductwork.
   1. Description: Remove 200 linear feet of existing ductwork in existing crawl space.
   2. Unit of Measurement: Linear feet.
   3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

END OF SECTION 012200
This page intentionally left blank.
SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1.  Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2.  The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1.  Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Fire-Rated Plywood
   1. Base Bid: Provide all 5/8" fire-rated plywood as specified and as shown on Drawings.
   2. Alternate (Deduct): Delete all 5/8" fire-rated plywood where indicated in all partition types on Sheet A-002 Partition Types and Sheet A-003 Partition Types.

B. Alternate No. 2: Very High Impact Gypsum Wallboard
   1. Base Bid: Provide very high impact gypsum wallboard at all partitions where Very High Impact Gypsum Wallboard is indicated on Sheet A-002 Partition Types and Sheet A-003 Partition Types.
   2. Alternate: In lieu of very high impact gypsum wallboard provide USG Fiberock AquaTough with Tuff-Hide Primer where very high impact gypsum wallboard is indicated on Sheet A-002 Partition Types and Sheet A-003 Partition Types.

C. Alternate No. 3: Courtyard Surfacing
   1. Base Bid: As indicated on civil drawings, tie perforated pipe to storm drainage system at area drain AD-1. As indicated on Courtyard Plan 3/L131, provide poured-in-place rubber surfacing Type 1 (detail 3/L501) everywhere with perforated pipe below connected to storm drainage.
   2. Alternate: Omit perforated pipe indicated on civil drawings. Install additional area drain AD-2 and associated piping. Poured-in-place rubber surfacing type 1 at spinner and fall zone only, see 3/L131 for zone extents. Poured-in-Place rubber surfacing type 2 (detail 4/L501) is substituted for all other PIP rubber type 1 in the courtyard base bid condition and perforated pipe below rubber surfacing is omitted.

END OF SECTION 012300
SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

2. Substitutions for Convenience: Changes proposed by Contractor that are not required in order to meet other Project requirements but may offer advantage to Owner.

1.3 ADMINISTRATIVE PROCEDURES

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

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use Document 006325 – Substitution Request Form provided in Project Manual or CSI Form 13.1A.

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

   a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

   b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

   c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

   d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

   e. Samples, where applicable or requested.

   f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

i. Research reports evidencing compliance with building code in effect for Project.

j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

k. Cost information, including a proposal of change, if any, in the Contract Sum.

l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

4. Forms of Acceptance:
   b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

A. Coordination: Revise or adjust affected Work as necessary to integrate Work of approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
1. Requests for substitutions are restricted to those necessitated by the following circumstances:
   a. Specified product is no longer available for purchase.
   b. Specified product is not available within schedule requirements of project.
   c. Specified product is not compatible with other product approved for project.
   d. Specified warranty is not available from any manufacturer.

2. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
   a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   b. Substitution request is fully documented and properly submitted.
   c. Requested substitution will not adversely affect Contractor's construction schedule.
   d. Requested substitution has received necessary approvals of authorities having jurisdiction.
   e. Requested substitution is compatible with other portions of the Work.
   f. Requested substitution has been coordinated with other portions of the Work.
   g. Requested substitution provides specified warranty.
   h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed unless indicated otherwise.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500
SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

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

1.4 PROPOSAL REQUESTS

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

1. Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.

2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

   a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

   b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

   c. Include costs of labor and supervision directly attributable to the change.

   d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

3. Include costs of labor and supervision directly attributable to the change.

4. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

5. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use CSI Form 13.6A "Change Order Request (Proposal)" with attachments CSI Form 13.6B "Proposal Worksheet Summary" and 13.6C "Proposal Worksheet Detail".

1.5 CHANGE ORDER PROCEDURES


B. The cost of the Contractors overhead and profit on any change order shall be:
   1. For extra Work completed by the Contractor with his own labor, not more than 15 percent shall be added as the allowance for overhead and profit.
   2. For extra Work completed by Subcontractors of the Contractor, not more than 10 percent shall be added as the allowance for overhead and profit.
   3. For Work deleted which would have been completed by the Contractor, with his own labor, not less than 10 percent shall be credited to the Owner as the allowance for overhead and profit.
   4. For Work deleted which would have been completed by Subcontractors of the Contractor, not less than 5 percent shall be credited to the Owner by the Contractor as the allowance for overhead and profit.

C. In order to facilitate checking of quotations for extras or credits, proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials, and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change be approved without such itemization."

1.6 CONSTRUCTION CHANGE DIRECTIVE


   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

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

1.7 EXTENSION OF TIME DUE TO WEATHER

A. General: This Article establishes conditions and procedure for amending the Contract Time when excess adverse weather conditions have repeatedly caused cancellation of scheduled critical activities, resulting in delay to the Project.

B. Definitions:

1. Adverse Weather: Job site environmental conditions in which precipitation, or soil conditions resulting from precipitation, or ambient temperature conditions during working hours preclude carrying out a Scheduled Critical Activity. The following conditions may be considered by the Architect in determining the extent of excess adverse weather conditions, depending upon the nature of the delayed project tasks:
   a. Precipitation greater than 0.1 inch of water equivalent per day.
   b. Days on which the average air temperature does not exceed 40 degrees F.
   c. Other weather conditions deemed hazardous by the Contractor.

2. Scheduled Critical Activity: Project tasks, the delay of which will directly result in a delay in the completion of the project.

C. Claim for Extension of Time Due to Weather:

1. Contractor shall file claim for each month during which adverse weather occurs.
   a. Attach copies of Contractor’s Daily Reports for each day of adverse weather, describing fully the weather conditions, scheduled activities delayed, and reasons for the delay.
   b. Include photographs where applicable for documenting soil conditions.
   c. Attach copy of NCDC/NOAA Local Climatological Data report for given month, or other published U.S. or state monthly weather data acceptable to Architect.

2. Claim shall be filed for a calendar month by attaching the completed documents to the Application for Payment submitted the following month.

3. Architect shall review and approve or take other action upon Contractor’s Claim for Extension of Time. Adjustment of Contract Time shall be made by a single Change Order prepared at project closeout.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600
SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1  RELATED DOCUMENTS

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

1.2  SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:
1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.
3. Section 017700 "Closeout Procedures" for requirements precedent to final application for payment.

1.3  SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's construction schedule.
1. Coordinate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
   a. Application for Payment forms with continuation sheets.
   b. Submittal schedule.
   c. Items required to be indicated as separate activities in Contractor's construction schedule.
2. Submit the Schedule of Values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Application for Payment.
3. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.

B. Format and Content: Use Project Manual Table of Contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
1. Identification: Include the following Project identification on the Schedule of Values:
   a. Project name and location.
   b. Name of Architect.
   c. Architect's project number.
   d. Contractor's name and address.
   e. Date of submittal.
2. Arrange Schedule of Values consistent with format of AIA Document G703, with separate columns to indicate the following for each item listed:
   a. Description of the Work.
   b. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
      1) Labor.
      2) Materials.
      3) Equipment.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual Table of Contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
   a. Include separate line items under Contractor and principal subcontracts for Project closeout requirements.

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

5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

7. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.

8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
   1. Submit draft copy of Application for Payment prior to due date for review by Architect.
C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
   1. Entries shall match data on the Schedule of Values.
   2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
   3. Include amounts of approved Change Orders, after all signatures are executed.
   4. Provide Sales and Use Tax Report with each Application for Payment.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
   1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
   2. Provide supporting documentation that verifies amount requested, such as paid invoices.
   3. Provide summary documentation for stored materials indicating the following:
      a. Value of materials previously stored and included in previous Applications for Payment.
      b. Value of work completed for this Application utilizing previously stored materials.
      c. Value of additional materials stored with this Application.
      d. Value of total materials remaining stored, including materials with this Application.

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: Owner reserves the right to require waivers of mechanic’s liens from subcontractors, sub-subcontractors, and suppliers with each Application for Payment.
   1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
   2. When an application shows completion of an item, submit conditional final or full waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
   5. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's construction schedule (preliminary if not final).
4. Products list (preliminary if not final).
5. Submittal schedule (preliminary if not final).
6. List of Contractor's staff assignments.
7. List of Contractor's principal consultants.
10. Certificates of insurance and insurance policies.
11. Performance and payment bonds.
12. Data needed to acquire Owner's insurance.

I. Retainage Reduction: Until the Work is 50 percent complete, the Owner shall pay 95 percent of the amount due to the Contractor on account of progress payments. At the time the Work is 50 percent complete and thereafter, the Contractor shall submit, for Owner's and Architect's review and approval a written request for retainage reduction. Upon Owner's approval, with written consent of the surety, the Architect may certify remaining partial payments to be paid in full.

1. The Contractor, as a condition precedent to retainage reduction, shall submit for review and approval by the Architect the required Operation and Maintenance Manuals.

J. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. Upon Substantial Completion of the work, the Contractor shall transmit the record set of Contract Documents to the Architect along with a typed list of each change or revision made during construction of the project. This list shall include change order numbers, authorization dates, and other information relevant to each change. Record Drawings must be received and approved prior to issuance of Final Payment.

K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.


PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900
SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project information management system.
5. Project meetings.

B. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
1. Post copies of list in project meeting room, in temporary field office, on Project Information Management System, and by each temporary telephone. Keep list current at all times.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

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

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.
1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

   a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
   b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
   c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
   d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
   e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
   f. Indicate required installation sequences.
   g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
   c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire-Protection System: Show the following:
   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

10. Coordination Drawing Format: Prepare coordination drawings according to requirements in Section 013300 "Submittal Procedures" and post to Project Information Management System.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
   1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
   2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
   3. BIM File Incorporation: Incorporate coordination drawing files into Building Information Model established for Project.
      a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI via the Project Information Management System.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

   a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form via the Project Information Management System.

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:
a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for approval of Contractor's means and methods.
d. Requests for coordination information already indicated in the Contract Documents.
e. Requests for adjustments in the Contract Time or the Contract Sum.
f. Requests for interpretation of Architect's actions on submittals.
g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.

3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 “Contract Modification Procedures.”
   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

E. RFI Log: The Project Information Management System will create and maintain the RFI log.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
   1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
   2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 WEB-BASED PROJECT INFORMATION MANAGEMENT SYSTEM

A. The Architect has established a web-based Project Information Management System to facilitate communication and record-keeping during the Project. Architect will provide access to Contractor’s key personnel. Refer to www.NewForma.com.
   1. Use Architect’s web-based Project Information Management System for purposes of managing project communication and documentation until Final Completion.
   2. Due to the size restrictions on email communication, all electronic files must be submitted through the Project Information Management System. Architect assumes no responsibility for information not received or retrieved by Constructor’s failure to use the Project Information Management System and such loss or delay of information will not be considered as a delay claim.

B. The Project Information Management System shall include the following:
   1. Project directory.
   2. Project correspondence.
   3. Meeting minutes.
5. RFI forms and logs.
6. Submittal forms and logs.
7. Architect’s Supplementary Instruction forms and logs.
8. Proposal request forms and logs.
9. Change order forms and logs.
10. Reminder and tracking functions.
11. Task and issue management.
12. Photo documentation.
13. Schedule and calendar management.
14. Payment application forms.
15. Drawing and specification document hosting, viewing, and updating.
17. Archiving function.

C. Contractor, subcontractors, and other parties granted access by Contractor to the Project Information Management System shall execute a data licensing agreement in the form of Agreement included in this Project Manual.

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:
   a. Tentative construction schedule.
   b. Phasing.
   c. Critical work sequencing and long-lead items.
   d. Designation of key personnel and their duties.
   e. Lines of communications.
   f. Procedures for processing field decisions and Change Orders.
g. Procedures for RFI's.
h. Procedures for testing and inspecting.
i. Procedures for processing Applications for Payment.
j. Distribution of the Contract Documents.
k. Submittal procedures.
l. Sustainable design requirements.
m. Preparation of record documents.
n. Use of the premises.
o. Work restrictions.
p. Working hours.
q. Owner's occupancy requirements.
r. Responsibility for temporary facilities and controls.
s. Procedures for moisture and mold control.
t. Procedures for disruptions and shutdowns.
u. Construction waste management and recycling.
v. Parking availability.
w. Office, work, and storage areas.
x. Equipment deliveries and priorities.
y. First aid.
z. Security.
aa. Progress cleaning.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

b. Options.
c. Related RFI's.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Sustainable design requirements.
i. Review of mockups.
j. Possible conflicts.
k. Compatibility requirements.
l. Time schedules.
m. Weather limitations.
n. Manufacturer's written instructions.
o. Warranty requirements.
q. Acceptability of substrates.
r. Temporary facilities and controls.
s. Space and access limitations.
t. Regulations of authorities having jurisdiction.
u. Testing and inspecting requirements.
v. Installation procedures.
w. Coordination with other work.
x. Required performance results.
y. Protection of adjacent work.
z. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of record documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for completing sustainable design documentation.
e. Requirements for preparing operations and maintenance data.
f. Requirements for delivery of material samples, attic stock, and spare parts.
g. Requirements for demonstration and training.
h. Preparation of Contractor's punch list.
i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
j. Submittal procedures.
k. Coordination of separate contracts.
l. Owner's partial occupancy requirements.
m. Installation of Owner's furniture, fixtures, and equipment.
n. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at regular intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

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

      1) Review schedule for next period.

   b. Review present and future needs of each entity present, including the following:

      1) Interface requirements.
      2) Sequence of operations.
      3) Resolution of BIM component conflicts.
      4) Status of submittals.
      5) Status of sustainable design documentation.
      6) Deliveries.
      7) Off-site fabrication.
      8) Access.
      9) Site utilization.
     10) Temporary facilities and controls.
     11) Progress cleaning.
     12) Quality and work standards.
     13) Status of correction of deficient items.
     14) Field observations.
     15) Status of RFIs.
     16) Status of proposal requests.
     17) Pending changes.
     18) Status of Change Orders.
     19) Pending claims and disputes.
     20) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
a. Schedule Updating: Revise Contractor’s construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

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

2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

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

b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.

c. Review present and future needs of each contractor present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Resolution of BIM component conflicts.
4) Status of submittals.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site utilization.
9) Temporary facilities and controls.
10) Work hours.
11) Hazards and risks.
12) Progress cleaning.
13) Quality and work standards.
14) Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100
SECTI0N 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Startup construction schedule.
   2. Construction schedule.
   3. Construction schedule updating reports.
   4. Daily construction reports.
   5. Site condition reports.
   6. Special reports.

B. Related Requirements:
   1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
   2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

A. General: Refer to glossary of terms in AGC's "Construction Planning & Scheduling" for terminology used in this section.

B. Float: The measure of leeway in starting and completing an activity.
   1. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
   2. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
   1. PDF electronic file.

B. Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
   1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date.
C. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
   1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
   2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
   3. Total Float Report: List of all activities sorted in ascending order of total float.

D. Construction Schedule Updating Reports: Submit with Applications for Payment.

E. Daily Construction Reports: Submit at monthly intervals.

F. Site Condition Reports: Submit at time of discovery of differing conditions.

G. Special Reports: Submit at time of unusual event.

1.5 COORDINATION

A. Coordinate construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from entities involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
   2. The Contractor shall conduct his operations so the completion date in the Agreement is met.

C. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
   2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule.
Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.


4. Startup and Testing Time: Include no fewer than 14 days for startup and testing.

5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

6. Punch List and Final Completion: Include not more than 30 days or the number of days indicated in the Agreement for punch list and Final Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Work Restrictions: Show the effect of work restrictions on the schedule.

2. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
   a. Subcontract awards.
   b. Submittals.
   c. Purchases.
   d. Deliveries.
   e. Mockups.
   f. Fabrication.
   g. Sample testing.
   h. Installation.
   i. Tests and inspections.
   j. Adjusting.
   k. Curing.
   l. Startup and placement into final use and operation.

3. Construction Areas: Identify each major area of construction for each major portion of the Work.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 STARTUP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work.

2.3 CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. CPM Schedule: Prepare construction schedule using a time-scaled CPM network analysis diagram for the Work.
   1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 45 days after date established for the Notice to Proceed.
      a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
   2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
   3. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work.
   1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
      a. Preparation and processing of submittals.
      b. Mobilization and demobilization.
      c. Utility interruptions.
      d. Testing.
      e. Punch list and Final Completion.
   2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
   3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
   4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

5. Float: Indicate float time for each activity.
   a. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
5. Changes in the critical path.
6. Changes in total float or slack time.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors.
2. List of separate contractors.
3. Approximate count of construction personnel.
4. Equipment.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Field Orders received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests.
18. Partial completions.
19. Substantial Completion authorized.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONSTRUCTION SCHEDULE

A. Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Original target dates shall be retained in scheduling software for the duration of the Project.
2. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
3. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
4. As the Work progresses, indicate completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200
This page intentionally left blank.
SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Periodic construction photographs.
   3. Final completion construction photographs.
B. Related Requirements:
   1. Section 017700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.

1.3 INFORMATIONAL SUBMITTALS
A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
   1. Fireproofing Photographs: Provide photographic documentation of completed fireproofing installation in all concealed spaces.
B. Digital Photographs: Submit image files within three days of taking photographs.
   1. Digital Camera: Minimum sensor resolution of 8 megapixels.
   2. Format: Minimum 1600 by 1200 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
   3. Identification: Provide the following information with each image description in file metadata tag:
      a. Name of Project.
      b. Name of Architect.
      c. Name of Contractor.
      d. Date photograph was taken.
e. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

f. Unique sequential identifier keyed to accompanying key plan.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 1600 x 1200 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.

C. Periodic Construction Photographs: Take 20 photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

D. Architect- or Owner Directed Construction Photographs: From time to time, Architect or Owner will instruct Contractor about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

E. Final Completion Construction Photographs: Take color photographs, in the amount directed by Architect after date of Substantial Completion for submission as project record documents. Architect and Owner will inform Contractor of desired vantage points.

END OF SECTION 013233
SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Electronic Files Transfer: Use Architect’s Project Information Management System specifically established for Project for submittals containing electronic files. Refer to Section 013100 “Project Management and Coordination” for additional information on the Project Information Management System.

1. The web address or hyperlink will be provided at initial preconstruction conference.
2. The Architect assumes no responsibility for information lost or not received by Contractor’s failure to submit and retrieve through the Project Information Management System.
3. Contractor’s failure to submit and retrieve through the Project Information Management System will not be considered in delay claims associated with lost or missing information.

C. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Section 017823 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect’s responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet
protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.


1.3 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

   a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

   a. Scheduled date for first submittal.
   b. Specification Section number and title.
   c. Submittal category: Action; informational.
   d. Name of subcontractor.
   e. Description of the Work covered.
   f. Scheduled date for Architect’s final release or approval.
   g. Scheduled date of fabrication.
   h. Scheduled dates for purchasing.
   i. Scheduled dates for installation.
   j. Activity or event number.

B. Closeout Submittal List: Submit a list of warranties, operation and maintenance manuals, and other closeout documents, arranged in Division and Section order as listed in the Project Manual.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
1. Upon request, Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings, Coordination Drawings, and Project record drawings.
   a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
   b. Digital Drawing Software Program: Verify with Architect for software program used for Drawings.
2. The digital data files are available under the following conditions:
   b. Digital data drawings are not considered Contract Documents as defined by the General Conditions for the Contract for Construction.
   c. The Contract Documents executed or identified in the Owner/Contractor Agreement, shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers.
   d. The Contractor shall not transfer or reuse Instruments of Service in electronic or machine-readable form without the prior written consent of the Architect.
3. Cost: Per sheet charges will be in accordance with Architect’s rates as noted in the Digital Data Letter of Agreement. Charges may also apply for file format conversion.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittal Period: Provide all submittals to Architect and Architect’s Consultants within 180 calendar days of the Notice to Proceed.
1. If submittals are not provided within the submittal period stated above, the Contractor shall provide one of the brands specified. No alternate manufacturers will be considered for review beyond the allowable submittal period. This does not relieve the Contractor from responsibility to provide all required shop drawings, product data, and samples.
2. If the number of submittals not received within the submittal period is significant or their nature deemed of specific importance, the Architect may recommend that the Owner suspend or delay payment to the Contractor until such time as the required submittals have been received.

D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect’s receipt of submittal. No extension of the
Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Allow 15 days for review of each resubmittal.

4. Sequential Review: Where sequential review of submittals by Architect’s consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect’s consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

2. Name file with submittal number, including revision identifier.
   a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor’s review and approval markings and action taken by Architect.

4. Transmittal Form for Electronic Submittals: Use software-generated form from the Project Information Management System.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
   a. Project name.
   b. Number and title of appropriate Specification Section.
   c. Manufacturer name.
   d. Product name.

F. Options: Identify options requiring selection by Architect.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor’s letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.

3. Resubmit submittals until they are marked with approval notation from Architect’s action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect’s action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Post electronic submittals as PDF electronic files directly to the Project Information Management System specifically established for Project.

2. Submit electronic submittals via email as PDF electronic files.

3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
   a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
   a. Manufacturer's catalog cuts.
   b. Manufacturer's product specifications.
   c. Standard color charts.
d. Statement of compliance with specified referenced standards.

e. Testing by recognized testing agency.

f. Application of testing agency labels and seals.

g. Notation of coordination requirements.

h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.

b. Printed performance curves.

c. Operational range diagrams.

d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.

6. Submit Product Data in the following format:

a. PDF electronic file via Electronic File Transfer requirements.

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, unless submittal based on Architect's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.

b. Schedules.

c. Compliance with specified standards.

d. Notation of coordination requirements.

e. Notation of dimensions established by field measurement.

f. Relationship and attachment to adjoining construction clearly indicated.

g. Seal and signature of professional engineer if specified.

2. Submit Shop Drawings in the following format:

a. PDF electronic file via Electronic File Transfer requirements.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.

b. Product name and name of manufacturer.

c. Sample source.

d. Number and title of applicable Specification Section.

e. Specification paragraph number and generic name of each item.
3. Electronic Submittals: Provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record and submit via Electronic File Transfer Requirements.

4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
     1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
     2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
   2. Manufacturer and product name, and model number if applicable.
   3. Number and name of room or space.
   4. Location within room or space.
   5. Submit product schedule in the following format:
a. PDF electronic file via Electronic File Transfer requirements.

F. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."

K. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on
evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers’ names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

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

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor’s approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, annotate to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:

1. No Exceptions Taken: The work covered by the submittal may proceed.
2. Note Markings: The work covered by the submittal may proceed provided it complies with both the Architect’s notations and corrections on the submittal and the Contract Documents.
3. Rejected: Do not proceed with the Work covered by the submittal. Prepare a new submittal for a product that complies with the contract documents.

C. Informational Submittals: Architect will review each submittal and will not return it, noting “No Action Taken.” If it does not comply with requirements, Architect will return it noting “Revise and Resubmit.” Architect will forward each submittal to appropriate party.

D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review, with notation “Revise and Resubmit.”

F. Submittals not required by the Contract Documents may be returned by the Architect without action, with notation “No Action Taken.”

END OF SECTION 013300
DIGITAL DATA LETTER OF AGREEMENT

An Agreement Between the Architect and _____________ (the “Transferee,” either Original or Third Party, as the case may be) for Transfer of Digital Data

Architect: LS3P
434 Fayetteville St, Suite 1700
Raleigh, NC 27601
Contact: Eileen McDonough

Transferee: Original
3rd Party

Contract No.: 8405-177070
Project No.: 5
Project Name: Alliance Health - Child Crisis Center Renovation: Phase D Final Renovation

Location: Fuquay-Varina, NC

Date: The Architect will provide the following Digital Data, dated as of the particular transmission, to the Transferee for information purposes only:

Digital Data was prepared using the following:
Software: AutoCAD (.dwg)
MicroStation (.dgn)
Revit (.rvt)

Digital Data to be delivered via the following media: Newforma Website posting

Transferee shall pay the Architect a service fee of $0.00 and other good and valuable consideration.

TERMS AND CONDITIONS

1. The Architect and its consultants make no representation as to the compatibility of the Digital Data with any hardware or software. The Transferee shall notify the Architect within five (5) business days of any problems associated with accessing and/or using the Digital Data.

2. The Transferee acknowledges and agrees that the Digital Data can be modified unintentionally or otherwise. The Transferee acknowledges and agrees that the Architect and its consultants may remove all indications of ownership from the Digital Data prior to transmission.

3. All Digital Data shall be considered the property of the Architect and/or its consultants and shall not be used for other Projects, for additions to this Project, or for completion of this Project without the prior written permission of the Architect and/or its consultants. Digital Data shall not be re-transmitted by the Original Transferee to a Third Party Transferee without prior execution of an agreement identical to this Agreement between the Architect, the Original Transferee, and the Third Party Transferee. Under no circumstances shall the transmission of the Digital Data be considered a sale of goods or a sale of copyrights.

4. THE ARCHITECT AND THE ARCHITECT’S CONSULTANTS HEREBY EXPRESSLY DISCLAIM ANY AND ALL WARRANTIES, BOTH EXPRESS AND IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY AND THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AS WELL AS ANY WARRANTY OF
ACCURACY, COMPLETENESS, AND/OR PERMANENCE. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. Addenda information and/or revisions made to the most current Digital Data after any date of transmission may not have been incorporated into the transmitted Digital Data. The Architect may update the Digital Data and give notice to authorized parties (or not) as is consistent with the Architect’s professional skill and care and the orderly progress of the Work. In the event of a conflict between the Architect’s printed instruments of service (whether sealed or not) and the Digital Data, the printed instruments of service shall govern. The Transferee acknowledges and agrees that the duty to determine the existence of any and all conflicts between the Digital Data and any other information upon which the Transferee relies rests solely upon the Transferee. The Digital Data shall not be considered Contract Documents or Construction Documents as defined by any General Conditions of Contract for Construction. The Digital Data is being provided on a strictly “AS IS” basis.

5. The use and/or provision of the Digital Data prepared by the Architect and/or its consultants shall not in any way reduce or obviate the Transferee’s duty to check and coordinate dimensions, details, and quantities of materials as required to facilitate construction of the Project. Confirmation of existing conditions is the sole responsibility of the Transferee.

6. The Transferee agrees to the extent permitted by applicable law, to indemnify, hold harmless, release, and defend the Architect and/or its consultants, their officers, shareholders, employees, and sub-consultants from any and all injuries, claims, demands, expenses, suits, liabilities, losses, damages, costs, disputes, other matters in question, third party claims, pass-through claims, subrogated claims, and/or claim expenses related to the Digital Data, including but not limited to, attorneys’ fees, expert witness fees, and court costs arising out of or in any way related to or connected with any negligent act and/or omission in the generation, provision, and/or use of the Digital Data by the Transferee and/or any of its subcontractors, suppliers, and/or consultants and waive any and all rights to such claims and causes of action.

7. The Transferee waives damages against the Architect for any and all injuries, claims, losses, expenses, damages, disputes, other matters in question, and/or claim expenses arising out of or relating to this Agreement and/or generation, provision, and/or use of the Digital Data, including, but not limited to, consequential damages and reasonable attorneys’ fees and defense costs.

8. The Architect’s and/or the Architect’s consultants’ liability to the Transferee and/or any of its subcontractors, suppliers, and/or consultants for any and all injuries, claims, losses, expenses, damages, disputes, other matters in question, third party claims, pass-through claims, subrogated claims, and/or claim expenses arising out of or relating to this Agreement and/or the Digital Data, including, but not limited to, reasonable attorneys’ fees and defense costs, regardless of the nature of the claim or damage, shall not exceed, either individually or in the aggregate, the total amount of $1,000.00. Such causes include, but are not limited to, the Architect’s and/or the Architect’s consultants’ negligence, errors, omissions, strict liability, breach of contract, and/or breach of warranty.

9. Upon information and belief, there are no licensing or copyright fees due to others based on the transmission of the Digital Data, but to the extent that such unknown fees do exist, the Transferee agrees to pay the required fees and hold the Architect and/or its consultants harmless from any associated costs or penalties.

10. Upon execution of this Agreement, the Architect grants to the Transferee a non-exclusive, non-transferable (except as set forth herein) license to use the Digital Data solely and exclusively for informational purposes only, provided that the Transferee substantially performs its obligations, including prompt payment of all sums when due, under this Agreement.

11. Any purchase order number provided by the Transferee is for the Transferee’s accounting purposes only. The Transferee acknowledges and agrees that purchase order terms and conditions are null, void, and inapplicable to this Agreement.

12. Payment of the service fee set forth herein is due prior to transmission of the Digital Data.
13. This Agreement constitutes the entire agreement between the parties relative to the Digital Data and shall be governed by the laws of the State of North Carolina.

AUTHORIZED ACCEPTANCE

by Architect: 
LS3P

Signature

Print Name and Title

Date

by Original Transferee:

Signature

Print Name and Title

Date

by Third Party Transferee:

Signature

Print Name and Title

Date
This page intentionally left blank.
SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.

3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections:

1. Division 02 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
1. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

D. Preconstruction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.

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

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

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

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

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
B. Contractor's Quality-Control Manager Qualifications: For supervisory personnel.
C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.
   3. Description of test and inspection.
   4. Identification of applicable standards.
   5. Identification of test and inspection methods.
   6. Number of tests and inspections required.
   7. Time schedule or time span for tests and inspections.
   8. Requirements for obtaining samples.
   9. Unique characteristics of each quality-control service.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
   1. Project quality-control manager may also serve as Project superintendent.
C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
D. Testing and Inspection: Include in quality-control plan a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

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

1.8 REPORTS AND DOCUMENTS

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

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

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

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

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

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

1.9 QUALITY ASSURANCE

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

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

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

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

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

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

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
G. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at the Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
   a. Allow seven days for initial review and each re-review of each mockup.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed, unless otherwise indicated.

H. Room Mockups: Construct room mockups as indicated below, incorporating required construction to demonstrate final finished construction, including but not limited to, doors, hardware frames, equipment, fixtures, accessories and finishes. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work. Comply with requirements in "Mockups" Paragraph.
1. Provide room mockups of the following rooms:
   a. Patient Bedrooms.
   b. Shower Rooms.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approved Room Mockups may be incorporated into the work.

I. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

J. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

K. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

L. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
   a. Provide test specimens representative of proposed products and construction.
   b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
   c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
   d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
   e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
   f. When testing is complete, remove test specimens, assemblies, mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
   a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.


   1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
   3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
   5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
   6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.
   5. Delivery of samples to testing agencies.
   6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of the Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.
SECTION 014100 - SPECIAL INSPECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to individual technical specification sections for specific qualifications, inspections, tests, frequency and standards required.

1.2 GENERAL REQUIREMENTS

A. Special Inspections shall be in accordance with Chapter 17 of the North Carolina State Building Code.

B. The program of Special Inspection is a system intended to ensure that the work is performed in accordance with the Contract Documents. These services do not relieve the Contractor of responsibility for compliance with the requirements of the Contract Documents.

C. This specification section is intended to inform the Contractor of the Owner’s Special Inspection program and the extent of the responsibilities. This specification section is also intended to notify the Special Inspector, Testing Company/Testing Laboratory, and other Agents of the Special Inspector of their requirements and responsibilities.

D. Perform inspections in accordance with industry standard referenced for specific material or procedure unless other criteria are specified. In the absence of a referenced standard, perform inspections in accordance with generally accepted industry standards.

E. Failure to detect defective work or materials shall in no way prevent later rejection if defective work or materials are discovered.

1.3 SCHEDULE OF SPECIAL INSPECTIONS

A. Required Special Inspections are described in the attached Statement of Special Inspections.

1.4 DEFINITIONS

A. Testing: Evaluation of systems, primarily requiring physical manipulation and analysis of materials, in accordance with approved standards.

B. Inspection: Evaluation of systems, primarily requiring observation and judgment.

C. Special Inspection: Special Inspection herein includes items required by the current State Building Code, and other items which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure.
D. Structural Engineer of Record (SER): The Licensed Engineer in responsible charge of the structural design for the project.

E. Testing Agency (TA):
   1. Testing Agency: Approved independent materials testing agency acceptable to the Owner, Architect, and SER.

F. Special Inspector (SI): A licensed professional engineer responsible for administering and performing all Special Inspections required by the Statement of Special Inspections.

G. Agents of Special Inspection (AI): Individual inspectors performing specific Special Inspections on behalf of the Special Inspector.

H. Building Official: The Officer or duly authorized representative charged with the administration and enforcement of the State Building Code.

1.5 QUALIFICATIONS

A. The Special Inspector shall be a licensed Professional Engineer (licensed in state in which project is located) experienced with the type of work requiring Special Inspections, who is approved by the Owner, Structural Engineer of Record (SER) and Building Official.

B. Required inspector’s qualifications for the Special Inspector and Agents of the Special Inspector are described in the attached Statement of Special Inspection.

1.6 SUBMITTALS

A. The Special Inspector shall submit to the Owner for review a copy of their qualifications which shall include the names and qualifications of each of the agents of Special Inspection who will be performing inspections.

1.7 PAYMENT

A. The Owner shall engage and pay for the services of the Special Inspector and Agents of the Special Inspector.

B. The Contractor shall be responsible for the cost of any re-inspection of work which fails to comply with the requirements of the Contract Documents.

1.8 RESPONSIBILITIES/AUTHORITY

A. Special Inspection:
   1. Special Inspector and Agents of Special Inspections:
      a. Sign the Statement of Special Inspection in conjunction with other responsible parties prior to commencing construction.
      b. Inspect the work assigned for conformance with the contract documents and applicable material and workmanship provisions of the code. Perform inspection in a timely manner to avoid delay of work.
c. Bring nonconforming items to the immediate attention of the Contractor for correction, then, if uncorrected after a reasonable period of time, to the attention of the Structural Engineer of Record, the Building Official, and to the Owner.

d. Submit inspection reports to the Contractor the Structural Engineer of Record, Owner, and other designated persons in accordance with the Statement of Special Inspection.

e. Submit a final signed report stating whether the work requiring Special Inspection was, to the best of the Special Inspector’s knowledge, in conformance with the contract documents and the applicable workmanship provisions of the code.

2. Architect:
   a. Expedite resolution of construction issues.

3. Structural Engineer of Record:
   a. Identify items requiring Special Inspection and define qualifications of special inspector required for work.
   b. Prepare and sign the Statement of Special Inspection in conjunction with other responsible parties prior to commencing construction.
   c. Review reports issued by Special Inspector.
   d. Assist in resolution of construction issues identified by Special Inspector.

4. Testing Agency:
   a. When engaged as a special inspector, provide Special Inspection services as noted in Item 1.8.A.1.
   b. Copy Special Inspector on all materials testing reports.

5. Contractor:
   a. Arrange and attend all pre-construction meetings to review scope of Special Inspection. Include the Building Official, Owner, Architect, Structural Engineer of Record, Special Inspector, Testing Agency and other parties concerned.
   b. Post or make available the Statement of Special Inspection within the project site office. Provide timely notification to those parties designated on the schedule so they may properly prepare for and schedule their work.
   c. Provide special inspector access to the approved plans and specifications at the project site.
   d. Review all reports issued by special inspector.
   e. Retain at the project site all reports submitted by the special inspector for review by the building official upon request.
   f. Correct, in a timely manner, deficiencies identified in inspection reports.
   g. Provide safe access to the work requiring inspection.
   h. Provide labor and facilities to provide access to the work and to facilitate inspection.
   i. Sign the Contractor’s Statement of Responsibility, if required, prior to commencing construction.

6. Fabricator/Supplier:
   a. Submit one copy of all material certificates and other quality assurance documents as required in the Statement of Special Inspections to the Special Inspector.

7. Building Official:
a. Accept and sign completed Statement of Special Inspection.
b. Review the final report submitted by special inspector.
c. Determine work, which, in the Building Officials opinion, involves unusual hazards or conditions (IBC 1704.13 – Special Cases).

8. Owner:
   a. Provide and pay cost of Special Inspection services.
   b. Provide special inspector with Contract Documents and accepted shop drawings.
   c. Provide special inspector with full access to the site at all times.
   d. Sign the Statement of Special Inspection in conjunction with other responsible parties prior to commencing construction.

1.9 INSPECTION NOTES

A. Contractor provide minimum of 24 hours notice for all items requiring inspection. Do not construct items requiring inspection services until testing and inspection services are available. Do not enclose or obscure items requiring inspection services until inspection services are performed.

1.10 LIMITS ON AUTHORITY

A. The Special Inspector may not release, revoke, alter, or increase the requirements of the Contract Documents.

B. The Special Inspector will not have control over the Contractor means or methods of construction.

C. The Special Inspector shall not be responsible for construction site safety.

D. The Special Inspector has no authority to stop the work.

1.11 DAILY RECORDS AND REPORTS

A. Detailed daily reports shall be prepared by Special Inspector and Agents of Special Inspection of each inspection and submitted to the Special Inspector. Reports shall include, but not be limited to:
   1. date of inspection
   2. name of inspector or agent
   3. location of specific areas inspected
   4. description of inspection and results
   5. applicable ASTM standard
   6. weather conditions
   7. identification of product and specification section

B. Any discrepancies from the Contract Documents found during a Special Inspection shall be immediately reported to the Contractor. If the discrepancies are not corrected, the Special Inspector shall notify the Structural Engineer of Record and Owner. Reports shall document all discrepancies identified and the corrective action taken.
C. The Testing Company/Testing Laboratory shall immediately notify the Special Inspector of any test results which fail to comply with the requirements of the Contract Documents.

1.12 MONTHLY REPORTS

A. Monthly reports shall be prepared by the Special Inspector. Reports shall include, but not be limited to:
   1. Summary of elements inspected during that month.
   2. Copies of all discrepancies noted during that month.
   4. Summary of all material certifications and quality assurance documents collected and reviewed during that month.

1.13 FINAL REPORT OF SPECIAL INSPECTIONS

A. The Final Report of Special Inspections shall be completed by the Special Inspector and submitted to the Structural Engineer of Record, Owner, Contractor and Building Official prior to the issuance of a Certificate of Use and Occupancy.

B. The Final Report of Special Inspections will certify that all required inspections have been performed and will itemize any discrepancies and how those discrepancies were resolved.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION (not applicable)

END OF SECTION 014100
Contractor’s Statement of Responsibility

Each contractor responsible for the construction or fabrication of a system or component designated in the Quality Assurance Plan must submit a Statement of Responsibility.

Project:
Contractor’s Name:
Address:
License No.:
Description of designated building systems and components included in the Statement of Responsibility:

Contractor’s Acknowledgment of Special Requirements

I hereby acknowledge that I have received, read, and understand the Quality Assurance Plan and Special Inspection program.

I hereby acknowledge that control will be exercised to obtain conformance with the construction documents approved by the Building Official.

________________________________          _______________
Signature                                      Date

Contractor’s Provisions for Quality Control

Procedures for exercising control within the contractor’s organization, the method and frequency of reporting and the distribution of reports is attached to this Statement.

Identification and qualifications of the person(s) exercising such control and their position(s) in the organization are attached to this Statement.
This page intentionally left blank.
SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Owner will pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Owner will pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Owner will pay electric-power-service use charges for temporary electricity used by all entities for construction operations. Contractor shall arrange for change-over to permanent power, which shall be in the Owner's name, and Owner will pay permanent electric-power-service use changes.

1.3 INFORMATIONAL SUBMITTALS

A. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

B. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
   1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
   2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
   3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

C. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
   1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
5. Other dust-control measures.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.


1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

C. 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.

D. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Conference room of sufficient size to accommodate meetings of 25 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot square tack and marker boards.
2. Drinking water and private toilet.
3. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
4. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
E. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
   1. Store combustible materials apart from building.

F. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
   3. Permanent HVAC System: Use of the permanent HVAC system for temporary use during construction is restricted by the condition listed below. If permanent HVAC system is used for temporary conditioning during construction, Contractor is responsible to protect return air from contamination by covering open end of duct with MERV 8 filter. Remove filter at end of construction. Clean HVAC system as required in Section 017700 – Closeout Procedures.
      a. Owner must authorize use of permanent HVAC system for temporary use during construction.

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.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

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

3.2 SITE USE PLAN

A. Confine operations within the areas indicated and as shown on the site use plan and as permitted by law, ordinances, and permits. Site shall not be unreasonably encumbered with materials, products, or construction equipment.

B. The Contractor in reviewing the use of the site shall include access to proposed building for construction purposes, parking where possible for employees, temporary facilities including storage, utility hookups, staging areas, storage materials and products, and unloading space.
3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
   2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
   3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

B. Storm Sewers and Storm Drainage: If storm sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If storm sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither storm sewers nor storm drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
   1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
   2. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
   3. Maintain temporary storm sewers and storm drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use.

D. Sanitary Facilities: Provide temporary toilets and wash facilities for use of construction personnel. Coordinate and comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
   1. Contractors shall provide drinking water and paper cups for use of their personnel.
   2. Disposable Supplies: Provide, and maintain adequate supply of, toilet tissue and similar disposable materials for use of construction personnel.
   3. Toilets: Install self-contained toilet units.
   4. Provide safety showers, eyewash fountains, and similar facilities where required by authorities having jurisdiction.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
   1. Maintain a minimum temperature of 50 deg F in permanently enclosed portions of building for normal construction activities, and 65 deg F for finishing activities and areas where finished Work has been installed.

F. 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 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.

1. Dehumidification systems may be used to reduce substrate moisture levels to level required to allow installation or application of finishes.

G. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.

1. Install electric power service underground unless otherwise indicated.

H. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.

1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

J. Telephone Numbers: Provide a list of important telephone numbers. Include the following:

1. Police and fire departments.
2. Ambulance service.
3. Contractor's home office.
4. Contractor's emergency after-hours telephone number.
5. Architect's office.
6. Engineers' offices.
7. Owner's office.
8. Principal subcontractors' field and home offices.

3.4 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary shops and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas.
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
   1. Protect existing site improvements to remain including curbs, pavement, and utilities.
   2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Coordinate with Owner for temporary parking areas for construction personnel.

E. Dewatering Facilities and Drains: Coordinate and comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
   1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
   2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.
   3. Remove snow and ice as required to minimize accumulations.

F. Project Signs: Provide Project sign as indicated on sign sample following this section. Unauthorized signs are not permitted.
   1. Project sign layout shall be submitted to Architect for approval. Project sign shall include the following:
      a. Project name (text approved by Owner),
      b. Owner's logo,
      c. Rendering (provided by Architect),
      d. Architect's name/logo,
      e. Engineer's names/logos,
      f. Contractor's name/logo.
   2. Temporary Signs: Provide signs as required to inform public and individuals seeking entrance to Project. Provide temporary, directional signs for construction personnel and visitors.
   3. Engage an experienced sign painter to apply graphics for Project identification signs.
   4. Construct signs of exterior-type Grade B-B high-density concrete form overlay plywood unless indicated otherwise, and in sizes and thicknesses indicated. Support on posts and framing of preservative-treated wood.
   5. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer.
   6. Maintain and touchup signs so they are legible at all times.
   7. Location of project identification sign as directed by Architect.
   8. Directional Signage: Mount directional signage on pressure treated wood or galvanized steel posts and framing.

H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
   1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

I. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to 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 normal business hours.

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

D. Stormwater Control: Coordinate and comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Perform control operations lawfully, using environmentally safe materials.

G. Site Enclosure Fence: Site Enclosure Fence: A site enclosure fence will be provided by the Owner prior to the commencement of construction for use by prior construction contracts. Upon commencement of Renovation Phase D - Final Renovation, the contractor shall take over from the Owner responsibility for all rental costs and maintenance for the site enclosure fence.
   1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
   2. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
   3. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
   1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
   2. Vertical Openings: Close openings of 25 sq. ft. or less with plywood or similar materials.
   3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
   4. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use fire-retardant-treated material for framing and main sheathing.

J. Temporary Egress: Maintain temporary egress from existing occupied facilities as required by authorities having jurisdiction.

K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.
   1. Prohibit smoking on Project site.
   2. Supervise welding operations and similar sources of fire ignition according to requirements of authorities having jurisdiction.
   3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
   4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

A. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect porous materials from water damage, protect stored and installed material from water, keep porous materials from coming into prolonged contact with concrete, remove standing water from decks, and keep deck openings covered or dammed.

B. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
   1. Do not load or install drywall or other porous materials, into partially enclosed building.
   2. Keep interior spaces clean and protected from water damage.
   3. Discard or replace water-damaged material. Do not install material that is wet.
   4. Discard, replace, or clean stored or installed material that begins to grow mold.
   5. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

C. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
   1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. If authorized by Owner, use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

3.7 OPERATION, TERMINATION, AND REMOVAL

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

B. Maintenance: Maintain facilities in good operating condition until removal.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 – Closeout Procedures.

END OF SECTION 015000
This page intentionally left blank.
SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:
   1. Section 012500 "Substitution Procedures" for requests for substitutions.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.

2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.

3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 SUBMITTALS

A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.

2. Form: Tabulate information for each product under the following column headings:
   a. Specification Section number and title.
   b. Generic name used in the Contract Documents.
   c. Proprietary name, model number, and similar designations.
   d. Manufacturer's name and address.
   e. Projected delivery date or time span of delivery period.
   f. Identification of items that require early submittal approval for scheduled delivery date.

3. Completed List: Within 90 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.

4. Architect's Action: Architect will respond in writing to Contractor within 30 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Comparable Product Requests: Comply with requirements in Section 012500 "Substitution Procedures."


1.5 QUALITY ASSURANCE

A. Compatibility: Contractor is responsible for providing products and construction methods compatible with other products and construction methods used on the Project.

B. Asbestos: No asbestos or asbestos-containing material may be incorporated into the Work.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

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

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

D. Material Moisture and Mold Control: Comply with recommendations contained in Associated General Contractors (AGC) document "Managing the Risk of Mold in the Construction of Buildings." Prepare and submit plan for protecting materials from water damage, including the following:
1. Indicate delivery, checking and storage operations affected by water damage control efforts.
2. Indicate procedures for protecting porous materials from water damage, and how damaged materials will be handled.
3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for handling water from these operations. Show procedures for verifying that wet work has dried sufficiently to permit installation of related finish materials.
4. Describe procedures for dealing with large and unexpected water intrusion into completed portions of building. Include procedures for investigation of cause and effects, and methods for dealing with both.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.

3. See Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017836 "Warranties."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

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

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

4. Where products are accompanied by the term "as selected," Architect will make selection.


6. Product Samples: Samples required for evaluation will not be returned for incorporation into the work.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

3. Products:
   a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
   b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:
a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the conditions of Section 012500 "Substitution Procedures" are satisfied. If the conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements.
This page intentionally left blank.
SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including the following:
   1. Installation of the Work.
   2. Moisture and mold control.
   3. Progress cleaning.
   4. Starting and adjusting.
   5. Protection of installed construction.
   6. Correction of Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
   2. Furnish location data for Work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
   1. Description of the Work.
   2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility, Architect, and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a Request for Interpretation to Architect according to requirements in Section 013100 - Project Management and Coordination.

3.3 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.4 MOISTURE AND MOLD CONTROL

A. General: Avoid trapping water in finished Work. Document visible signs of mold that may appear during construction. Comply with recommendations contained in Associated General Contractors (AGC) document “Managing the Risk of Mold in the Construction of Buildings,” including the following:
   1. Exposed Phase of Construction:
      a. Protect porous materials from water damage.
      b. Protect stored and installed material from flowing or standing water.
      c. Keep porous and organic materials from coming into prolonged contact with concrete.
      d. Remove standing water from decks.
      e. Keep deck openings covered or dammed.
      f. Use dunnage to create space between concrete decks and stored drywall.
   2. Partially Enclosed Phase of Construction:
      a. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
      b. Keep interior spaces reasonably clean and protected from water damage.
      c. Periodically collect and remove waste containing cellulose or other organic matter.
      d. Discard or replace water-damaged material.
      e. Do not install material that is wet.
      f. Discard, replace or clean stored or installed material that begins to grow mold.
g. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

3. Controlled Phase of Construction
   a. Control moisture and humidity inside building by maintaining effective dry-in conditions.
   b. Utilize permanent HVAC system to control humidity.

3.5 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
   2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 degs F.
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
      a. Use containers intended for holding waste materials of type to be stored.
   4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.6 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 - Quality Requirements.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.8 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300
SECTION 017329 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes procedural requirements for cutting and patching.

B. Related Requirements:
   1. Section 024119 “Selective Demolition” for demolition of selected portions of the building.

1.3 DEFINITIONS

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

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
   1. Primary operational systems and equipment.
   2. Air or smoke barriers.
   3. Fire-suppression systems.
   4. Mechanical systems piping and ducts.
   5. Control systems.
   6. Communication systems.
   7. Conveying systems.
   8. Electrical wiring systems.
   9. Operating systems of special construction in Division 13 sections.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity.
to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.

D. Protect fire-resistive material, according to advice of product manufacturer from damage resulting from cutting and patching or other causes so fire protection will be without damage or deterioration at the time of Substantial Completion.

1. As installation of other construction proceeds, inspect fire-resistive material and patch any damaged or removed areas.
2. Repair or replace work that has not been successfully protected.

E. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect’s opinion, reduce the building’s aesthetic qualities. Remove and replace construction that had been cut and patched in a visually unsatisfactory manner.

1.5 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical material are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing service/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer’s written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Division 31 where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as
possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosures: Patch components in a manner that restores enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017329
SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the work.

B. Related Requirements:

1. Section 017300 "Execution" for progress cleaning of Project site.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at final completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.
1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
   a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
5. Submit testing, adjusting, and balancing records.
6. Submit sustainable design submittals not previously submitted.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."

6. Advise Owner of changeover in utility services.

7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.

8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.

9. Complete final cleaning requirements.

10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, 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. 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.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."

2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
   a. Project name.
   b. Date.
   c. Name of Architect.
   d. Name of Contractor.
   e. Page number.

4. Submit list of incomplete items in the following format:

PART 2 - PRODUCTS

2.1 MATERIALS

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

1. Submit list of proposed cleaning agents with related product data to Owner prior to use.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

   a. 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.

   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

   d. Remove tools, construction equipment, machinery, and surplus material from Project site.

   e. Remove snow and ice to provide safe access to building.

   f. 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.

   g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

   h. Sweep concrete floors broom clean in unoccupied spaces.

   i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.

   j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.

   k. Remove labels that are not permanent.

   l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactory repaired or restored or that already show evidence of repair or restoration.

      1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates. Remove paint or other matter obscuring labels.

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

   n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

   o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

   p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

   q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.

   r. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 017419 “Construction Waste Management and Disposal.”
3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.

2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
   a. Do not paint over “UL” and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700
SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.

b. Enable inserted reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."
2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Architect.
7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
5. Power failure.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

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

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

2.4 OPERATION MANUALS

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

2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.
B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer’s name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

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

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer’s name.
3. Color, pattern, and texture.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
   1. Inspection procedures.
   2. Types of cleaning agents to be used and methods of cleaning.
   3. List of cleaning agents and methods of cleaning detrimental to product.
   4. Schedule for routine cleaning and maintenance.
   5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.
E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format,
identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823
SECTION 017836 - WARRANTIES

PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.
   1. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.
B. Related Requirements:
   1. Section 016000 "Product Requirements" for submitting product warranties.
   2. Section 017700 "Closeout Procedures" for submitting closeout and maintenance material submittals.
   3. Divisions 02 through 33 for specific requirements for warranties on products and installations specified to be warranted.
   4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 DEFINITIONS
A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS
A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

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

D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
   1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

E. Where the Contract Documents require a special warranty or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

F. Warranty Commencement: Warranties required by the Contract Documents shall commence on the Date of Substantial Completion of the Work or designated portion thereof.

1.5 SUBMITTALS

A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
   1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within 15 days of completion of that designated portion of the Work.

B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.

C. Prepare a written document utilizing the sample “General Warranty” form located at the end of this Section, ready for execution by the Contractor. The Contractor shall submit subcontractor, supplier, or manufacturer draft warranties to the Owner, through the Architect, for approval prior to final execution.
   1. Refer to Divisions 2 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.
D. Form of Submittal: At Final Completion compile two (2) copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

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

1. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.

2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.

3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017836

Attachment: Sample General Warranty
SAMPLE GENERAL WARRANTY

(To Be Printed on Company Letterhead. Letterhead Shall Include Phone and Fax Numbers)

GENERAL WARRANTY

Date:

Contractor: Name

Address

City, State, Zip Code

Owner: Name

Address

City, State Zip Code

Project: Name

Project Location: City, State

The above named contractor as the General Contractor for the Work on the above project, does hereby warrant that for a period of one (1) year from the date of the Date of Substantial Completion, the above Work that will remain free from all defects in workmanship and material, and that it will comply with all the specific requirements of the Contract Documents governing the Work.

________________________________________
Signature

________________________________________
Printed Name and Title
SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for general closeout procedures.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an acceptable drawing technique.
   c. Record data as soon as possible after obtaining it.
   d. Record and check the markup before enclosing concealed installations.
   e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order or Construction Change Directive.
   k. Changes made following Architect's written orders.
   l. Details not on the original Contract Drawings.
   m. Field records for variable and concealed conditions.
   n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
a. See Section 013300 "Submittal Procedures" for requirements related to use of Architect's digital data files.
b. Architect will provide data file layer information. Record markups in separate layers.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
   1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
   2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
   1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
   2. Format: Annotated PDF electronic file with comment function enabled.
   3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
   4. Identification: As follows:
      a. Project name.
      b. Date.
      c. Designation "PROJECT RECORD DRAWINGS."
      d. Name of Architect.
      e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
   5. Note related Change Orders, record Product Data, and record Drawings where applicable.
B. Format: Submit record Specifications as annotated PDF electronic file or scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839
SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
      1. Demonstration of operation of systems, subsystems, and equipment.
      2. Training in operation and maintenance of systems, subsystems, and equipment.
   B. Related Requirements:
      1. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 INFORMATIONAL SUBMITTALS
   A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   B. Qualification Data: For facilitator and instructor.
   C. Attendance Record: For each training module, submit list of participants and length of instruction time.
   D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS
   A. At completion of training, submit complete training manual(s) for Owner's use.
      1. Training Manual: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder.

1.5 QUALITY ASSURANCE
   A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for
this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved operation and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.

2. Documentation: Review the following items in detail:
   b. Maintenance manuals.
   c. Project record documents.
   d. Identification systems.
   e. Warranties and bonds.
   f. Maintenance service agreements and similar continuing commitments.
3. **Emergencies:** Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.

4. **Operations:** Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.

5. **Adjustments:** Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.

6. **Troubleshooting:** Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.

7. **Maintenance:** Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.

8. **Repairs:** Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.
PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operations and Maintenance Data."

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner, through Architect, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

F. Cleanup: Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900
SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected portions of building or structure.
   2. Demolition and removal of selected site elements.
   3. Salvage of existing items to be reused or recycled.

1.2 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
   1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.3 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS


B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of selective demolition activities with starting and ending dates for each activity.

D. Predemolition photographs or video.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

1.5 CLOSEOUT SUBMITTALS

A. Inventory of items that have been removed and salvaged.

1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.
1.7 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials included for review and use. Examine report to become aware of locations where hazardous materials are present.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

C. Inventory and record the condition of items to be removed and salvaged.
3.2 PREPARATION

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

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

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

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

C. Remove temporary barricades and protections where hazards no longer exist.
3.5 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
4. Maintain fire watch during and for at least 8 hours after flame-cutting operations.
5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
6. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area designated by Owner.
   5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:
   1. Clean and repair items to functional condition adequate for intended reuse.
   2. Pack or crate items after cleaning and repairing. Identify contents of containers.
   3. Protect items from damage during transport and storage.
   4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 CLEANING

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

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

END OF SECTION 024119
This page intentionally left blank.
SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following.

1. Footings.
2. Fence Post Foundations (Exterior)
3. Slabs-on-Grade.
4. Equipment pads and bases.
5. Concrete Toppings (fiber-reinforced).

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project Site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete Subcontractor.
   e. Special concrete finish Subcontractor.

2. Review testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures,
construction contraction and isolation joints, and joint-filler strips, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, embedded items, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, and supports for concrete reinforcement.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   1. Location of construction joints is subject to approval of the Engineer of Record.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Curing compounds.
   7. Adhesives.
   8. Vapor retarders.

D. Material Test Reports: For the following, from a qualified testing agency:
   1. Aggregates.
E. Field quality-control reports.

F. Minutes of pre-installation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA’s "Certification of Ready Mixed Concrete Production Facilities."

C. Mix Design Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer’s plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
1.10 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301.
2. ACI 117.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

D. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

E. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
   3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT
A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
B. Plain-Steel Wire: ASTM A 1064, as drawn.
C. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES
A. Smooth Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS
A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
B. Cementitious Materials:
1. Portland Cement: ASTM C 150, Type I/II.
2. Fly Ash: ASTM C 618, Class F.

A. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.


D. Water: ASTM C 94 and potable.

2.6 ADMIXTURES


B. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do 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, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.7 FIBER REINFORCEMENT

A. Macrosynthetic Fibers: Manufactured from virgin polyolefin, and engineered for use as temperature and shrinkage reinforcement, conforming to ASTM C1116, Type III.

1. Available Products:
   a. BASF Corporation; “MasterFiber MAC” Series.
   b. Approved equal.

2.8 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

B. Products: 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. Subject to compliance with requirements, provide one of the following:
   a. Fortifiber Corporation; Moistop Ultra A.
   b. Raven Industries Inc.; Vapor Block 15.
   c. Stego Industries, LLC; Stego Wrap 15 mil Class A.

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

2.9 CURING MATERIALS

A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

B. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Anti-Hydro International, Inc.; AH Clear Cure WB.
   b. BASF Construction Chemicals - Building Systems; Kure-N-Seal WB.
   c. ChemMasters; Safe-Cure & Seal 20.
   d. Conspec by Dayton Superior; Cure and Seal WB.
   e. Cresset Chemical Company; Crete-Trete 309-VOC Cure & Seal.
   f. Dayton Superior Corporation; Safe Cure and Seal (J-18).
   g. Edoco by Dayton Superior; Spartan Cote WB II.
   h. Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150.
   j. Lambert Corporation; Glazecote Sealer-20.
   k. L&M Construction Chemicals, Inc.; Dress & Seal WB.
   m. Metalcrete Industries; Metcure.
   n. Nox-Crete Products Group; Cure & Seal 150E.
   o. Symons by Dayton Superior; Cure & Seal 18 Percent E.
   p. TK Products, Division of Sierra Corporation; TK-2519 WB.
   q. Vexcon Chemicals, Inc.; Starseal 309.

C. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A certified by curing and sealing compound manufacturer to not interfere with bonding of floor covering.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. BASF Construction Chemicals - Building Systems; Kure 1315.
   b. ChemMasters; Polyseal WB.
   c. Conspec by Dayton Superior; Sealcure 1315 WB.
   d. Edoco by Dayton Superior; Cureseal 1315 WB.


e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; Luster Seal WB 300.


g. Lambert Corporation; UV Safe Seal.

h. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.


j. Metalcrete Industries; Metcure 30.

k. Right Pointe; Right Sheen WB30.

l. Symons by Dayton Superior; Cure & Seal 31 Percent E.

m. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

2.10 RELATED MATERIALS


B. Bonding Agent: ASTM C 1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

2.11 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.

4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.

B. Repair Overlay: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.

4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.
2.12 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete and concrete with a w/c ratio below 0.50.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Normal-weight concrete.

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum W/C Ratio: 0.55.
3. Slump Limit: 4 inches, plus or minus 1 inch (prior to pumping).
4. Slump Limit for concrete containing high-range water-reducing admixture or plasticizing admixture: 8 inches maximum for concrete with approved design mix slump of 3 to 5 inches before adding high-range water-reducing admixture or plasticizing admixture.
5. Air Content: 2 percent, plus or minus 1.5 percent at point of delivery (prior to pumping).


1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch at point of delivery (prior to pumping).
4. Slump Limit for Concrete Containing High-Range Water-Reducing Admixture or Plasticizing Admixture: 8 inches maximum for concrete with approved design mix slump of 3 to 5 inches before adding high-range water-reducing mixture or plasticizing admixture.
5. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery (prior to pumping).
C. Slabs-on-Grade: Normal-weight concrete.

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum W/C Ratio: 0.55.
3. Slump Limit: 4 inches, plus or minus 1 inch at point of delivery (prior to pumping).
4. Slump Limit for Concrete Containing High-Range Water-Reducing Admixture or Plasticizing Admixture: 8 inches maximum for concrete with approved design mix slump of 3 to 5 inches before adding high-range water-reducing mixture or plasticizing admixture.
5. Air Content: 2 percent, plus or minus 1.5 percent at point of delivery (prior to pumping).
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent at point of delivery (prior to pumping).

A. Concrete Toppings, Equipment Pads and Bases: Proportion lightweight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Calculated Equilibrium Unit Weight: 115 lb/cu. ft., plus or minus 3 lb/cu. ft. as determined by ASTM C 567.
3. Slump Limit: 4 inches plus or minus 1 inch at point of delivery (prior to pumping).
4. Slump Limit for concrete containing high-range water-reducing admixture or plasticizing admixture: 9 inches maximum for concrete with approved design mix slump of 3 to 5 inches before adding high-range water-reducing admixture or plasticizing admixture.
5. Air Content: Do not exceed 3 percent.
6. Macrosynthetic Fibers: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 3.0 lb/cu. yd.

2.14 FABRICATING REINFORCEMENT

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

2.15 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Provide ¾ inch chamfer at all exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

3.3 VAPOR-RETARDER INSTALLATION

A. Granular Course: Cover subgrade with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus ¾ inch.

B. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT INSTALLATION

A. General: 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.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer of Record.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as foundation walls and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
   2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
   3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer of Record.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
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 FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

1. Apply scratch finish to surfaces indicated, to receive concrete floor toppings and to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, to receive trowel finish, and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated, exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
   a. For Slabs-on-Grade (Other than Gymnasiums and Stage Floor): Specified overall values of flatness, $F(F)$ 30; and of levelness, $F(L)$ 20; with minimum local values of flatness, $F(F)$ 24; and of levelness, $F(L)$ 15.
   b. For Gymnasium and Stage Floor Slabs-on-Grade: Specified overall values of flatness, $F(F)$ 45; and of levelness, $F(L)$ 35; with minimum local values of flatness, $F(F)$ 30; and of levelness, $F(L)$ 24.
   c. For slabs-on-metal deck: Specified overall values of flatness, $F(F)$ 30; with minimum local values of flatness, $F(F)$ 24.
   d. Overall values of flatness and levelness are to be determined for each individual area of concrete placed at one time.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated and where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.9 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with inplace construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:
   1. Coordinate sizes and locations of concrete bases with actual equipment provided.
   2. Construct concrete bases as shown on Drawings.
   3. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.10 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

   a. Moisture cure or use moisture-retaining covers to cure concrete slab surfaces. Moisture-retaining covers may be used to cure all other concrete at Contractor’s option.

2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

   a. Cure concrete other than concrete slab surfaces with a curing compound at the Contractor’s option.

3. 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.

3.11 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

   1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

3.12 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Engineer of Record. Remove and replace concrete that cannot be repaired and patched to Engineer of Record’s approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer of Record.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Engineer of Record's approval, using epoxy adhesive and patching mortar.
F. Repair materials and installation not specified above may be used, subject to Engineer of Record's approval.

3.13 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain composite sample(s) for each day's pour of each concrete mixture exceeding 5 cu. yd per the following:

<table>
<thead>
<tr>
<th>Concrete Delivered</th>
<th>Composite Samples Obtained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5 cubic yards</td>
<td>None</td>
</tr>
<tr>
<td>5 cubic yards to 49 cubic yards</td>
<td>1 (take from first load delivered)</td>
</tr>
<tr>
<td>50 cubic yards to 100 cubic yards</td>
<td>1</td>
</tr>
<tr>
<td>Over 100 cubic yards</td>
<td>1 for each 100 cubic yards or fraction thereof</td>
</tr>
</tbody>
</table>

a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of delivery (back of concrete truck) prior to conveyance by pump, bucket, etc. for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173 volumetric method, for structural lightweight concrete; one test at point of delivery (back of concrete truck) prior to conveyance by pump, bucket, etc. for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test at point of delivery (back of concrete truck) prior to conveyance by pump, bucket, etc. for each composite sample, but not less than one test for each day's pour of each concrete mixture.

   a. Cast and laboratory cure five, 6 inch by 12 inch (or seven 4 inch by 8 inch) standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39; test one 6 by 12 inch (or one 4 by 8) laboratory-cured specimen at 7 days and two 6 by 12 (or three 4 by 8 inch) laboratory-cured specimens at 28 days and hold two 6 by 12 (or three 4 by 8 inch) laboratory-cured specimens in reserve for 56 day test if required.
   a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

9. Test results shall be reported in writing to Engineer of Record, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer of Record but will not be used as sole basis for approval or rejection of concrete.

11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer of Record. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Engineer of Record.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

END OF SECTION 033000
SECTION 033300 – LANDSCAPE ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place architectural concrete, including form facings, reinforcement and accessories, concrete materials, concrete mixture design, placement procedures, and finishes.

1. Requirements in Section 033000 "Cast-in-Place Concrete" apply to landscape architectural concrete.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete not designated as architectural concrete.

1.3 DEFINITIONS

A. Cast-in-Place Landscape Architectural Concrete: Formed concrete that is exposed to view on surfaces of completed structure or building and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.

B. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

C. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Require representatives of each entity directly concerned with cast-in-place architectural concrete to attend, including the following:

   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
2. Review concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction joints, forms and form-removal limitations, reinforcement accessory installation, concrete repair procedures, and protection of cast-in-place architectural concrete.

3. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Do not add water to concrete during delivery at Project site, or during placement unless approved by Landscape Architect

C. Formwork Shop Drawings: Show formwork construction, including form-facing joints, rustications, construction and contraction joints, form joint-sealant details, form tie locations and patterns, inserts and embedments, cutouts, cleanout panels, and other items that visually affect cast-in-place architectural concrete.

D. Placement Schedule: Submit concrete placement schedule before start of placement operations. Include locations of all joints, including construction joints.

E. Samples: For each of the following materials:

1. Form-facing panels.
2. Form ties.
3. Form liners.
4. Exposed aggregates.
5. Coarse- and fine-aggregate gradations.
6. Chamfers and rustications.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Repair materials.

C. Material Test Reports: For the following, by a qualified testing agency:
1. Aggregates. [Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.]

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "NRMCA Quality Control Manual - Section 3, Certification of Ready Mixed Concrete Production Facilities."

B. Mockups: Before casting architectural concrete, build mockups to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Build mockups of typical exterior wall of cast-in-place architectural concrete as shown on Drawings.
3. Demonstrate curing, cleaning, and protecting of cast-in-place architectural concrete, finishes, and contraction joints, as applicable.
4. In presence of Architect, damage part of the exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair of tie holes and surface blemishes to match adjacent undamaged surfaces.
5. Obtain Architect's approval of mockups before casting architectural concrete.
6. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
4. Do not use chemical accelerators unless otherwise specified and approved in design mixtures.

B. Hot-Weather Placement: Comply with ACI 301 and as follows:
   1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

   A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
      1. ACI 301.
      2. ACI 303.1.

2.2 FORM-FACING MATERIALS

   A. General: Comply with Section 033000 "Cast-in-Place Concrete" for formwork and other form-facing material requirements.

   B. Source Limitations: Obtain each type form-facing material from single source from single manufacturer.

   C. Form Liners: Units of face design, texture, arrangement, and configuration indicated. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent surface treatments of concrete.

   D. Rustication Strips: Metal or rigid plastic, or with sides beveled and back kerfed; nonstaining; in longest practicable lengths.

   E. Chamfer Strips: Metal, rigid plastic, elastomeric rubber, or dressed wood, 3/4 by 3/4 inch, minimum; nonstaining; in longest practicable lengths.

   F. Form Joint Tape: Compressible foam tape; pressure sensitive; AAMA 800; minimum 1/4 inch thick.

   G. Form Joint Sealant: Elastomeric sealant complying with ASTM C 920, Type M or Type S, Grade NS, that adheres to form joint substrates.
1. **Silicone type sealants and other sealants with history of potential staining/streaking are not allowed**

H. **Form-Release Agent:** Commercially formulated, colorless form-release agent that will not bond with, stain, or adversely affect architectural concrete surfaces and will not impair subsequent treatments of those surfaces.

I. **Form Ties:** Factory-fabricated, internally disconnecting ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish internally disconnecting ties that will leave no metal closer than 1-1/2 inches from the architectural concrete surface.
   2. Furnish glass-fiber-reinforced plastic ties, not less than 1/2 inch in diameter, of color selected by Architect from manufacturer's full range.
   3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 **STEEL REINFORCEMENT AND ACCESSORIES**

A. **General:** Comply with Section 033000 "Cast-in-Place Concrete" for steel reinforcement and other requirements for reinforcement accessories.

B. **Bar Supports:** Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place; manufactured according to CRSI's "Manual of Standard Practice."
   1. Where legs of wire bar supports contact forms, use CRSI Class 1, gray, plastic-protected bar supports.

2.4 **CONCRETE MATERIALS**

A. **Source Limitations:** Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. **Cementitious Materials:**
   1. **Portland Cement:** ASTM C 150/C 150M, Type I, gray.
   2. **Fly Ash:** ASTM C 618, Class F.
   3. **Slag Cement:** ASTM C 989/C 989M, Grade 100 or Grade 120.
   4. **Silica Fume:** ASTM C 1240 amorphous silica.

C. **Normal-Weight Aggregates:** ASTM C 33/C 33M, Class 5S coarse aggregate or better, graded. Provide aggregates from single source with documented service-record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   1. Maximum Coarse-Aggregate Size: 1/2 inch.
2. Gradation: Uniformly graded.

D. Normal-Weight Fine Aggregate: ASTM C 33/C 33M, manufactured or natural sand, from same source for entire Project.

E. Air-Entraining Admixture: ASTM C 260/C 260M.

F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that does 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.

G. Water: Potable, complying with ASTM C 94/C 94M, except free of wash water from mixer washout operations.

2.5 CURING MATERIALS

A. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B.

2.6 REPAIR MATERIALS

A. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

B. Epoxy Bonding Adhesive: ASTM C 881/C 881M two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements.

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.7 CONCRETE MIXTURES

A. Obtain each color, size, type, and variety of concrete mixture from single manufacturer with resources to provide cast-in-place architectural concrete of consistent quality in appearance and physical properties.
B. Prepare design mixtures for each type and strength of cast-in-place architectural concrete proportioned on basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed design mixtures based on laboratory trial mixtures.

C. Cementitious Materials: For cast-in-place architectural concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements. Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Admixtures: Use admixtures according to manufacturer's written instructions.

F. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

G. Concrete Mixtures:

2. Maximum W/C Ratio: 0.46.
3. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery

2.8 CONCRETE MIXING

A. Ready-Mixed Architectural Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information.

1. Clean equipment used to mix and deliver cast-in-place architectural concrete to prevent contamination from other concrete.
2. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. General: Comply with Section 033000 "Cast-in-Place Concrete" for formwork, embedded items, and shoring and reshoring.
B. In addition to ACI 303.1 limits on form-facing panel deflection, limit cast-in-place architectural concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch.

C. Construct forms to result in cast-in-place architectural concrete that complies with ACI 117 (ASI 117M).

D. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-in-place surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood rustications, keyways, reglets, recesses, and the like, for easy removal.

1. Seal form joints and penetrations at form ties with form joint tape or form joint sealant to prevent cement paste leakage.
2. Do not use rust-stained steel form-facing material.

E. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

F. Chamfer exterior corners and edges of cast-in-place architectural concrete.

G. Coat contact surfaces of wood rustications and chamfer strips with sealer before placing reinforcement, anchoring devices, and embedded items.

H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

L. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and attach securely to prevent deflection and maintain stability of liners during concreting. Prevent form liners from sagging and stretching in hot weather. Seal joints of form liners and form-liner accessories to prevent mortar leaks. Coat form liner with form-release agent.

3.2 REINFORCEMENT AND INSERT INSTALLATION

A. General: Comply with Section 033000 "Cast-in-Place Concrete" for fabricating and installing steel reinforcement. Securely fasten steel reinforcement and wire ties against shifting during concrete placement.
B. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.3 REMOVING AND REUSING FORMS

A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

1. Schedule form removal to maintain surface appearance that matches approved mockups.

B. Clean and repair surfaces of forms to be reused in the Work. Do not use split, frayed, delaminated, or otherwise damaged form-facing material. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for cast-in-place architectural concrete surfaces.

3.4 JOINTS

A. Construction Joints: Install construction joints true to line, with faces perpendicular to surface plane of cast-in-place architectural concrete, so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.
2. Form keyed joints as indicated. Align construction joint within rustications attached to form-facing material.
3. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

B. Contraction Joints: Form weakened-plane contraction joints true to line, with faces perpendicular to surface plane of cast-in-place architectural concrete, so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, form-release agent, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Deposit concrete continuously between construction joints. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 303.1.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. Do not permit vibrators to contact forms.

3.6 FINISHES, GENERAL

A. Architectural Concrete Finish: Match Architect's design reference sample, identified and described as indicated, to satisfaction of Architect.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.

1. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

C. Maintain uniformity of special finishes over construction joints unless otherwise indicated.

3.7 AS-CAST FORMED FINISHES

A. Architectural Grade Form-Liner Finish (Type 'A' Finish Quality): Produce a smooth, textured surface free of pockets, streaks, and honeycombs, and of uniform appearance, color, and texture by use of a lined high density overlay form material.

B. Smooth-Formed Finish: As-cast concrete texture imparted by un-lined form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Remove fins and other projections exceeding specified limits on formed-surface irregularities. [Repair] [Do not repair] and patch tie holes and defects.

C. Form-Liner Finish: Produce a textured surface free of pockets, streaks, and honeycombs, and of uniform appearance, color, and texture.

3.8 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.

B. Begin curing cast-in-place architectural concrete immediately after removing forms from concrete. Cure according to ACI 308.1, by one or a combination of the following methods that will not mottle, discolor, or stain concrete:
1. Curing Compound: Mist concrete surfaces with water. Apply curing compound uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recomcoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.9 FIELD QUALITY CONTROL

A. General: Comply with field quality-control requirements in Section 033000 "Cast-in-Place Concrete."

3.10 REPAIR, PROTECTION, AND CLEANING

A. Repair and cure damaged finished surfaces of cast-in-place architectural concrete when approved by Architect. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.

1. Remove and replace cast-in-place architectural concrete that cannot be repaired and cured to Architect's approval.

B. Protect corners, edges, and surfaces of cast-in-place architectural concrete from damage; use guards and barricades.

C. Protect cast-in-place architectural concrete from staining, laitance, and contamination during remainder of construction period.

D. Clean cast-in-place architectural concrete surfaces after finish treatment to remove stains, markings, dust, and debris.

E. Wash and rinse surfaces according to concrete finish applicator's written instructions. Protect other Work from staining or damage due to cleaning operations.

1. Do not use cleaning materials or processes that could change the appearance of cast-in-place architectural concrete finishes.

END OF SECTION 033000
SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. This Section includes requirements for Installer qualifications, including material and labor provision, separate bonding capacity, project experience, and key personnel experience.

1.2 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:
   1. Concrete masonry units (CMUs).
   2. Cleaning and painting of existing face brick.
   3. Mortar and grout.
   4. Reinforcing steel.
   5. Masonry joint reinforcement.
   6. Ties and anchors.
   7. Embedded flashing.
   8. Miscellaneous masonry accessories.

B. Products furnished, but not installed, under this Section include the following:
   1. Dovetail slots for masonry anchors, installed under Section 033000 "Cast-in-Place Concrete."
   2. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Section 051200 "Structural Steel Framing."

C. Products installed, but not furnished, under this Section include the following:
   1. Steel lintels and shelf angles for unit masonry, furnished under Section 055000 "Metal Fabrications."
   2. Manufactured reglets in masonry joints for metal flashing, furnished under Section 077100 "Roof Specialties."

1.3 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops a net-area compressive strengths ($f_{m}^\prime$) of 1,500 psi at 28 days.

B. Determine net-area compressive strength ($f_{m}^\prime$) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
C. Determine net-area compressive strength ($f'_m$) of masonry by testing masonry prisms according to ASTM C 1314.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
   3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples: For each type and color of the following:
   1. Special shapes.
   2. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
   3. Weep holes/vents.
   4. Accessories embedded in masonry.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
   1. Submit list of minimum of five similar projects, including description of project size and scope, and name and contact information for architect, for Installer, superintendent, and crew chiefs. Indicate total years of experience for each.

B. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
   1. Masonry units.
      a. Include material test reports substantiating compliance with requirements.
      b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
      c. For exposed brick, include material test report for efflorescence according to ASTM C 67.
      d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
   2. Aggregates.
   3. Cementitious materials. Include brand, type, and name of manufacturer.
   4. Supplemental Cementing Material: Include type and name of manufacturer or source.
   5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   6. Grout mixes. Include description of type and proportions of ingredients.
   7. Reinforcing bars.
   8. Joint reinforcement.
   9. Anchors, ties, and metal accessories.
C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather and hot-weather requirements.
c. ASTM C 641: Staining Materials in Lightweight Concrete Aggregates.
d. ASTM C 151: Autoclave Expansion of Hydraulic Cement (for popouts.)
e. ASTM C 331: Lightweight Aggregates for Concrete Masonry Units

E. Preconstruction Testing Service: Owner may engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

1. Clay Masonry Unit Test: For each type of unit required, per ASTM C 67.
2. Concrete Masonry Unit Test: For each type of unit required, per ASTM C 140.
3. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019.
4. Mortar Test: For mortar properties per ASTM C 270.
5. Prism Test: For each type of construction required, per ASTM C 1314.

F. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

G. Sample Panels: Build two (2) sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

H. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Refer to Section 014000 "Quality Requirements" for additional requirements.

1. Build mockups for typical exterior wall in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
   a. Include a sealant-filled joint at least 16 inches long in mockup.
   b. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
   c. Include veneer anchors, flashing, and weep holes in exterior masonry-veneer wall mockup.

2. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
3. Protect accepted mockups from the elements with weather-resistant membrane.
4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
   a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
   b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
I. Daily Log: Maintain a daily log of masonry work in progress for inspection by Owner, Architect, Special Inspector, or Authority Having Jurisdiction.
   1. Indicate on small scale plans where masonry was erected and grouted.
   2. Identify crew and assigned work area.
   3. Certify that the following tasks have been performed.
      a. Inspection of reinforcing and thru-wall flashings.
      b. Inspection of construction and verification of compliance with requirements.
      c. Testing of cavity drainage.
      d. Daily cleaning.

J. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.8 DELIVERY, STORAGE, AND HANDLING
A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 PROJECT CONDITIONS
A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
   2. Where 1 wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
2. Remove ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch before beginning to lay any masonry units.
3. Provide temporary protection of completed unit masonry to insure 48 hours curing at a minimum temperature of 40 degrees Fahrenheit.
4. Remove masonry determined to be frozen or damaged by freezing conditions.
5. Lay no unit masonry unless temperature is at least 40 degrees Fahrenheit and rising.
6. Do not use "anti-freeze" or accelerating admixtures in mortar.
7. Perform the following protections for completed masonry and masonry not being worked on.
   a. When the mean daily air temperature range is from 40 degrees Fahrenheit to 32 degrees F, protect masonry from rain or snow for at least 24 hours by covering with weather-resistant membrane.
   b. When mean daily air temperature range is from 32 degree F to 20 degrees F, completely cover masonry with insulating blankets or similar protection for at least 24 hours.
   c. When mean daily temperature is 20 degrees F and below, maintain masonry temperature above 32 degrees F for 24 hours using enclosures and supplementary heat, electric heating blankets, or infra-red lamps.


F. Cleaning Masonry Surfaces: Comply with manufacturer's requirements and environmental conditions.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.
2.2 CONCRETE MASONRY UNITS (CMUs)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Adams Products
   2. Carolina Prestress Corporation
   3. E. Dillon & Company
   4. Fay Block Materials
   5. Cemex
   6. Suffolk Block Company
   7. Johnson Concrete Company
   8. Lightweight Block Co.

B. Concrete Masonry Units: ASTM C 90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
   2. Weight Classification: Lightweight.
   3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

C. Decorative CMUs: ASTM C90.
   1. Basis of Design: Johnson Concrete Company; Split-Rib CMU
      a. Sizes: Provide the following sizes where indicated on Drawings to match existing.
         1) 8” and 12” standard.
         2) 3-5/8” veneer.
      2. Density Classification: Lightweight.
      3. Colors: To match existing as selected by Architect from manufacturer's full range.

D. Shapes: Provide shapes indicated and as follows:
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide square-edged units for outside corners, unless otherwise indicated. Provide bull-nose block for exposed corners on interior walls.

E. Integral Water Repellent: Provide exterior, exposed concrete masonry units made with integral water repellent.
   1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ACM Chemistries
      b. Master Builders, Inc./BASF
      c. W. R. Grace & Co.
2.3 MASONRY LINTELS

A. General: Provide masonry lintels complying with requirements below.

B. Masonry Lintels: Built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.
3. For veneer masonry, use Type N.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

E. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S. Provide natural color or white cement as required to produce mortar color indicated.

F. Masonry Cement: Not Permitted.

G. Mortar Cement: ASTM C 1329.

H. Colored Cement Product: Packaged blend made from portland cement and lime or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients. Field-mixing of colors not permitted.

1. Color: Mortar to match brick color. As selected by Architect from manufacturer's full range of colors.
a. Maximum of three colors to be selected.

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.

3. Pigments shall not exceed 10 percent of portland cement by weight.

4. Pigments shall not exceed 5 percent of mortar cement by weight.

I. Aggregate for Mortar: ASTM C 144.

1. Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

2. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone, from same source using same run or vein for entire operation.

3. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

4. Natural Color.

5. White-Mortar Aggregates: Natural white sand or crushed white stone.


K. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated. Provide one of the following products:

1. Addiment Incorporated; Mortar Kick.

2. Euclid Chemical Company (The); Accelguard 80.


4. Sonneborn, Div. of ChemRex; Trimix-NCA.

L. Water-Repellent Admixture for Exterior, Exposed Mortar: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer. Provide products by one of the following:

1. ACM Chemistries

2. Master Builders, Inc./BASF


M. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951.

1. Interior Walls: Hot-dip galvanized, carbon steel.

2. Exterior Walls: Hot-dip galvanized, carbon steel.

3. Wire Size for Side Rods: W1.7 or 0.148-inch diameter.

4. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.

5. Wire Size for Veneer Ties: W1.7 or 0.148-inch diameter.

6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.

7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry:
   1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate ties that extend into facing wythe. Ties have two hooks that engage eyes or slots in reinforcement and resist movement perpendicular to wall. Ties extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.
   2. Continuous Horizontal Masonry Joint Reinforcement for Veneers: Single 0.188-inch diameter, hot-dip galvanized, carbon-steel continuous wire.
      a. Provide at all bed joints in soldier and stacked coursing.

2.6 TIES AND ANCHORS

A. General: Provide 2-piece assemblies allowing vertical or horizontal differential movement between veneer and wall framing parallel to plane of wall but resisting tension and compression forces perpendicular to it, for attachment over sheathing to metal studs, and with the following structural performance characteristics:
   1. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in either tension or compression without developing play or deforming more than 0.05 inch.

B. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with subparagraphs below, unless otherwise indicated.
   2. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
   3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
   4. Stainless-Steel Sheet: ASTM A 666, Type 304.
   5. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

D. Adjustable Masonry Veneer Anchors for Connecting to Framing: Unless otherwise indicated, provide, at Contractor's option, one of the following types of anchors:
   1. Screw-Attached Masonry Veneer Anchor: Units consisting of a wire tie and a metal anchor section.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following.
         1) Hohmann & Barnard, Inc.
         2) Dayton Superior Corporation; Dur-O-Wal Division
         3) Heckmann Building Products Inc.
         4) Wire-Bond
b. Contractor's Option: Provide one of the following types.

1) Anchor Section: Sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch wide by 3-5/8 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie. Fabricate sheet metal anchor section from 1.05 inch thick steel sheet, galvanized after fabrication. Provide self-healing strip under each clip. Basis of Design: Hohmann & Barnard, Inc.; Model # X-Seal.

2) Anchor Section: Corrosion-resistant, self-drilling, eye-screw designed to receive wire tie. Eye-screw has spacer that seats directly against framing and is same thickness as sheathing and has gasketed, washer head that covers hole in sheathing. Basis of Design: Heckmann Building Products Inc.; Pos-I-Tie.


E. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Where wythes are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.


F. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch diameter, hot-dip galvanized steel wire.

2. Tie Section for Steel Frame: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.188-inch diameter, hot-dip galvanized steel wire.

G. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

H. Partition Top Anchors: 0.097-inch thick metal plate with 3/8-inch diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

2.7 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch, galvanized steel sheet.

C. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

D. Postinstalled Anchors: Provide chemical anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and
equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.

2.8 EMBEDDED FLASHING MATERIALS

A. General: Provide prefabricated inside and outside corners and end dams of same material and thickness as primary material and from the same flashing manufacturer.

B. Provide minimum 10-inch wide strips of same material under joints.

C. Flexible Flashing: For flashing not exposed to the exterior, use the following, unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry. Subject to compliance with requirements, provide one of the following products:
   a. Advanced Building Products Inc.; Copper Fabric Flashing
   b. AFCO Products Inc.; Copper Fabric
   c. Hohmann & Barnard, Inc.; H & B C-Fab Flashing
   d. Phoenix Building Products; Type FCC-Fabric Covered Copper
   e. Polytite Manufacturing Corp.; Copper Fabric Flashing
   f. Sandell Manufacturing Co., Inc.; Copper Fabric Flashing
   g. York Manufacturing, Inc.; York Copper Fabric Flashing

D. Partially Exposed Flashing: Stainless steel, minimum 0.016 inch thick.

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrate

F. Termination Bar: Stainless steel.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Pre-Compressed Joint Filler for CMU: Manufacturer's standard preformed, precompressed, closed-cell expanding foam sealant manufactured from 100 percent acrylic and impregnated with a nondrying, water-repellent agent. Factory produced in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. EMSEAL Joint Systems, Ltd.; BackerSeal (Basis of Design)
   b. Dayton Superior Specialty Chemicals
   c. Sandell Manufacturing Co., Inc.
   d. Schul International, Inc.
   e. Willseal USA, LLC
B. Compressible Filler for Brick Veneer: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or urethane.

C. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
   2. PVC: ASTM D 2287, Type PVC-65406.

D. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

E. Weep/Vent Products: Use the following, unless otherwise indicated:
   1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
      a. Advanced Building Products Inc.; Mortar Maze weep vent.
      b. Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
      c. Heckmann Building Products Inc.; No. 85 Cell Vent.
      d. Hohmann & Barnard, Inc.; Quadro-Vent.
      e. Wire-Bond; Cell Vent.

F. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
   1. Products:
      a. Advanced Building Products Inc.; Mortar Break (1 to 1-3/4 inch air space) or Mortar Break II (2-inch airspace).
      b. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
      c. Mortar Net USA, Ltd.; Mortar Net.
      d. Archovations, Inc.; CavClear Masonry Mat.

G. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
   1. Products: Subject to compliance with requirements, provide one of the products specified.
      a. Dayton Superior Corp., Dur-o-Wal Division; D/A 810, D/A 812, or D/A 817
      b. Heckman Building Products, Inc.; No. 376 Rebar Positioner
      c. Hohmann & Barnard, Inc.; RB-Twin Rebar Positioner
      d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner

2.10 CAVITY-WALL INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, closed-cell product extruded with an integral skin.

B. Adhesive: Type recommended by insulation board manufacturer for application indicated.
2.11 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Diedrich Technologies, Inc.
   b. EaCo Chem, Inc.; NMD80 (Basis of Design)
   c. ProSoCo, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.
F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
   2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
   3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
   6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
   7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
   2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
   4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
   5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets.
Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
   1. Install compressible filler in joint between top of partition and underside of structure above.
   2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c., unless otherwise indicated.
   3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078446 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

A. General: Prepare mortar in accordance with current Portland Cement Association publications.

B. Prepare fresh mortar at the rate it will be used, in order to maintain consistent color and workability. Do not use mortar that has stiffened because of hydration. Discard when not used within the time recommended by mortar manufacturer or PCA publications, whichever is shorter. Retemper mortar carefully to avoid color changes, no more than twice per batch.

C. Measure mortar materials using cubic foot measuring box or other approved container of known volume, of size appropriate for operation. Use a consistent ratio of water to mortar materials, within the range recommended by the mortar manufacturer's written instructions.
1. Measurement of sand by shovel shall not be permitted.

D. Lay hollow brick and concrete masonry units as follows:
   1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
   2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
   3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
   4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

E. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

F. Tool exposed joints when thumbprint hard.
   1. Tooling Pattern: Weathered joint.

3.6 CLEANING AND PAINTING EXISTING MASONRY

3.7 CAVITY WALLS

A. Bond wythes of cavity walls together using bonding system indicated on Drawings.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Apply air barrier to face of backup wythe to comply with Section 072726 "Fluid Applied Membrane Air Barriers."

D. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
   1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.8 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
      a. Reinforcement above is in addition to continuous reinforcement.
B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
C. Provide continuous wire reinforcement in soldier and stacked courses.
D. Provide continuity at wall intersections by using prefabricated T-shaped units.
E. Provide continuity at corners by using prefabricated L-shaped units.
F. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE
A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
   1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.10 ANCHORING MASONRY VENEERS
A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
   1. Wall Framing Backup: Fasten screw-attached anchors through insulation and sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
   2. Concrete Masonry Unit Backup: Embed tie sections in masonry joints. Provide air space as indicated on Drawings.
   3. Space anchors as indicated, but not more than 16 inches o.c. vertically and 16 inches o.c. horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

3.11 CONTROL AND EXPANSION JOINTS
A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
B. Form control joints in concrete masonry using the following method:
   1. Install preformed control-joint gaskets designed to fit standard sash block.
   2. At veneer side of masonry walls, install pre-compressed joint filler in CMU control joints during CMU installation.
a. Install at depth sufficient to allow installation of properly sized backer rod and liquid sealant in front of joint filler. Comply with manufacturer's written instructions.

1) Install each length of joint filler immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of joint filler requires acceleration to produce seal, apply heat to joint filler in compliance with manufacturer's written instructions.

C. Form expansion joints in brick made from clay or shale as follows:
1. Build in compressible joint fillers where indicated.
2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.
1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.12 LINTELS

A. Install steel lintels where indicated. Secure lintels immediately after placing into position to prevent movement and collapse. Unsecured lintels shall be removed and replaced when they can be secured immediately.

B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 16 inches at each jamb, unless otherwise indicated.

3.13 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows, unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and 1-1/2 inches into the inner wythe.
3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
4. Extend flexible flashing to within 3/8 inch of the exterior face of the outer wythe of masonry.
C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
   1. Use specified weep/vent products to form weep holes.
   2. Space weep holes 24 inches o.c., unless otherwise indicated.
E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

3.14 REINFORCED UNIT MASONRY INSTALLATION
A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Limit height of vertical grout pours to not more than 60 inches.

3.15 FIELD QUALITY CONTROL
A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
   1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports:
   1. Payment for these services will be made by Owner.
2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

C. Water Testing: Upon request of the Architect, and as often as deemed appropriate by the Contractor, the cavity drainage system shall be tested by pouring a 5-gallon bucket of water into the masonry cavity, or use a hose bib, to verify system performance.

3.16 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress/Daily Cleaning: Clean unit masonry as work progresses by scraping off lumps of mortar, wiping down wall surface with burlap bags or equivalent or dry brushing to remove mortar fins and smears before tooling joints. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Examine substrates, areas, and conditions under which masonry cleaning will be performed, for compliance with manufacturer’s and project requirements in order to achieve the approved results.
   2. Verify that surfaces and conditions are suitable prior to commencing work of this section.
   3. Do not proceed with the work until unsatisfactory conditions have been corrected.
   4. Establish by demonstration the pressure to be used, angle of spray and distance of the nozzle from the wall required to properly clean. Maintain this established method throughout the cleaning operation.
   5. Test cleaning methods on mock-up wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   6. Prevent overspray, wind drift, and splash onto surfaces not to be treated. Protect adjacent and surrounding surfaces from exposure to the cleaning solution when necessary.
   7. Avoid direct contact with building occupants, pedestrians, vehicles and foliage. Cover landscaping using plastic or wet the foliage with water before and after the cleaning process.
   8. Avoid wind drifting of spray of chemical cleaning products, residues, and rinse water.
   9. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   10. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
   11. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20 or low-pressure spray method, using a proprietary acidic cleaner applied according to manufacturer's written instructions.
12. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

END OF SECTION 042000
SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Structural steel.
   2. Grout.

B. Related Requirements:
   1. Division 05 Section "Steel Decking" for field installation of shear connectors through deck.
   2. Division 05 Section "Metal Fabrications" for miscellaneous steel fabrications and other steel items not defined as structural steel.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. AESS: Structural steel designated as “architecturally exposed structural steel” or “AESS” in the Contract Documents.

C. Category 1 AESS: All steel designated as “AESS-1” in the Contract Documents.

1.4 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.
1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.

F. Source quality-control reports.

G. Field quality-control and special inspection reports.
1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

D. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.
PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator, to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC 360.
2. Use Allowable Stress Design; data are given at service-load level.

B. Moment Connections: Type FR, fully restrained.

C. Construction: Moment frame.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992.

B. Channels, Angles, ASTM A 36.

C. Plate and Bar: ASTM A 572, Grade 50 or ASTM A 36.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53, Type E or Type S, Grade B.

1. Weight Class: As indicated.
2. Finish: Black except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers with plain finish.
1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type with plain finish.

C. Unheaded Anchor Rods: ASTM F 1554, Grade 36, or ASTM F 1554, Grade 55, as indicated.
   4. Washers: ASTM F 436, Type 1, hardened carbon steel.
   5. Finish: Plain or Hot-dip zinc coating, ASTM A 153, Class C as indicated.

D. Headed Anchor Rods/Thru Bolts: ASTM F 1554, Grade 36, straight.
   3. Washers: ASTM F 436, Type 1, hardened carbon steel.


F. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

G. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.4 PRIMER
A. Primer for steel not exposed to exterior: Fabricator's standard lead- and chromate-free, nonasphallic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Primer for steel designated as Category 1 AESS and exposed to exterior: Zinc-Rich Aromatic Urethane primer (performance equal to Tnemec Series 90-97 Tneme-Zinc) and compatible with topcoat.

C. Galvanizing Repair Paint: ASTM A 780.

2.5 GROUT
A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
2.6 FABRICATION

   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
   4. Mark and match-mark materials for field assembly.
   5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. AESS: Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and expedite erection. In addition to special care used to handle and fabricate AESS, comply with the following:
   1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.
   2. Fabricate Category 1 AESS with exposed surfaces free of mill marks, including rolled trade names and stamped or raised identification.
   3. Fabricate Category 1 AESS with exposed surfaces free of seams to maximum extent possible.
   4. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
   5. Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.
   6. Fabricate Category 1 AESS to the tolerances specified in AISC 303 for steel that is designated AESS.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning" and SSPC-SP 3, "Power Tool Cleaning."

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.
2.7 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.

B. Surface Preparation for steel not designated as AESS: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. Surface Preparation for steel designated as Category 1 AESS: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 6/NACE "Commercial Blast Cleaning."
2. Surface must be clean and dry prior to priming.

D. Priming of steel note designated as AESS: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

E. Priming of steel designated as Category 1 AESS: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to
provide a minimum dry film thickness of 2.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize and prime lintels located in exterior walls.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
4. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests according to requirements in AWS D1.1 on additional shear connectors if weld fracture occurs on shear connectors already tested.

E. Prepare test and inspection reports.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.


   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of baseplate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

   1. Level and plumb individual members of structure.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.
F. Do not use thermal cutting during erection unless approved by Structural Engineer of Record. Finish thermally cut sections within smoothness limits in AWS D1.1.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Set and erect steel that is designated Category 1 AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector and testing agency to perform the following special inspections:
   1. Verify structural-steel materials and inspect steel frame joint details.
   2. Verify weld materials and inspect welds.
   3. Verify connection materials and inspect high-strength bolted connections.

B. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Visually inspect field welds according to AWS D1.1.
   1. In addition to visual inspection, test and inspect field welds according to AWS D1.1 and the following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

D. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
This page intentionally left blank.
SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Roof deck.

B. Related Requirements:
   1. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
   2. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:
   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
   1. Power-actuated mechanical fasteners.

D. Evaluation Reports: For steel deck, from ICC-ES.
1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.


1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 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. Canam Steel Corporation; Canam Group, Inc.
2. New Millennium Building Systems, LLC.
3. Nucor Corp.
4. United Steel Deck.
5. Verco Decking, Inc., a Nucor company.
2.3 ROOF DECK – GALVANIZED

A. Roof Deck - Vented: Fabricate ribbed- and vented-steel sheet panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: As indicated.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

E. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

F. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

G. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

H. Galvanizing Repair Paint: ASTM A 780.
3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Locate deck bundles to prevent overloading of supporting members.

C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

H. Mechanical fasteners may be used in lieu of welding to fasten deck where indicated on drawings. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members and steel embed plates in CMU with mechanical fasteners as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.

1. Mechanically fasten cover plates at changes in direction of roof-deck panels unless otherwise indicated.
3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Prepare test and inspection reports promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor’s expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100
This page intentionally left blank.
SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Steel framing and supports for countertops, mechanical and electrical equipment, and applications where framing and supports are not specified in other Sections.
   2. Shelf angles.
   3. Loose bearing and leveling plates.
   4. Steel weld plates and angles for casting into concrete not specified in other Sections.
   5. Miscellaneous steel trim including steel edgings.
   6. Areaway grate.
   7. Metal ladders.
   8. Metal bollards.

B. Products furnished, but not installed, under this Section include the following:
   1. Loose steel lintels.
   2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Sections include the following:
   1. Section 033000 "Cast-In-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
   2. Section 042000 "Unit Masonry" for installing anchor bolts and other items indicated to be built into unit masonry.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Delegated Design: Design metal fabrications, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
1. Professional engineer shall be legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Paint products.
   2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.
   1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
   2. Provide templates for anchors and bolts specified for installation under other Sections.

C. Delegated Design: For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified registered professional engineer in the state of North Carolina responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Qualification Data: For professional engineer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
   2. Provide allowance for trimming and fitting at site.

1.8 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor
bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

C. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500, cold-formed steel tubing.

C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls.

1. Select fasteners for type, grade, and class required.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring iron fabrications to other types of construction indicated and capable of withstanding design loads.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.

E. Anchor Bolts: ASTM F 1554, Grade 36.
1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

F. Eyebolts: ASTM A 489.

G. Machine Screws: ASME B18.6.3.


J. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

K. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.


2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 09 painting Sections.

C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

D. Intermediate Coats and Topcoats: Provide products that comply with Division 09 painting sections.

E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

H. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion
cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. **Water-Resistant Product**: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

### 2.5 FABRICATION, GENERAL

**A. Shop Assembly**: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

**B. Cut, drill, and punch metals cleanly and accurately.** Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

**C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.**

**D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.**

**E. Connections**: Provide welded connections unless otherwise indicated.

**F. Weld corners and seams continuously to comply with the following:**

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

**G. Mechanical Connections**: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

**H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.** Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

**I. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water.** Provide weep holes where water may accumulate.

**J. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.**

**K. Provide for anchorage of type indicated; coordinate with supporting structure.** Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts if units are installed after concrete is placed.
3. Equip units with integrally welded anchors for casting into concrete or building into masonry.
4. Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide x 1/4 inch x 8 inches long.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls using G-90 coating.

2.8 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. Galvanize shelf angles located in exterior walls.
2.9 LOOSE BEARING AND LEVELING PLATES
A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
B. Galvanize plates after fabrication.

2.10 STEEL WELD PLATES AND ANGLES
A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.11 MISCELLANEOUS STEEL TRIM
A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
C. Galvanize exterior miscellaneous steel trim.
D. Prime interior miscellaneous steel trim, where indicated with zinc-rich primer.

2.12 AREAWAY GRATE
A. Areaway Grate: Subject to compliance with requirements provide basis of design product as specified and as shown on Drawings or an Architect approved comparable product.
   2. Bar Spacing: 1-1/14 inches o.c.
   3. Bar Thickness: 1/4 inch

2.13 METAL LADDERS
A. General:
   1. Comply with ANSI A14.3, unless otherwise indicated.
   2. Space siderails 18 inches apart, unless otherwise indicated.
   3. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted brackets, made from same metal as ladder.
B. Steel Ladders: Provide the following unless otherwise indicated on Drawings.
   1. Siderails: Continuous, 3/8- by 2-inch steel flat bars, with eased edges.
   2. Rungs: 3/4-inch diameter steel bars.
   3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
4. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

5. Galvanize exterior ladders and interior ladders, including brackets and fasteners.

2.14 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe. Cap bollards with 1/4 inch minimum thickness steel base plate.

B. Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4-inch thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.

C. Precast Bollard Domes: Provide 5000 psi, fiber-reinforced precast concrete pipe bollard caps with Class A formed finish and symmetrically domed profile.

2.15 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.16 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

1. Do not weld, cut, or abrade surfaces of components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Adjust fabrications before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Connections:

1. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting fabrication components. Use wood blocks and padding to prevent damage to members and fittings.

2. Welded Connections: Use fully welded joints for permanently connecting fabrication components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLING BEARING AND LEVELING PLATES


B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, nonmetallic, in all locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING METAL BOLLARDS

A. Anchor bollards to existing construction with expansion anchors or anchor bolts. Provide four 3/4-inch bolts at each bollard, unless otherwise indicated.
   1. Embed anchor bolts at least 4 inches in concrete.

B. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

C. Fill bollards solidly with concrete, and install precast bollard cap in accordance with manufacturer's written instructions.

D. Refer to Division 09 for paint requirements.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Extent and Testing Methodology: Testing agency will randomly select completed metal fabrication assemblies for testing that are representative of different designs and conditions in the completed Work. Railings will be tested according to ASTM E 894 and ASTM E 935 for compliance with performance requirements.

C. Remove and replace fabrications where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and will comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.7 PROTECTION

A. Protect finishes from damage during construction period with temporary protective coverings approved by manufacturer. Remove protective coverings at time of Substantial Completion.
B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055000
SECTION 055813 - METAL COLUMN WRAPS

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 metal column wraps.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including finishing materials.

B. Shop Drawings: Show fabrication and installation details for column covers.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Samples for Verification: For each type of exposed finish required, prepared on 6-inch-square Samples of metal of same thickness and material indicated for the Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For to include in maintenance manuals.

1.6 QUALITY ASSURANCE

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

B. Organic-Coating Applicator Qualifications: A firm experienced in successfully applying organic coatings of type indicated to metals of types indicated and that employs competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups of typical column covers.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver column covers wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.

PART 2 - PRODUCTS

2.1 SNAP-TOGETHER COLUMN WRAPS

A. Manufacturers: Subject to compliance with requirements, provide Basis of Design products indicated or Architect approved comparable products by one of the following:
   a. Atas International (Basis of Design)
   b. Pac-Clad.
   c. Or equal.

B. Form column covers to shapes shown on Drawings from metal of type and minimum thickness indicated below. Return vertical edges and bend to form hook that engages continuous mounting clips.
   1. Aluminum Sheet: ASTM B 209, with not less than strength and durability properties of Alloy 5005-H32, 0.125 inch thick. facings bonded, using no glues or adhesives, to solid, extruded thermoplastic core; formed into profile indicated.
      a. Finish: As Scheduled.
   2. Stainless Steel: Where indicated on Drawings provide 16 gage stainless steel column covers.
   3. Column covers may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.
   4. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide flat surfaces where indicated.
   5. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
   6. Hairline vertical joint connections.
   7. Diameter: 12-inches, unless otherwise indicated.
   8. Fabricate column covers without horizontal joints.
   9. Fabricate base and ceilings ring to match column covers.
   10. Fabricate with calk stop/stiffener ring.
   11. Apply manufacturer's recommended sound-deadening insulation or mastic to backs of column covers.

2.2 MISCELLANEOUS MATERIALS

A. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.
1. Provide concealed fasteners for interconnecting column covers and for attaching them to other work unless otherwise indicated.
2. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

B. Sound-Deadening Materials:
   2. Mastic: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

C. Backing Materials: Provided or recommended by column cover manufacturer.

2.3 FABRICATION, GENERAL
   A. Coordinate dimensions and attachment methods of column covers with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
   B. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends.

2.4 GENERAL FINISH REQUIREMENTS
   A. Complete mechanical finishes of flat sheet metal surfaces before fabrication where possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.
   B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
   C. Apply organic finishes to formed metal after fabrication unless otherwise indicated.
   D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ALUMINUM FINISHES
   A. Color and Gloss: As Scheduled and as Specified in Division 09 “High Performance Coatings”.
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 column covers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate and place column covers plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install column covers.

1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

B. Use concealed anchorages where possible.

C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.

D. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

3.3 ADJUSTING AND CLEANING

A. Clean copper alloys according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.

B. Touchup Painting: Immediately after erection, clean abraded areas of shop paint and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

C. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.4 PROTECTION

A. Protect finishes from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.
END OF SECTION 055813
This page intentionally left blank.
SECTION 061053 - MISCELLANEous ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Wood blocking, cants, and nailers.
   2. Plywood backing panels.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   2. NLGA: National Lumber Grades Authority.
   4. WCLIB: West Coast Lumber Inspection Bureau.
   5. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
   1. Preservative-treated wood.
   2. Fire-retardant-treated wood.
   3. Metal framing anchors.
1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation.

B. Lumber shall be stored off of the ground.

C. Provide for air circulation around stacks and under coverings with breathable tarps.

D. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

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. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
3. Use Categories:
   a. AWPA U1-UC1: Interior, dry applications, such as furniture, some millwork.
   b. AWPA U1-UC2: Interior, potentially damp applications, such as beams, timbers, flooring, framing, millwork, sill plates.
   c. AWPA U1-UC3A: Exterior, coated not in contact with ground, such as coated millwork, siding, trim.
   d. AWPA U1-UC4A: Exterior, in contact with ground normal, such as fence/deck posts.
   e. AWPA U1-UC5B: Exposed to salt water between NJ and Georgia/south of San Francisco

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
D. Application: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, blocking, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, blocking, and similar concealed members in contact with masonry or concrete.
   3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).
   1. Use treatment that does not promote corrosion of metal fasteners.
   2. Exterior: Use type for exterior locations and where indicated.
   3. Interior: Use Type A, High Temperature (HT) for enclosed roof framing and where indicated.
   4. Interior: Use Type A, unless otherwise indicated.

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

C. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

D. Application: Treat all interior and concealed wood blocking in and attached to rated walls and miscellaneous carpentry, unless otherwise indicated.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including blocking, nailers, and cants.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
   1. Spruce-pine-fir (south) or spruce-pine-fir, Construction or 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
   2. Eastern softwoods, No. 2 Common grade; NELMA.

D. For blocking not used for attachment of other construction Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness and fire-retardant treated per AWPA C27.
   1. Use treatment that does not promote corrosion of metal fasteners.
   2. Use Interior Type A, unless otherwise indicated.
   3. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 316 stainless steel.
B. Nails, Brads, and Staples: ASTM F 1667.
D. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
E. Lag Bolts: ASME B18.2.1.
F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
G. Expansion Anchors: 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.
   2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

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 to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
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 fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated.

E. Sort and select lumber so that natural characteristics will 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. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.

G. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

H. 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 between members. Install fasteners without splitting wood; 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.
   1. Do not use wood blocking in fire-resistance-rated assemblies.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 PROTECTION

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

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053
This page intentionally left blank.
SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Wall sheathing.

B. Related Sections include the following:

1. Section 061053 "Miscellaneous Rough Carpentry" for plywood backing panels.
2. Section 072726 "Fluid Applied Membrane Air Barriers" for air barrier membrane, flexible flashings at openings in sheathing and joint treatment of gypsum sheathing.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.


1.5 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 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Product: Subject to compliance with requirements, provide one of the following:

   a. CertainTeed Corporation; GlasRoc
   b. G-P Gypsum Corporation; DensGlass Gold
c. Lafarge North America; Weather Defense Platinum

d. National Gypsum; eXP Sheathing

e. United States Gypsum; Securock

2. Type and Thickness: Type X, 5/8 inch thick.


2.2 FASTENERS

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

   1. For wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.


D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

   1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.

   2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

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 ICC's "International Building Code."

D. Coordinate wall sheathing installation with flashing and joint-treatment installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

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

B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

C. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
   1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

3.3 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Refer to Section 072726 "Fluid-Applied Membrane Air Barriers" for joint and penetration treatment.

END OF SECTION 061600
This page intentionally left blank.
SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

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

1.2 SUMMARY
   A. This Section includes the following:
      1. Custom wood veneer millwork.
      3. Custom-laminate wood veneer cabinets.
      4. Solid-surface polymer countertops.
      5. Shop finishing of interior woodwork.

   B. Related Sections include the following:
      1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking concealed within other construction.
      2. Section 092216 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring cabinets.
      3. Section 096513 "Resilient Base and Accessories" for resilient base applied to casework.

1.3 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.

   B. MDF: Medium-density fiberboard.

   C. Exposed Portions of Cabinets: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches above floor, and surfaces visible in open cabinets.

   D. Semiexposed Portions of Cabinets: Surfaces behind opaque doors, such as interiors of cabinets, shelves, dividers, interiors and sides of drawers, and interior faces of doors. Tops of cases 78 inches or more above floor are defined as semiexposed.

   E. Concealed Portions of Cabinets: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, and ends and backs that are placed directly against walls or other cabinets.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated, including cabinet hardware and accessories.
B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   2. Show locations and sizes of cutouts and holes for plumbing fixtures and other items installed in architectural woodwork.

C. Samples: For each type of finish indicated.

D. Samples for Verification:
   1. Veneer-faced 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.
   2. Plastic-laminate materials, 6 inches square.
   3. Solid-surfacing materials, 6 inches square.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: AWI certified, with minimum of five years continuous experience in performing work of similar quality and scope.

B. Installer Qualifications: Fabricator of products.

C. 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.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.7 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.
B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.8 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.

1.9 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.

B. Coordinate construction of casework to accommodate countertops. Obtain specifications for countertops from fabricator and provide additional framing to support weight and span of countertops material.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Delamination of components or other failures of glue bond.
      b. Warping of components.
      c. Failure of operating hardware.
      d. Deterioration of finishes.
   2. Warranty Period: Five years from date of Substantial Completion.

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 Products: Comply with the following:
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Formica Corporation.
      c. Pionite Decorative Surfaces
      d. Wilsonart International; Div. of Premark International, Inc.
   2. Edgebanding: Grade VGS PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
   3. Colors, Patterns, and Finishes: As indicated on Interior Finish Legend.

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. E. I. du Pont de Nemours and Company
      b. Formica Corporation.
      c. LG Chemical Ltd.
      d. Samsung, Cheil Industries Inc.
      e. Transolid, Inc.
      f. Wilsonart International
   2. Type: Standard type made from material complying with requirements for Standard type, as indicated.
   3. Colors and Patterns: As indicated on Interior Finish Legend.

2.2 MISCELLANEOUS MATERIALS

A. General: All exposed fasteners in Patient Areas shall be tamper resistant equal to Torx rejection pin 6-lobe head.

B. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood 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.
2.3 FABRICATORS

A. Fabricators: Subject to compliance with requirements, provide interior architectural woodwork by one of the following:

1. Cabinets by Design, Duluth, GA
2. Cleora Sterling
3. Pridgen Millwork
4. Stephenson Millwork
5. Stevens Industries, Inc.
6. Harwil Fixtures

2.4 CUSTOM MILLWORK

A. Nurses Station and Registration Desk: Complying with the AWI's, AWMAC's and WI's "Architectural Woodwork Standards."

1. Grade: Premium.
2. Wood Veneer Species and Cut: Select White Maple, quarter sawn.
3. Grain Direction: Vertical, unless otherwise indicated.
5. Veneer Matching within Panel Face: Center-balance match.
6. Substrate shall be scored plywood.
7. Profile and Dimensions: As indicated on Drawings.
8. Polycarbonate 3/8" thickness window with sanded edges.

2.5 PLASTIC-LAMINATE-FACED CABINETS

A. Grade: Custom.

B. Cabinet Construction: Reveal overlay.

C. Exposed Cabinet Materials: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.
4. Unless otherwise indicated, provide specified edgebanding on all exposed edges.

D. Semiexposed Cabinet Materials:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS to match exposed surfaces.
   a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
   b. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.
F. Plastic-Laminate-Faced Cabinet Construction: As required by referenced quality standard, but not less than the following:

1. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch particleboard, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semiexposed surfaces.
2. Cabinet Joinery: Fixed body members shall be joined using dowels and assembled using glue and pressure.
3. Shelves: 1 inch thick particleboard, plastic-laminate faced.
4. Backs of Cabinets: 1/2-inch particleboard, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semiexposed surfaces.
5. Drawer Fronts: 3/4-inch particleboard, plastic-laminate faced.
6. Drawer Sides and Backs: 1/2-inch thermoset decorative panels, with glued dovetail or multiple-dowel joints.
7. Drawer Bottoms: 1/2-inch thermoset decorative panels glued and dadoed into front, back, and sides of drawers.
8. Doors: 3/4-inch particleboard or MDF, plastic-laminate faced.

G. Toe Kicks: Plastic laminate or wood veneer. Provide as shown on Drawings.

H. Filler Strips: Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.

I. Colors, Patterns, and Finishes: As indicated on Finish Legend.

2.6 CUSTOM WOOD CABINETS

A. Quality Standard: Comply with AWI Section 400 and the requirements of this section.

B. Grade: Premium.

C. AWI Type of Cabinet Construction: Flush overlay.

D. Reveal Dimension: As indicated.

E. Cabinet Materials

1. Exposed Cabinet Materials:
   a) Wood Species: Select White Hard Maple.
   b) Plywood: Hardwood plywood with face veneer. Grade A exposed faces at least 1/50 inch (0.5 mm) thick, and Grade J crossbands. Provide backs of same species as faces.
      i. Face Veneer Cut: Plain sliced.
   c) Unless otherwise indicated, provide specified edgebanding on all exposed edges.

2. Semiexposed Cabinet Materials:
   a) Solid Wood: Sound hardwood lumber.
   b) Plywood: Hardwood plywood of same species as exposed wood. Grade B faces and Grade J crossbands. Provide backs of same species as faces.

3. Concealed Cabinet Materials:
   a) Solid Wood: Any hardwood species, with no defects affecting strength or utility.
   b) Plywood: Hardwood plywood. Provide backs of same species as faces.
F. Cabinet Fabrication
   1. Wood-Faced Cabinet Construction:
      a) Bottoms of Cabinets and Tops of Wall Cabinets: 3/4-inch (19-mm) hardwood plywood.
      b) Ends of Cabinets: 3/4-inch (19-mm) hardwood plywood.
      c) Shelves: 3/4-inch (19-mm) veneer-core hardwood plywood.
      d) Base Cabinet Top Frames: 3/4-by-2-inch (19-by-51-mm) solid wood with mortise and tenon or doveled connections, glued and pinned or screwed.
      e) Base Cabinet Stretchers: 3/4-by-4-1/2-inch (19-by-114-mm) plywood, particleboard, or MDF strips or solid-wood boards at front and back of cabinet, glued and pinned or screwed.
      f) Base Cabinet Subtops: 3/4-inch (19-mm) panel product glued and pinned or screwed.
      g) Backs of Cabinets: 3/4-inch (19-mm) particleboard-core hardwood plywood where exposed, 1/4-inch (6.4-mm) hardboard dadoed into sides, bottoms, and tops where not exposed.
      h) Drawer Fronts: solid hardwood.
      i) Drawer Sides and Backs: 1/2-inch (12.7-mm) solid-wood or veneer-core hardwood plywood, with glued dovetail or multiple-dowel joints.
      j) Drawer Bottoms: 1/4-inch (6.4-mm) veneer-core hardwood plywood glued and dadoed into front, back, and sides of drawers. Use 1/2-inch (12.7-mm) material for drawers more than 24 inches (600 mm) wide.
      k) Doors 48 Inches (1220 mm) or Less in Height: 3/4 inch (19 mm) thick, with solid hardwood stiles and rails, hardwood plywood cores, and hardwood face veneers and crossbands.
      l) Doors More Than 48 Inches (1220 mm) in Height: 1-1/8 inches (29 mm) thick, with hardwood plywood cores and hardwood face veneers and crossbands.
   2. Leg Shoes: Rubber, black, open-bottom type.
   3. Filler Strips: Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.

G. Finish for Wood-Faced Manufactured Casework
   1. Finishing Closed-Grain Woods: Apply manufacturer's standard two-coat, baked, clear finish consisting of a thermosetting catalyzed sealer and a thermosetting catalyzed conversion varnish. Sand and wipe clean between applications of sealer and topcoat. Topcoat may be omitted on concealed surfaces.

2.7 CABINET HARDWARE AND ACCESSORIES
   A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Section 087100 "Door Hardware."
      1. Exposed fasteners shall be Torx rejection pin, 6-lobe head tamper-resistant.
   B. Butt Hinges: 2-3/4-inch, 5-knuckle steel hinges made from 0.095-inch thick metal, and as follows:
      1. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.
   C. Recessed Pulls: 2-9/16-inch stainless steel, circular recessed pull; equal to Doug Mockett Model No. DP153.
D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

E. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

F. Hanging File Storage: Provide manufacturer’s standard integral hanging file folder rails for file cabinet casework.

G. Drawer Slides: BHMA A156.9, B05091.
   1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
   2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches high and 24 inches wide.
   3. File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches high or 24 inches wide.
   4. Pencil Drawer Slides: Grade 1; for drawers not more than 3 inches high and 24 inches wide.

H. Door Locks: BHMA A156.11, E07121.

I. Drawer Locks: BHMA A156.11, E07041.

J. Grommets for Cable Passage through Countertops: Molded-plastic grommets and matching plastic caps with slot for wire passage.
      a. Provide "TG" (typical).
      b. Provide "XG" for large plugs (coordinate locations with Owner prior to installation).
   2. Provide at each sit down station.
   3. Color: To match counter.
   4. Grommet shall be permanently adhered to countertop with adhesive as recommended by the manufacturer.

K. Wall Mounted Shelf Standards and Brackets: Heavy-duty, double-slot, No. 87 Standards and No. 187 Brackets as manufactured by Knape & Vogt (Basis of Design) unless otherwise indicated on Drawings. Finish shall be clear anodized.

L. Counter Support Brackets: Work Station Brackets as manufactured by A & M Hardware, Inc. or equal. Brackets shall be fabricated of 1/8 inch thick steel. Size shall be 24 inch by 24 inch, unless indicated otherwise. Color shall be selected by the Architect from the manufacturer’s full line of standard colors. Provide at all countertop locations where there are no base cabinets, just knee space, unless indicated otherwise.

M. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish numbers indicated.
   1. BHMA 630: Satin finish stainless steel, unless indicated otherwise.

N. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
2.8 COUNTERTOPS

A. Countertops, General:
   1. Provide smooth, clean exposed tops and edges in uniform plane free of defects.
   2. Coordinate with keyboard slide requirements.
   3. Provide front and end overhang of 1 inch over base cabinets.

B. Solid-Surfacing Material:
   1. Grade/Price Group: As Scheduled.
   2. Solid-Surfacing-Material Thickness: 1/2 inch; use substrate per manufacturer's recommendation to achieve thickness as shown on Drawings.
   3. Fabricate tops with shop-applied edges of materials and configuration indicated.
      a. Front: Straight, slightly eased at top.
      b. Backsplash: Straight, slightly eased at corner.
      c. Endsplash: Matching backsplash.
   4. Fabricate tops with loose backsplashes for field application.
   5. Sink Bowl:
      a. Basis of Design (where indicated): Wilsonart – Oval ADA Vanity Bowl “BV1512”
      c. Color: As selected by Architect from manufacturer's full range.
   6. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
      a. Adhesive color shall match solid-surfacing material.

2.9 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:

D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

E. Shop-cut openings to maximum extent possible to receive hardware 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.

2.10 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.

D. Transparent Finish:

1. Grade: Custom.
2. AWI Finish System: Catalyzed polyurethane.
3. Staining: As selected by Architect from manufacturer's full range.
4. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.

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. Custom Millwork: Install custom millwork level, plumb, true, and straight with no distortions. Adjust hardware to provide unencumbered operation.
   1. Maintain veneer sequence matching of cabinets with transparent finish.

G. 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. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with the following:
      a. No. 10 security-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.
      b. No. 10 security-head screws through metal backing or metal framing behind wall finish.
      c. Toggle bolts through metal backing or metal framing behind wall finish.

H. Countertops:
   1. Install countertops level to a tolerance of 1/8 inch in 8 feet.
   2. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
      a. Install backsplashes and endsplashes to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
   3. Seal edges of cutouts in particleboard subtops by saturating with varnish.

I. 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 semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

D. Protection: Provide 6-mil plastic or other suitable water-resistant covering over countertop surfaces. Tape to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 064023
SECTION 070150 – ROOF PATCHING AND REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Repair of roofing.

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 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations. Submit before Work begins.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Approved by warrantor of existing roofing system to work on existing roofing.

   B. Roof Patching Conference: Conduct conference at Project site.

1.6 FIELD CONDITIONS

A. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.

   B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

   C. Limit construction loads on roof. Do not stack material in excess of structural capacity.

   D. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.
1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during reroofing, by methods and with materials so as not to void existing roofing system warranty issued by GAF. Warranty is appended to this section as a reference.

1. Notify warrantor before proceeding with the Work.
2. Notify warrantor of existing roofing system on completion of reroofing, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect.
   a. Submit documentation at Project closeout.

B.

PART 2 - PRODUCTS

2.1 INFILL AND REPLACEMENT MATERIALS
A. Use infill materials matching existing roofing system materials unless otherwise indicated.

2.2 AUXILIARY REROOFING MATERIALS
A. General: Use auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing and new roofing system.

PART 3 - EXECUTION

3.1 PREPARATION
A. Shut off rooftop utilities and service piping before beginning the Work.
B. Protect existing roofing system that is not altered.
C. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.

3.2 ROOF TEAR-OFF
A. Partial Roof Tear-Off: Where indicated, remove existing roofing and immediately check for presence of moisture by visually observing substrate that is to remain.
B. Cut back existing roofing where required to accommodate new and enlarged penetrations as indicated.
3.3 BASE FLASHING REMOVAL

A. Remove existing base flashings where indicated. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.

B. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings of same metal, weight or thickness, and finish.

3.4 FLASHING AND REPAIRS

A. Comply with manufacturer’s recommendations and detail plates in NRCA Roofing Manual: Membrane Roof Systems - 2011 for flashing new curbs into existing roofing and other work on roof, as indicated.

B. Repair damaged areas, as indicated, with material matching existing.

C. Perform all work to ensure existing warranty remains in force.

3.5 DISPOSAL

A. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 070150
GAF DIAMOND PLEDGE™ NDL ROOF GUARANTEE

ALLIANCE CHILD CRISIS CENTER DBA ALLIANCE CHILD

OWNER:

NAME AND TYPE OF BUILDING:

ADDRESS OF BUILDING:

APPLIED BY:

GUARANTEE PERIOD:

DATE OF COMPLETION:

GUARANTEE EXPIRATION DATE:

THE GUARANTEE/SOLE AND EXCLUSIVE REMEDY

GAF guarantees to you, the owner of the building described above, that GAF will provide “Edge To Edge” protection by repelling leaks through the GAF roofing membrane, built-up membrane or coating, base flashing, high wall waterproofing flashing, joint covers, flashed accessory metal sheeting, and metal flashings used by the contractor of record that meet SMACNA standards (the “GAF Roofing Materials”) and/or materials that are manufactured defect, ordinary wear and tear, or workmanship in applying them. This guarantee has no dollar limit on covered leaks. Leaks caused by any non-GAF materials, such as the roof deck or non-GAF insulation, are not covered.

GUARANTEE PERIOD

This guarantee ends on the expiration date listed above. NOTE: Lexacore® flashings are covered by this guarantee ONLY for the first ten years.

OWNER RESPONSIBILITIES

Notification of Leaks

In the event of a leak through the GAF Roofing Materials, you MUST make sure that GAF is notified directly about the leak, in writing, within 30 days after the leak is first discovered. You must (a) notify GAF via fax or e-mail at 1-888-733-7974 or gaf.com or by postal mail to GAF Guarantee Services, 1 Campus Drive, Parsippany, NJ 07054, or GAF will have no responsibility for making repairs. NOTE: The roofing contractor is NOT an agent of GAF; GAF does not pay for roof leaks. By notifying GAF, you authorize GAF to investigate the cause of the leak. If the investigation reveals that the leak is not covered by this guarantee, you agree to pay an investigation cost of $500. This guarantee will be cancelled if you fail to pay this cost within 30 days of receipt of an invoice for it.

Preventative Maintenance and Repairs

A. You must perform regular inspections and maintenance and keep records of this work.

B. To keep this guarantee in effect, you must repair any conditions in the building structure or roofing system that are not covered by this guarantee but that GAF concludes may be threatening the integrity of the GAF Roofing Materials. Any such repairs must be performed by a GAF-certified roofing contractor. Failure to make timely repairs may jeopardize guarantee coverage.

C. You may make temporary repairs to minimize damage to the building or its contents in an emergency, at your own expense. These repairs will not result in cancellation of the guarantee as long as they are reasonable and customary and do not result in permanent damage in the GAF Roofing Materials.

D. Any equipment or material that impeded any inspection or repair must be removed at your expense so that GAF can perform inspections or repairs.

EXCLUSIONS FROM COVERAGE

(For example, items that are not "ordinary wear and tear" or are beyond GAF’s control)

This guarantee does NOT cover conditions other than leaks. This guarantee also does NOT cover leaks caused by any of the following:

1. Inadequate roof maintenance, that is, the failure to follow the Scheduled Maintenance Checklists provided with this guarantee or any applicable building manual (extra copies available by calling Guarantee Services at 1-800-378-9027 or gaf.com or by postal mail to GAF Guarantee Services, 1 Campus Drive, Parsippany, NJ 07054, or GAF will have no responsibility for making repairs).

2. Unusual weather conditions or natural disasters including, but not limited to, winds in excess of 55 miles per hour, hail, floods, hurricanes, tornados, and earthquakes, unless specifically covered by an endorsement to this guarantee.

3. Impact of foreign objects or physical damage caused by any intentional or negligent acts, accidents, misuse, abuse or the like.

4. Damage to the roof constructed of the GAF Roofing Materials due to: (a) movement, cracking, or other failure of the roof deck or building; (b) improper installation or failure of any non-GAF insulation or materials; (c) condensation or perforation or infiltration of moisture through or around the walls, copings, building structure, or surrounding materials except where high wall GAF waterproofing flashings are installed; (d) chemical attack on the membrane, including, but not limited to, exposure to gasoline or other flammable or corrosive liquids; (e) the failure of wood rafters to remain attached to the structure; (f) use of materials that are incompatible with the GAF Roofing Materials; or (g) architectural, engineering, or design defects or flaws.

5. Traffic of any nature on the roof unless using GAF walkways, ramps, or other means approved in writing by GAF or GAF’s application instructions.

6. Entries in the GAF Roofing Materials that have not resulted in leaks.

7. Changes in the use of the building or any repairs, modifications, or additions to the GAF Roofing Materials after the roof is completed, unless approved in writing by GAF.

8. Exposure to sustained high-temperature conditions; however, for the systems utilizing EverGuard Extreme® TPO membrane, exposure in excess of 195°F.

No representative, employee, or agent of GAF, or any other person, has the authority to assume any additional or other liability or responsibility for GAF; unless it is in writing and signed by an authorized GAF Field Service Manager or Director. GAF does not practice engineering or architecture. Neither the issuance of this guarantee, nor any review of the roof constructed of the GAF Roofing Materials or the plans for the roof, by GAF shall constitute any warranty of such plans, specifications or construction or the suitability or code compliance of the GAF Roofing Materials for any particular structure. NOTE: Any inspections made by GAF are limited to a surface inspection only, are for GAF’s sole benefit, and do not constitute a waiver or extension of any of the terms and conditions of this guarantee.

This guarantee MAY BE SUSPENDED OR CANCELLED IF THE ROOF IS DAMAGED BY ANY CAUSE LISTED ABOVE AS AN EXCLUSION FROM COVERAGE that may affect the integrity or water-tightness of the roof.

TRANSFERABILITY

You may transfer or assign this guarantee to a subsequent owner of this building for the remaining term only if: (1) the request is in writing at GAF at the address listed within 60 days after ownership transfer; (2) you make any repairs to the GAF Roofing Materials or other roofing or building components that are identified by GAF after an inspection as necessary to preserve the integrity of the GAF Roofing Materials; and (3) you pay an assignment fee of $500. This guarantee is NOT otherwise transferable or assignable by contract or operation of law, either directly or indirectly.

LIMITATION OF DAMAGES; MEDIATION; JURISDICTION; CHOICE OF LAW

This guarantee is expressly in lieu of any other guarantees or warranties, express or implied, including any implied warranty of merchantability or fitness for a particular purpose, and of any other obligations or liabilities of GAF, whether any claim against it is based upon negligence, breach of warranty, or any other theory. In no event shall GAF be liable for any CONSEQUENTIAL or INCIDENTAL DAMAGES of any kind, including, but not limited to, interior or exterior damage due to wind or hail.

The parties agree that, as a condition precedent to litigation, any controversy or claim relating to this guarantee shall be first submitted to mediation with a mutually acceptable mediator. In the event that mediation is unsuccessful, the parties agree that neither one will commence or prosecute any lawsuit or proceeding other than before the appropriate state or federal court in the State of New Jersey. This guarantee shall be governed by the laws of the State of New Jersey, without regard to principles of conflicts of law. Each party irrevocably consents to the jurisdiction and venue of the above identified courts.

NOTE: GAF shall have no obligation under this guarantee unless and until all bills for installation and supplies have been paid in full to the roofing contractor and materials suppliers, and the guarantee charge has been paid to GAF.

This guarantee must have a raised seal to be valid.
This page intentionally left blank.
SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Foam-plastic board insulation.
   2. Glass-fiber blanket insulation.

B. Related Sections:
   1. Section 042000 "Unit Masonry" for insulation installed in cavity walls.
   2. Section 075216 "Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing" for insulation specified as part of roofing construction.
   3. Section 078446 "Fire-Resistive Joint System" for head-of-wall fire-stop sealants used for fire-rated walls.
   4. Section 092900 "Gypsum Board" for sound attenuation blankets.

1.3 DEFINITIONS


1.4 ACTION SUBMITTALS

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

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.5 INFORMATIONAL SUBMITTALS

A. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.
1.6 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1.7 PERFORMANCE REQUIREMENTS

A. Provide insulation, where indicated, in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
   1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm air velocity.
   2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

1.8 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:
   1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
   3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.
PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. DiversiFoam Products
      b. Dow Chemical Company
      c. Owens Corning
   2. Type IV, 25 psi.
   3. Provide manufacturer's standard shiplap or tongue and groove edges on vertical applications below grade and over exterior sheathing on metal stud cavity wall assembly.
   4. Thickness: As indicated on Drawings or as required to meet R-value indicated on Drawings.
   5. Thermal Resistance, per ASTM C518, at 75 deg. F mean temperature shall be R-5 per inch.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.2 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CertainTeed Corporation
   2. Johns Manville
   3. Knauf Insulation
   4. Owens Corning

B. Glass-Fiber Blanket, Reinforced-Foil Faced: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

2.3 MINERAL-WOOL BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Fibrex Insulations Inc.
   2. Owens Corning
   3. Roxul Inc.
   4. Thermafiber
B. Unfaced, Mineral-Wool Blanket Insulation: 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.

2.4 INSULATION FASTENERS

A. Fasteners: Product recommended and approved by insulation manufacturer, with demonstrated capability to secure insulation to substrates indicated without damaging insulation and substrates and complying with other listed performance characteristics.

B. Mastic Sealer: Type recommended by insulation manufacturer for bonding edge joints between units and filling voids in work.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
   1. If not otherwise indicated, extend insulation a minimum of 36 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.
1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.5 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
6. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100
This page intentionally left blank.
SECTION 072419 - WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. EIFS-clad drainage-wall assemblies that are field applied over substrate.
2. Water-resistant coatings.

B. Related Requirements:

1. Section 014000 "Quality Requirements" for integrated exterior mockup for field testing of EIFS system.
2. Section 072726 "Fluid-Applied Membrane Air Barriers."
3. 079200 "Joint Sealants" for sealing joints in EIFS with elastomeric joint sealants and for perimeter joints between system and other materials.

1.3 DEFINITIONS

A. Definitions in ASTM E 2110 apply to Work of this Section.

B. EIFS: Exterior insulation and finish system(s).


1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each EIFS component, trim, and accessory, including water-resistant coatings.

B. Samples: For each exposed product and for each color and texture specified, 8 inches square in size.
C. Samples for Verification: 24-inch-square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work including custom trim, each profile, and an aesthetic reveal.

1. Include exposed trim and accessory Samples to verify color selected.
2. Include a typical control joint filled with sealant of color selected, as specified in Section 079200 "Joint Sealants."

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer Certificates: Signed by EIFS manufacturer certifying the following:

1. EIFS complies with requirements.
2. Substrates to which EIFS is indicated to be attached are acceptable to EIFS manufacturer.
3. Accessory products installed with EIFS, including joint sealants, flashing, water-resistive coatings, trim, whether or not furnished by EIFS manufacturer and whether or not specified in this Section, are acceptable to EIFS manufacturer.

C. Product Certificates: For insulation and joint sealant, from manufacturer.

D. Product Test Reports: For each EIFS assembly and component, and for water-resistive coatings, for tests performed by a qualified testing agency.

E. Field quality-control reports and special inspection reports.

F. Evaluation Reports: For EIFS, including insulation fasteners, water-resistive coatings, and flexible membrane flashing, from ICC-ES.

G. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For EIFS to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation. Refer to Section 014000 "Quality Requirements."
1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.

   1. Stack insulation board flat and off the ground.
   2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
   3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.10 FIELD CONDITIONS

A. Weather Limitations: Maintain ambient temperatures above 40 deg F for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EIFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1.11 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS-clad drainage-wall assemblies that fail in materials or workmanship within specified warranty period.

   1. Failures include, but are not limited to, the following:
      a. Bond integrity and weathertightness.
      b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.

   2. Warranty coverage includes the following components of EIFS-clad drainage-wall assemblies:
      a. EIFS finish, including base coats, finish coats, and reinforcing mesh.
      b. Insulation installed as part of EIFS including foam build-outs.
      c. Insulation adhesive and mechanical fasteners.
      d. EIFS accessories, including trim components and flashing.
      e. Water-resistive coatings.
      f. EIFS drainage components.

   1. Warranty coverage also includes the fluid-applied membrane air barrier specified in Section 072419.
2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Subject to compliance with requirements, provide StoTherm ci Lotusan System by STO or comparable system by one of the following:

1. BASF Corporation; Wall Systems.
2. Dryvit Systems, Inc.
3. Parex USA, Inc.
4. Senergy.
5. Sto Corp.

B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with EIFS components.

2.2 PERFORMANCE REQUIREMENTS

A. EIFS Performance: Comply with ASTM E 2568 and ICC-ES AC219 and with the following:

1. Weathertightness: Resistant to uncontrolled water penetration from exterior, with a means to drain water entering EIFS to the exterior.
3. Structural Performance: EIFS assembly and components shall comply with ICC-ES AC219 when tested according to ASTM E 2568.
   a. Wind Loads: Uniform pressure as indicated on Drawings.
4. Impact Performance: ASTM E 2568, impact resistance, as indicated.
   a. First Floor and within touch at upper floors: High.
5. Bond Integrity: Free from bond failure within EIFS components or between EIFS and substrates, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
6. Abrasion Resistance of Finish Coat: Sample consisting of 1-inch-thick EIFS mounted on 1/2-inch-thick gypsum board; cured for a minimum of 28 days and shows no cracking, checking, or loss of film integrity after exposure to 528 quarts of sand when tested according to ASTM D 968, Method A.
7. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch clean glass substrate; cured for 28 days and shows no growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274.
2.3 EIFS MATERIALS

A. Primer/Sealer: EIFS manufacturer's standard substrate conditioner designed to protect substrates from moisture penetration and to improve the bond between substrate and insulation adhesive.

B. Water-Resistive Coatings: EIFS manufacturer's standard formulation and accessories for use as water-resistant barriers; compatible with substrate and complying with physical and performance criteria of ASTM E 2570.

C. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

D. Expanded Polystyrene Board Insulation: Comply with ASTM C 578, Type X; and EIFS manufacturer's requirements for most stringent requirements for material performance and qualities of insulation, including dimensions and permissible variations, and the following:
   1. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than six weeks.
   2. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, according to ASTM E 84.
   3. Dimensions: Provide insulation boards of not more than 24 by 48 inches and in thickness indicated, but not more than 4 inches thick or less than the thickness allowed by ASTM C 1397.
   4. Channeled Board Insulation: EIFS manufacturer's standard factory-fabricated profile with linear, vertical-drainage channels, slots, or waves on the back side of board.
   5. Foam Build-Outs: Provide with profiles and dimensions indicated on Drawings.

E. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; specifically formulated to be applied to back side of insulation in a manner that creates open vertical channels designed to serve as an integral part of the water-drainage system of the EIFS-clad drainage-wall assembly; compatible with substrate; and complying with one of the following:
   1. Job-mixed formulation of portland cement complying with ASTM C 150/C 150M, Type I, and polymer-based adhesive specified for base coat.
   2. Factory-blended dry formulation of portland cement, dry polymer admixture, and fillers specified for base coat.
   3. Factory-mixed noncementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.

F. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. according to ASTM E 2098 and the following:
   1. Reinforcing Mesh for EIFS, General: Not less than weight required to meet impact-performance level specified in "Performance Requirements" Article.
   2. Strip Reinforcing Mesh: Not less than 3.75 oz./sq. yd..
   3. Detail Reinforcing Mesh: Not less than 4.0 oz./sq. yd..
   4. Corner Reinforcing Mesh: Not less than 7.2 oz./sq. yd.
G. Base-Coat Materials: EIFS manufacturer's standard mixture complying with one of the following:

1. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
2. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.

H. Waterproof Adhesive/Base-Coat Materials: EIFS manufacturer's standard waterproof formulation and complying with one of the following:

1. Job-mixed formulation of portland cement complying with ASTM C 150/C 150M, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.

I. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.

J. Finish-Coat Materials: EIFS manufacturer's acrylic-based coating with proprietary water-shedding additives complying with the following:

1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
2. Colors: As indicated by manufacturer's designations.
3. Textures: As indicated by manufacturer's designations.
   a. Smooth: Sto Fine 1.0.
   b. Ultra Smooth: Stolit Milano Ultra Smooth

K. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.

L. Water: Potable.

M. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784, manufacturer's standard cell class for use intended, and ASTM C 1063.

1. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
2. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
3. Weep Screed/Track: Prefabricated, one-piece type for attachment behind insulation with perforated face leg extended to form a drip and weep holes in track bottom, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg; designed to drain incidental moisture that gets into wall construction to the exterior at terminations of EIFS with drainage.

4. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.

5. Windowsill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.

2.4 MIXING

A. Comply with EIFS manufacturer’s requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Begin coating application only after surfaces are dry.

2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.

B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind drainage plane of EIFS and deterioration of substrates.

C. Prepare and clean substrates to comply with EIFS manufacturer’s written instructions to obtain optimum bond between substrate and adhesive for insulation.
3.3 EIFS INSTALLATION, GENERAL

A. Comply with ASTM C 1397, ASTM E 2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

3.4 SUBSTRATE PROTECTION APPLICATION

A. Water-Resistive Coating: Apply over sheathing to provide a water-resistive barrier.

1. Tape and seal joints, exposed edges, terminations, and inside and outside corners of sheathing unless otherwise indicated by EIFS manufacturer's written instructions.

B. Flexible-Membrane Flashing: Install over weather-resistant barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where required by EIFS manufacturer. Prime substrates if required and install flashing to comply with EIFS manufacturer's written instructions and details.

3.5 TRIM INSTALLATION

A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, at windowsills, and elsewhere as indicated. Coordinate with installation of insulation.

1. Weep Screed/Track: Use at bottom termination edges, at window and door heads, and at floor line expansion joints of water-drainage EIFS unless otherwise indicated.

2. Windowsill Flashing: Use at windows unless otherwise indicated.

3. Expansion Joint: Use where indicated on Drawings.

4. Casing Bead: Use at other locations.

3.6 INSULATION INSTALLATION

A. Board Insulation: Adhesively attach insulation to substrate in compliance with ASTM C 1397 and the following:

1. Apply adhesive to ridges on back of channeled insulation by notched-trowel method in a manner that results in full adhesive contact over the entire surface of ridges, leaving channels free of adhesive once insulation is adhered to substrate.

2. Press and slide insulation into place. Apply pressure over the entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.

3. Allow adhered insulation to remain undisturbed for not less than 24 hours, before installing mechanical fasteners, beginning rasping and sanding insulation or applying base coat and reinforcing mesh.

4. Apply insulation over substrates in courses with long edges of boards oriented horizontally.

5. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.

6. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints so no piece of insulation is less than 12 inches wide or 6 inches...
high. Offset joints not less than 6 inches from corners of window and door openings and not less than 4 inches from aesthetic reveals.

a. Adhesive Attachment: Offset joints of insulation not less than 6 inches from horizontal and 4 inches from vertical joints in sheathing.

7. Mechanical Attachment: Offset joints of insulation from horizontal joints in sheathingInterlock ends at internal and external corners.

8. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.

9. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.

10. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch. Prevent airborne dispersal and immediately collect insulation raspings or sandings.

11. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch.

12. Install foam build-outs and attach to sheathing.

13. Interrupt insulation for expansion joints where indicated.

14. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.

15. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.

16. After installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches over front and back face unless otherwise indicated on Drawings.

17. Treat exposed edges of insulation as follows:

a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.

b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.

c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.

18. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and water-resistive barrier.

B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:

1. At expansion joints in substrates behind EIFS.
2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
3. At floor lines in multilevel wood-framed construction.
4. Where wall height or building shape changes.
5. Where EIFS manufacturer requires joints in long continuous elevations.

3.7 BASE-COAT INSTALLATION

A. Waterproof Adhesive/Base Coat: To exposed surfaces of insulation, apply in minimum thickness recommended in writing by EIFS manufacturer over sloped surfaces, windowsills, parapets, foam build-outs, and where indicated on Drawings.

B. Base Coat: Apply to exposed surfaces of insulation and foam build-outs in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch dry-coat thickness.

C. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.

D. Double-Layer Reinforcing-Mesh Application: Where indicated or required, apply second base coat and second layer of reinforcing mesh, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions in same manner as first application. Do not apply until first base coat has cured.

E. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings, extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch-wide, strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches on each side of corners.

   1. At aesthetic reveals, apply strip reinforcing mesh not less than 8 inches wide.
   2. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.

F. Foam Build-Outs: Fully embed reinforcing mesh in base coat.

G. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application, except without reinforcing mesh. Do not apply until first base coat has cured.

3.8 FINISH-COAT INSTALLATION

A. Primer: Apply over dry base coat according to EIFS manufacturer's written instructions.

B. Finish Coat: Apply over dry primed base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color.
and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

C. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

3.9 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. As stipulated in Ch. 17 of the IBC.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.


D. EIFS will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 CLEANING AND PROTECTION

A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION 072419
This page intentionally left blank.
SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Fluid-applied vapor-permeable membrane air barriers.

B. Related Sections include the following:
   1. Section 042000 "Unit Masonry" for embedded flashings.
   2. Section 061600 "Sheathing" for wall sheathings.
   3. Section 072100 "Thermal Insulation" for foam-plastic board insulation.
   4. Section 076200 "Sheet Metal Flashing and Trim" for sheet metal flashings.
   5. Section 079200 "Joint Sealants" for joint-sealant materials and installation.

1.3 DEFINITIONS

A. ABAA: Air Barrier Association of America.

B. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

C. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

D. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air barrier meets ABAA performance for vapor-retarding air barrier assemblies.
C. Air Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357 or .004 for ASTM E 2178 per ABAA Guide Specification.

D. Water Resistance: Material shall resist 21.6 in water for 5 hours before and after aging when tested per ICC-ES 212.

E. Nail Seal-Ability: Material shall allow no water found on nail shanks, on underside of sheathing and/or between sheathing and product coating when tested per ASTM D 1970.

F. Flammability: Material shall allow a flame spread of less than 25 and smoke development of less than 450 when tested per ASTM E 84.

G. Adhesion: Material shall exhibit a minimum adhesion of 15 psi when tested per ASTM D 4541.

H. Compatibility: Material shall be compatible with adjacent materials.

I. UV Stability: Material shall survive a minimum of 6 months UV Exposure during construction.

J. System Continuity: Material Manufacturer shall provide materials/system for an interface with windows, door and other penetrations that integrate into a compatible and continuous air barrier assembly.

1.5 ACTION SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.

B. Shop Drawings: Manufacturer to provide job specific details for air-barrier assemblies.
   1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   2. Include details of interfaces with other materials that form part of air barrier.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.

B. Qualification Data: For Installer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers.
1.7 QUALITY ASSURANCE

A. Installer Qualifications: A firm with three to five years experience in applying air barrier materials similar in material, design, complexity, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Manufacturer’s Technical Representative Qualifications: An authorized full-time employee representative of manufacturer experienced in the installation and maintenance of the specified system and qualified to determine Installer’s compliance with the requirements of this Project.

C. All associated products used in conjunction with air barrier membranes and forming an integral part of the waterproofing system must meet the approval of the air barrier manufacturer and maintain applicable warranties.

D. Mockups: Before beginning installation of air barrier, build mockups of exterior wall assembly, incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, penetration and barrier flashings, terminations, and penetrations of air barrier membrane.
   1. Mockup can be a designated area of the actual wall construction or a freestanding wall assembly mockup panel.
   2. Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.
   3. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
   4. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
   5. If designated area of the actual wall construction is used as a mockup, the approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site.
   1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.
   2. Include Owner, Architect, Installer, Manufacturer’s technical representative, and installers of other construction affecting or connecting to air barrier, including roofing, waterproofing, architectural precast concrete, masonry, sealants, windows, glazed curtain walls, and door frames.
   3. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in their original undamaged packages, with labels intact and legible.

B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.
C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Store materials according to manufacturer’s written instructions.

E. Protect stored materials from direct sunlight.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

   1. Apply materials when ambient temperature is above minimum temperature recommended by the manufacturer for a period of 24 hours prior to the application and when air temperature during the cure period is expected to remain above minimum temperature recommended by the manufacturer.

B. Product selection shall be coordinated with construction sequence to ensure that manufacturer’s exposure limits are adequate for anticipated schedule. Air barrier membrane exposed beyond the manufacturer’s exposure limits shall be recoated, reinspected and reapproved at Contractor’s own expense.

PART 2 - PRODUCTS

2.1 FLUID-APPLIED MEMBRANE AIR BARRIER

A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Elastomeric, modified bituminous or synthetic polymer membrane.

   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Elastomeric, Modified Bituminous Membrane:
         1) Henry Company; Air-Bloc 17.
         2) Hohmann & Barnard, Inc.; Textroflash Liquid VP.
         3) Meadows, W. R., Inc.; Air-Shield LMP.
         4) Tremco Incorporated; an RPM company; ExoAir 220R.
      b. Synthetic Polymer Membrane:
         1) Carlisle Coatings & Waterproofing Inc.; Barritech VP.
         2) Grace, W. R., & Co. - Conn.; Perm-A-Barrier VP.
         3) Henry Company; Air-Bloc 31.
         4) Tremco Incorporated; an RPM company; ExoAir 230.
         5) Tk Products; Air Max 2104 VP.

   2. Physical and Performance Properties:
      a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
      b. Vapor Permeance: Minimum 10 perms; ASTM E 96/E 96M.
      c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
2.2 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid solvent-borne primer recommended for substrate by manufacturer of air barrier material.

C. Penetration and Barrier Flashing: Vapor-retarding, 40-mil-thick, smooth-suraced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil-thick polyethylene film with release liner backing.

D. Elastomeric Flashing Sheet: ASTM D 2000, 2BC415 to 3BC620, minimum 50- to 65-mil-thick, cured sheet neoprene with manufacturer's recommended contact adhesives and lap sealant with stainless-steel termination bars and fasteners.

E. Counterflashing and Transition Strip: Modified bituminous, 40-mil-thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil-thick, crosslaminated polyethylene film with release liner backing.

F. Joint Reinforcing Strip: Air barrier manufacturer's glass-fiber-mesh tape.

G. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

H. Adhesive and Tape: Air barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

I. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

J. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.

K. Sprayed Polyurethane Foam Sealant: 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.

L. Preformed Silicone- Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

M. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 "Joint Sealants."
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer and Manufacturer’s Technical Representative present, for compliance with requirements and other conditions affecting performance.
   1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
   2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
   3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
   4. Verify that masonry joints are flush and completely filled with mortar.
   5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
   1. Prime substrate and apply a single thickness of preparation coat strip extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of air barrier membrane and embed a joint reinforcing strip in preparation coat.
B. Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and with air barrier manufacturer's written instructions. Tape joints with 2-inch wide mesh tape.

3.4 FLASHING INSTALLATION

A. Install flashings and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
   1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
   2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, PVC membranes, and sealants not approved by air barrier manufacturer.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.
   1. Prime glass-fiber-surfaces of gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

C. Penetration Flashing: Apply penetration flashing at all openings and penetrations so that a minimum of 3 inches of coverage is achieved over both substrates.

D. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

E. Barrier Flashing: Apply barrier flashing to connect and seal exterior wall air barrier membrane continuously to perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations.

F. Install transition strip, of compatible material, over roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over both substrates.

G. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

H. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transitions as required by manufacturer.

I. Seal flashings around masonry reinforcing or ties and penetrations with termination mastic.

J. Seal top of through-wall flashings to air barrier with an additional 6-inch wide, counterflashing strip.

K. Seal exposed edges of flashings at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

L. Repair punctures, voids, and deficient lapped seams in flashings. Slit and flatten fishmouths and blisters. Patch with flashings extending 6 inches beyond repaired areas in strip direction.

M. At end of each working day, seal top edge of flashings to substrate with termination mastic.
3.5 AIR BARRIER MEMBRANE INSTALLATION

A. Begin application in presence of, and after the Manufacturer’s Technical Representative has approved mockup. Commencement of application constitutes Contractor’s acceptance of substrates and conditions.

B. Apply air barrier membrane to form a seal with flashings and to achieve a continuous air barrier according to air barrier manufacturer's written instructions.

C. Apply air barrier membrane within manufacturer's recommended application temperature ranges.

D. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.
   1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

E. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.
   1. Vapor-Permeable Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 40-mil dry film thickness, applied in one or more equal coats.

F. Apply flashings over cured air barrier membrane overlapping 3 inches onto each surface according to air barrier manufacturer's written instructions.

G. Do not cover air barrier until it has been inspected by Owner's testing agency.

H. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.6 FIELD QUALITY CONTROL

A. Contractor/Installer Testing: Installer shall have a wet film thickness gauge at all times during application and shall periodically check thickness of membrane during application with wet film thickness gauge.

B. Manufacturer’s Technical Representative: Contractor will engage a qualified Manufacturer’s Technical Representative for a minimum of two full-time days to perform on-site inspections and prepare reports.
   1. Manufacturer’s representative shall conduct inspections at start of installation, twenty-five percent complete, fifty percent complete and final, with reports to Architect. Deficiencies shall be listed on the inspection reports and repairs/corrections certified completed with next or final report.

C. 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 flashings have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
8. Termination mastic has been applied on cut edges.
9. Flashings 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.
13. All penetrations have been sealed.

D. Remove and replace deficient air barrier components and reinspect as specified above.

3.7 CLEANING AND PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier showing signs of deterioration or when left exposed beyond manufacturer’s approved exposure limitation.

B. 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.

C. Remove masking materials after air barrier installation is complete.

END OF SECTION 072726
This page intentionally left blank.
SECTION 074243 - METAL COMPOSITE WALL AND SOFFIT PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

   A. Section Includes:
      1. Concealed-fastener, metal-faced composite wall panels.
      2. Concealed-fastener, metal-faced composite soffit panels.

   B. Related Sections:
      1. Section 076200 "Sheet Metal Flashing and Trim" for field-formed flashings and other sheet metal work not part of metal composite panel assemblies.

1.3 DEFINITION

   A. Metal-Faced Composite Wall and Soffit Panel Assembly: Metal-faced composite wall and soffit panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete wall and soffit system.

1.4 ACTION SUBMITTALS

   A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal composite panel and accessory.

   B. Shop Drawings: Show fabrication and installation layouts of metal composite panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work. Shop drawings shall be prepared by panel manufacturer.

      1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
         a. Flashing and trim.
         b. Anchorage systems.

   C. Samples: For each type of exposed finish required.

      1. Metal Composite Wall and Soffit Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.
      2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch long Samples for each type of accessory.

D. Delegated-Design Submittal: For metal composite panel assemblies 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. Coordination Drawings: Exterior elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Metal composite panels and attachments.
   2. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
   3. Penetrations of wall by pipes and utilities.

B. Qualification Data: Submit name and qualification data for Panel Fabricator/Installer and Manufacturer, indicating full compliance with specification requirements. Manufacturers who are not able to provide this information will or may be rejected. Architect and Owner reserve the right to reject Panel Fabricator/Installer and/or Manufacturer if documentation of full compliance with specifications is not provided.
   1. Submit certificate from manufacturer certifying that Fabricator/Installer has been trained by the manufacturer and is an authorized/certified fabricator/installer of the specific metal composite panels proposed for this Project.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

D. Field quality-control reports.

E. Warranties: Samples of special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain metal composite wall and soffit panel from single source from single manufacturer.

B. Metal composite panel work shall be directly sub-contracted by the General Contractor to a company that specializes in the installation of metal composite panels and has an on-going business relationship with the manufacturer, whose product is to be supplied for this project. Brokering or sub-subcontracting of metal composite panel work is unacceptable and will not be allowed.
C. Manufacturer Qualifications: A manufacturing firm that has specialized in the manufacture of metal composite panel systems of the type specified and has been in standard production of the types of panels specified for at least 5 years.
   1. Manufacturer is responsible for the preparation of data for metal panels, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
   2. Manufacturer shall provide the technical inspection such that manufacturer’s intent and contractor’s efforts remain coordinated.

D. Fabricator/Installer Qualifications: A qualified firm that is approved, authorized, or licensed by metal composite panel system manufacturer to fabricate and install manufacturer's product and that is eligible to receive manufacturer's special warranty.
   1. The fabricator/installer shall demonstrate and offer written attested certification that he has fabricated and installed; a minimum of 10,000 sq. ft. per year for each of the past three years, of the material that he is bidding.
      a. Fabrication and installation of other types of panels, or another manufacturer’s goods is not considered as meeting the above requirement.
      b. Fabricator/Installer shall have been in business under its present name for at least 5 years prior to the start of this project.
      c. Fabricator/Installer shall have not filed for protection from creditors under any state or federal insolvency or debtor relief statutes or codes.
   2. The fabricator/installer shall substantiate a track record of the manufacturer’s working with the fabricator/installer, for three consecutive years, and at a scale of operations cited above.
   3. The Crew Chief/Foreman, shall be physically on-site, directly supervising the Work, during the entire period of installation of panel system.
   4. Installation Crew Chief/Forman shall be trained and certified by the panel system manufacturer and shall have on their person an identification card, certifying completion of training and approval of the manufacturer for the system being installed. The installer shall have been actively installing the type of system defined in these specifications for a minimum of 3 years.

E. Fire-Resistance Ratings: Where indicated, provide metal composite panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical wall panel as shown on Drawings; full thickness, including supports, attachments, and accessories.
      a. Include four-way joint and full thickness, factory fabricated corners and attachments for metal composite panels.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

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

H. Inspections: Make required notifications, secure required inspections and pay fees such that the specified systems warranty are assured at the time of completion of the Work.
1. Contractor and Manufacturer's assigned representative shall inspect and warrant the Work as a condition of acceptance.
2. Manufacturer shall provide a technical representative for start-up of installation, and progress inspections at 25 percent, 50 percent, and a final inspection with reports to the Installer, General Contractor and Architect/Owner. Deficiencies shall be listed on the inspection reports and all repairs/corrections made and certified completed and approved with next and final report.
3. Manufacturer's Final Completion/Warranty Inspection: Upon completion of the Work and prior to final payment, the metal composite panel manufacturer's representative, in the presence of the Owner and Architect, shall inspect the metal composite paneling Work. Discrepancies shall be recorded and immediately rectified. Final payment will not be issued until the manufacturer's representative has given his certification/approval of Work and close-out submittals, including Warranties and maintenance instructions, have been received by the Architect. Warranties issued prior to final inspection are not acceptable and shall not qualify for release of final payment for the metal composite panel system work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal composite panels, and other manufactured items so as not to be damaged or deformed. Package metal composite panels for protection during transportation and handling.

B. Unload, store, and erect metal composite panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal composite panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope
for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal composite panels for period of metal panel installation.

E. Protect foam-plastic insulation as follows:
1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.9 PROJECT CONDITIONS

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

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal composite panel fabrication, and indicate measurements on Shop Drawings.

1.10 COORDINATION

A. Coordinate metal composite panel assemblies with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a secure and noncorrosive installation.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite panel assemblies that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
   a. Structural failures, including rupturing, cracking, or puncturing.
   b. Deterioration of metals and other materials beyond normal weathering.
2. Warranty Period: 2 years from date of Substantial Completion.

B. Special Warranty on Aluminum Composite Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Finish Warranty Period: 10 years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Metal composite wall and soffit panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Design metal composite panel assemblies, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
   1. Professional engineer shall be legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.

C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at the following test-pressure difference:
   1. Test-Pressure Difference: 1.57 lbf/sq. ft.

D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

E. Structural Performance: Provide metal composite panel assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
   1. Wind Loads: Determine loads based on the following minimum design wind pressures:
      a. Uniform pressure as indicated on Drawings.
   2. Deflection Limits: Metal composite panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/175 of the span at the perimeter and 1/60 of the span anywhere in the panel.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing 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 (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 PANEL MATERIALS

A. Aluminum Composite Material: Provide factory-formed and -assembled, aluminum-faced composite panels fabricated from two 0.020-inch thick, coil-coated aluminum sheet facings bonded, using no glues or adhesives, to solid, extruded thermoplastic core; formed into profile indicated.
   1. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. 3A Composites USA; Alucobond Plus
b. Alcoa Inc.; Reynobond FR

c. Aluciel; Intrabond FR

d. CENTRIA Architectural Systems; Formabond

e. Mitsubishi Chemical America, Inc.; ALPOLIC FR (Basis of Design)

f. Protean Construction Products, Inc.; ACM 100


4. Panel Thickness: 0.157 inch.

5. Core: Standard.

6. Exposed Finish:
   a. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

7. Concealed Finish: Apply pretreatment and manufacturer’s standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.3 METAL-FACED COMPOSITE WALL PANELS

A. General: Provide factory-formed metal wall panels designed to be attached to supports using concealed fasteners. Include attachment system components, miscellaneous metal framing, and accessories required for complete system.

   1. Include manufacturer’s standard perimeter extrusions with integral weather stripping, panel stiffeners, panel clips, and anchor channels.

B. Reveal-Joint, Concealed-Fastener Aluminum Metal Wall Panels: Formed with vertical panel edges and flat pan between panel edges; with reveal joint between panels.

   1. Material: Aluminum composite.
      a. Application: Open and dry joint rainscreen system.

   2. Panel Coverage: As indicated on Drawings.

   3. Reveal Width: 1 inch.

   4. Panel Height: 1 inch.


2.4 METAL-FACED COMPOSITE SOFFIT PANELS

A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include attachment system components, miscellaneous metal framing, and accessories required for complete system.

   1. Include manufacturer’s standard perimeter extrusions with integral weather stripping, panel stiffeners, panel clips, and anchor channels.

B. Flush-Profile, Concealed-Fastener Metal Soffit Panels: Solid panels formed with vertical panel edges and flat pan between panel edges; with flush joint between panels.

   1. Material: Aluminum composite.

   2. Panel Coverage: As indicated on Drawings.

   3. Panel Height: 1 inch.

2.5 FIELD-INSTALLED THERMAL INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60-lb/cu. ft., with maximum flame-spread index of 75 and smoke-developed index of 450.

2.6 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G60 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Zee Clips: 0.079-inch nominal thickness.

C. Base or Sill Angles: 0.079-inch nominal thickness.

D. Hat-Shaped, Rigid Furring Channels:
   1. Nominal Thickness: 0.0312 inch, or as required to meet performance requirements.
   2. Depth: As indicated.

E. Cold-Rolled Furring Channels: Minimum 1/2-inch wide flange.
   1. Nominal Thickness: As required to meet performance requirements.
   2. Depth: 3/4 inch.
   3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch.
   4. 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.

F. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, and depth required to fit insulation thickness indicated.
   1. Nominal Thickness: 0.0312 inch.

G. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.7 MISCELLANEOUS MATERIALS

A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.8 ACCESSORIES

A. Panel Accessories: Provide components required for a complete metal composite panel assembly including trim, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers,
closure strips, and similar items. Match material and finish of metal composite panels, unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal composite panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

B. Flashing and Trim: Formed from 0.040-inch minimum thickness, aluminum or zinc sheet to match adjacent metal composite panels. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fascia, parapet caps, soffits, reveals, and fillers.

2.9 FABRICATION

A. General: Fabricate and finish metal composite panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Available Fabricators: Subject to compliance with requirements available fabricators include:
   1. Advanced Exterior Systems (Basis of Design)
   2. Lucobond, Synergy Systems
   3. Eastern Cladding Systems

C. Metal Composite Panels: Factory form panels in a continuous process with no glues or adhesives between dissimilar materials. Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.
   1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
   2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
   3. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.
   4. Dimensional Tolerances:
      a. Panel Bow: 0.8 percent maximum of panel length or width.
      b. Squareness: 0.25 inch maximum.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal composite panel manufacturer.
   a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal composite panel manufacturer for application, but not less than thickness of metal being secured.

2.10 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 exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite panel supports, and other conditions affecting performance of the Work.
   1. Examine wall framing to verify that angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite panel manufacturer.
   2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite panel manufacturer.
   3. Verify that fluid-applied membrane air barrier has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
   4. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal composite panels to verify actual locations of penetrations relative to seam locations of panels before panel installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Miscellaneous Framing: Install base angles, sills, furring, and other miscellaneous panel support members and anchorage according to ASTM C754 and metal composite panel manufacturer's written instructions.
   1. Soffit Framing: Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.3 THERMAL INSULATION INSTALLATION

A. Board Insulation: Extend insulation in thickness indicated to cover entire wall. Comply with installation requirements in Section 072100 "Thermal Insulation."
   1. Erect insulation horizontally and hold in place with Z-shaped furring members. Attach furring members to substrate with screws spaced 24 inches o.c., or as required by wind loads.
   2. Retain insulation in place by metal clips and straps or integral pockets within panels, spaced at intervals according to insulation manufacturer's instructions. Maintain cavity width between insulation and metal liner panel of dimension indicated.

3.4 METAL-FACED COMPOSITE WALL PANEL INSTALLATION

A. General: Install metal-faced composite wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Factory-authorized representative shall be present at beginning of metal composite panel installation and shall remain on-site full-time for the first three days of installation.
   2. Shim or otherwise plumb substrates receiving metal-faced composite panels.
   3. Flash and seal metal-faced composite panels at perimeter of all openings. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
   4. Install screw fasteners in predrilled holes.
   5. Locate and space fastenings in uniform vertical and horizontal alignment.
   6. Install flashing and trim as metal panel work proceeds.
   7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   8. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
   9. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
   10. Provide escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal-faced composite panel manufacturer.
D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal composite panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.
1. Seal metal panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

E. Attachment System Installation, General: Install attachment system required to support metal composite panels and to provide a complete system, including perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
2. Do not begin installation until weather barrier and flashings that will be concealed by composite panels are installed.

F. Track-Support Installation: Provide manufacturer's standard horizontal and vertical tracks that provide support and complete secondary drainage system, draining to the exterior at horizontal joints. Install support system at locations, spacings, and with fasteners recommended by manufacturer. Attach panels to wall by interlocking tracks with perimeter extrusions attached to wall panels. Fully engage integral gaskets and leave horizontal and vertical joints with open reveal.
1. Attach routed-and-returned flanges of panels to perimeter extrusions with manufacturer's standard fasteners.
2. Attach flush panels to perimeter extrusions by engaging panel edges and by attaching with manufacturer's standard structural silicone adhesive.
3. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
4. Do not apply sealants to joints unless otherwise indicated on Drawings.

3.5 METAL-FACED COMPOSITE SOFFIT PANEL INSTALLATION

A. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.
1. Comply with requirements of "Metal-Faced Composite Wall Panel Installation" Article.
2. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.

3.6 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal composite panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners
where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

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

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

### 3.7 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal composite panel units within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

### 3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal composite panel installation, including accessories.

C. Metal Composite Panel Inspections: Metal panel system manufacturer's technical personnel and Owner’s Testing Agency shall inspect metal composite panel installation as required in the Quality Assurance Article of this Section, and submit report to Architect.

1. Provide written report to Architect of every inspection. Indicate non-complying work and describe in detail the corrective activities required.

2. Notify Architect or Owner 48 hours in advance of date and time of final inspection.

D. Remove and replace metal composite panels where tests and inspections indicate that they do not comply with specified requirements.

E. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.9 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal composite panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.
B. After metal composite panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal composite panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

D. END OF SECTION 074243
SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Adhered thermoplastic polyolefin (TPO) roofing system.
2. Roof insulation.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 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. Review deck substrate requirements for conditions and finishes, 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.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. 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. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of compliance with performance requirements.

C. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.

D. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.
1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.

1.9 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.

1.10 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.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes roofing, base flashings, roof insulation, cover boards, and other components of roofing system.

2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, verify and provide roofing system by manufacturer of existing roof:

1. Carlisle SynTec Incorporated.
2. Firestone Building Products.
3. GAF Materials Corporation.
5. Johns Manville.

B. Source Limitations: Obtain components including roof insulation and fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 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 uplift pressures as indicated on Drawings.

D. Verification of Roofing System Design: Roofing System Design shall verified by one of the following:

1. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of an insulated single ply system, and shall be listed in FM Global’s "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
   a. Fire/Windstorm Classification: Class 1A-90.
   b. Hail-Resistance Rating: MH.

E. 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.
2.3 **TPO ROOFING**

   1. Thickness: 60 mils, nominal.
   2. Exposed Face Color: Grey.

2.4 **AUXILIARY ROOFING MATERIALS**

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
   1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils thick, minimum, of same color as TPO sheet.

C. Bonding Adhesive: Manufacturer's standard.

D. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

E. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.

G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.5 **ROOF INSULATION**

A. General: Preformed roof insulation boards manufactured or approved by TPO 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 or glass-fiber mat facer on both major surfaces.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Carlisle SynTec Incorporated.
      c. Firestone Building Products.
d. GAF Materials Corporation.
e. Hunter Panels.
f. Insulfoam LLC; a Carlisle company.
g. Johns Manville.
h. Rmax, Inc.

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. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
2. Full-spread spray-applied, low-rise, two-component urethane adhesive.

D. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch thick, factory primed.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. CertainTeed Corporation;
   b. Georgia-Pacific Corporation; Dens Deck.
   c. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.
   d. Temple-Inland, Inc; GreenGlass Exterior Sheathing.
   e. USG Corporation; Securock Glass Mat Roof Board.

E. Cover Board, Contractor's Option: ASTM C 1289, Type II, Class 4, Grade 1, 2 or 3, High Density polyisocyanurate with fiberglass facing, approved by membrane manufacturer as component of warranted system, 1/2 inch thick.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Atlas; ACFoam HS.
   b. Carlisle; SecurShield HD Polyiso.
   c. Firestone: Isoguard.
2.7 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

2.8 INSTALLATION PLACARD

A. Custom Installation Placard, non-corrosive metal or metallic polyester, approximately 4 inch wide by 3 inch high, securely adhered or fastened to face of each door and hatch opening onto roof, with the following information permanently stamped, printed, or engraved:

1. Name of Roofing Manufacturer with warranty report telephone number.
2. Termination date of manufacturer warranty.
3. Name of Roofing Installer with telephone number.
4. Description of roofing membrane system type.
5. Text as follows in large legible type: “Emergency roof repairs by authorized persons only. Report all leaks and roof damage to above parties immediately. Contact above parties prior to initiating any work affecting existing roofing.”

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 053100 "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 roof system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Install roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.

3.4 INSULATION INSTALLATION

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.

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. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:

1. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
2. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

H. Mechanically Fastened and Adhered Insulation: Install each layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
1. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
2. Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive or full-spread adhesive, firmly pressing and maintaining insulation in place.

I. 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.

   1. Fasten cover boards according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
   2. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.5 ADHERED ROOFING INSTALLATION

A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.

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 perimeter of roofing.

F. Apply roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.

   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
   2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
   3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.6 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 seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.7 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

A. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D 5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.
2. Flood each area for 48 hours.
3. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.9 PROTECTING AND CLEANING

A. Protect 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 roofing system that does not comply with requirements, repair substrates, and repair or reinstall 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.

3.10 ROOFING INSTALLER'S WARRANTY

A. WHEREAS ____________________________ of _____________________________, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <Insert name of Owner>.
2. Address: <Insert address>.
3. Building Name/Type: <Insert information>.
4. Address: <Insert address>.
5. Area of Work: <Insert information>.
6. Acceptance Date: ________________.
7. Warranty Period: <Insert time>.
8. Expiration Date: ________________.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
   a. lightning;
   b. peak gust wind speed exceeding 74 mph;
   c. fire;
   d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
   e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
   f. vapor condensation on bottom of roofing; and
   g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.

3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.

7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner’s General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this ___________ day of __________________, ________.

1. Authorized Signature: _______________________________________.
2. Name: ________________________________________.
3. Title: ________________________________________.

END OF SECTION 075423
SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Formed Products:
   a. Formed low-slope roof sheet metal fabrications.
   b. Formed wall sheet metal fabrications.
   c. Formed equipment support flashing.

B. Related Sections:
1. Section 042000 "Unit Masonry" for embedded flashing materials.
2. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
3. Section 074243 "Metal Composite Wall and Soffit Panels" for sheet metal flashing and trim integral with composite wall panels.
5. Section 077100 "Roof Specialties" for manufactured roof specialties not part of sheet metal flashing and trim.
6. Section 077200 "Roof Accessories" for roof hatches.

1.3 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
1. Identification of material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
4. Details of termination points and assemblies, including fixed points.
5. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
7. Details of special conditions.
8. Details of connections to adjoining work.
9. Detail formed flashing and trim at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified fabricator.

B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA’s "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

C. Preinstallation Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner’s insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.9 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
   1. Surface: Smooth, flat.
   2. Exposed Coil-Coated Finishes:
      a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      3. Color: Color as selected by Architect from manufacturer's full range.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.2 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
   2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
   3. Products: Subject to compliance with requirements, provide one of the following:
      a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
      c. Henry Company; Blueskin PE200 HT.
      d. Metal-Fab Manufacturing, LLC; MetShield.
      e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

B. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item 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 or manufactured item.
   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.
      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, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
E. 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 complying with ASTM D 1187.


2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA’s "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
   1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   2. Obtain field measurements for accurate fit before shop fabrication.
   3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
   4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices of sizes as recommended by SMACNA’s "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

F. Seams: Fabricate nonmoving seams with flat-lock seams.
   1. Tin edges to be seamed, form seams, and solder.
   2. Coated Metals: Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
G. Do not use graphite pencils to mark metal surfaces.

2.5 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Base Flashing: Fabricate from 0.040 inch thick aluminum.
B. Counterflashing: Refer to Section 077100 "Roof Specialties."
C. Flashing Receivers: Fabricate from 0.040 inch thick aluminum.
D. Roof-Penetration Flashing: Roofing membrane manufacturer’s approved system.
E. Roof-Drain Flashing: Roofing membrane manufacturer’s approved system.

2.6 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Refer to Section 042000 "Unit Masonry."
B. Opening Flashings in Frame Construction: Fabricate head, sill, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch high, end dams. Fabricate from 0.040 inch thick aluminum.
   1. Refer to Section 072726 "Fluid-Applied Membrane Air Barriers" for flexible flashings.

2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Pipe Penetrations: Premolded rubber or roof membrane manufacturer’s recommended elastomeric type.
   1. Provide stainless steel clamp ring, sealant, and fasteners as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
C. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 UNDERLAYMENT INSTALLATION

A. General: Install underlayment as indicated on Drawings.

B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails 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 with roller. Cover underlayment within 14 days.

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, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

5. Install sealant tape where indicated.

6. Torch cutting of sheet metal flashing and trim is not permitted.

7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Coat back side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of underlayment and cover with a slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as shown and as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

F. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer’s written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

C. Counterflashing: Refer to Section 077100 "Roof Specialties."

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 042000 "Unit Masonry."

C. Opening Flashings in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches beyond wall openings.

1. Install flexible flashings in accordance with Section 072726 "Fluid-Applied Membrane Air Barriers."

3.6 MISCELLANEOUS FLASHING INSTALLATION

A. Pipe Penetration Flashing: Install in accordance with roofing membrane manufacturer’s written instructions.
3.7 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200
This page intentionally left blank.
SECTION 077100 - ROOF SPECIALTIES

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. Copings.
   2. Roof-edge specialties.
   3. Reglets and counterflashings.

B. Related Sections:
   1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
   2. Section 076200 "Sheet Metal Flashing and Trim" for sheet metal flashing and trim.
   3. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Except as otherwise shown on Drawings or specified, the workmanship of sheet metal work, method for forming joints, anchoring, cleating and provisions for expansion shall conform to the standard details and recommendations of the Copper and Brass Research Association; and workmanship shall be of the best quality, in accordance with best trade practice and the recommendations and specifications of the Sheet Metal and Air Conditioning Contractors National Association, Inc.

C. FM Approvals' Listing: Manufacture and install copings and roof-edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.

D. SPRI Wind Design Standard: Manufacture and install copings and roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:
   1. Design Pressure: As indicated on Drawings.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:
   1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
   2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
   3. Details of termination points and assemblies, including fixed points.
   4. Details of special conditions.

C. Samples: For each type of roof specialty indicated with factory-applied color finishes.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for copings and roof-edge flashings.

B. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical roof edge, approximately 10 feet long, including supporting construction, seams, attachments, and accessories.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects roof specialties including installers of roofing materials and accessories.
   2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
   3. Review special roof details and condition of other construction that will affect roof specialties.
1.7 DELIVERY, STORAGE, AND HANDLING
   A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
   B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

1.8 PROJECT CONDITIONS
   A. Field Measurements: Verify actual dimensions of construction contiguous with copings and roof-edge flashings by field measurements before fabrication.

1.9 WARRANTY
   A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
      1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
         a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
         b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
         c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
      2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXPOSED METALS
   A. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
      1. Surface: Smooth, flat finish.
      2. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
         a. Two-Coat Fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
         b. Color: Custom color as selected by Architect.

2.2 CONCEALED METALS
   A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
   B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.
2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.

C. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

E. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 COPINGS

A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following as required to match existing, adjacent coping profile, depth, manufacturer and color:
   a. ATAS International, Inc.
   b. Hickman Company, W. P.
   c. Metal-Era, Inc.
   d. Metal Roofing Systems, Inc.
   e. Petersen Aluminum Corporation

2. Coping-Cap Material: Formed aluminum, 0.050 inch thick; or thickness as required to meet performance requirements.


4. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material.
   a. Snap-on-Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 incheswide, with integral cleats.

2.5 ROOF-EDGE SPECIALTIES

A. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous formed galvanized-steel sheet cant, 0.028 inch thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following as required to match existing, adjacent coping profile, depth, manufacturer and color:
   a. Metal-Era; Anchor-Tite Standard Fascia
   b. ATAS International
   c. Hickman Company, W.P.
   d. Metal Roofing Systems, Inc.
   e. Petersen Aluminum Corporation

2. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, 0.040 inch thick or thickness as required to meet performance requirements.
   a. Surface: Smooth, flat finish.
   b. Finish: Two-coat fluoropolymer.
   c. Color: As selected by Architect from manufacturer's full range.

4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.

2.6 REGLETS AND COUNTERFLASHINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Fry Reglet Corporation.
   2. Hickman Company, W. P.
   3. Metal-Era, Inc.

B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
   1. Material: Aluminum, 0.040 inch thick.
   2. Corners: Factory mitered and continuously welded.
   3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal:
   1. Formed Aluminum: 0.040 inch thick.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
C. Appearance of Finished Work: 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, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL
A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.
1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.
B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
2. 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.
D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
E. Seal joints with elastomeric sealant as required by roofing-specialty manufacturer and as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.3 COPING INSTALLATION
A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
B. Anchor copings to meet performance requirements.
   1. Interlock face leg and back leg drip edges on snap-on coping cap into cleated anchored plates anchored to substrate at manufacturer's required spacing that meets performance requirements.

3.4 ROOF-EDGE SPECIALITIES INSTALLATION
A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.5 REGLET AND COUNTERFLASHING INSTALLATION
A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.
B. Surface-Mounted Reglets: Install reglets to receive flashings where indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.
C. Counterflashings: Coordinate installation of counterflashings with installation of base flashing. Insert counterflashings into reglets or other indicated receivers and fit tightly to base flashing. Extend counterflashings 4 inches over top edge of base flashings. Lap counterflashings joints a minimum of 4 inches and bed with elastomeric sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.

3.6 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 and sealants.
C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100
SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

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

1.2 SUMMARY

A. Section Includes:
   1. Roof hatches.

B. Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

   1. Section 055000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
   2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
   3. Section 077100 "Roof Specialties" for manufactured fasciae, copings, gravel stops, gutters and downspouts, and counterflashing.
   4. Section 086200 "Unit Skylights" for single- and double-glazed domed plastic skylights with curb frame.
   5. Section 233423 "HVAC Power Ventilators" for power roof-mounted ventilators.
   6. Section 237413 "Rooftop Air Conditioners" for standard curbs specified with rooftop units.
   7. Section 284621.11 "Addressable Fire-Alarm Systems" for interconnects to automatically operated heat and smoke vents.

1.3 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
1.4 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.
   1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.5 INFORMATIONAL SUBMITTALS

Retain "Coordination Drawings" Paragraph below if Drawings do not include detailed plans or if Project involves unusual coordination requirements; revise to suit Project.

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
   1. Size and location of roof accessories specified in this Section.
   2. Method of attaching roof accessories to roof or building structure.
   3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
   4. Required clearances.

B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 WARRANTY

When warranties are required, verify with Owner's counsel that warranties stated in this article are not less than remedies available to Owner under prevailing local laws.

Retain "Special Warranty on Painted Finishes" Paragraph below for factory-coated metal. Delete if metal is field finished or left uncoated. Coordinate with finishes retained in Part 2.
A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

Verify available warranties and warranty periods for finishes with manufacturers listed in Part 2. Periods of 20 years or longer are for fluoropolymer finishes and are included with manufacturers' published data; longer periods for premium finishes may be available.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

Retain "Wind-Restraint Performance" Paragraph with "Delegated-Design Submittal" Paragraph in "Action Submittals" Article for projects requiring wind-restraint design. Units are available from certain manufacturers that meet hurricane high wind zone design requirements. Verify requirements of authorities having jurisdiction.

B. Wind-Restraint Performance: As indicated on Drawings.

2.2 ROOF HATCHES

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, integral metal cant, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide Basis of Design, Bilco Type E, or comparable Architect-approved product by one of the following:
   a. Babcock-Davis
b. Bilco Company, Type E (Basis of Design)
c. J. L. Industries, Inc.
d. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
e. Nystrom
f. O'Keefes Inc.
g. Pate Company

B. Type and Size: Single-leaf lid, as indicated on Drawings. Measurements of roof hatch shall be field-verified prior to ordering.

Verify load requirements with authorities having jurisdiction.


Retain "Dome Glazing" Subparagraph below if hatch lid is glazed.


Retain one of three "Hatch Material" paragraphs below. If Project requires more than one material or finish, indicate locations on Drawings or by inserts.

D. Hatch Material: Aluminum sheet, 0.090 inch thick steel sheet.

1. Thickness: Manufacturer's standard thickness for hatch size indicated.

First option in "Finish" Subparagraph below applies only to zinc-coated (galvanized) steel sheet.

2. Finish: Two-coat fluoropolymer.

Retain "Color" Subparagraph below if retaining either of last two options in "Finish" Subparagraph above.

3. Color: As selected by Architect from manufacturer's full range.

E. Hatch Material: Aluminum sheet.

1. Thickness: Manufacturer's standard thickness for hatch size indicated.

2. Finish: Two-coat fluoropolymer.

Retain "Color" Subparagraph below if retaining any of last three options in "Finish" Subparagraph above.

3. Color: As selected by Architect from manufacturer's full range.

F. Hatch Material: Stainless steel sheet.

1. Thickness: Manufacturer's standard thickness for hatch size indicated.

2. Finish: Manufacturer's standard.

G. Construction:
Retain one material option in "Insulation" Subparagraph below; options are presented in ascending order of cost and thermal resistance; third option for high-performing insulation is available from some of the listed manufacturers.

1. Insulation: 1-inch- thick, glass-fiber board.

In "R-Value" Subparagraph below, first option corresponds with cellulosic-fiber board insulation, second option corresponds with glass-fiber board insulation, and third option corresponds with polyisocyanurate board insulation specified in "Insulation" Subparagraph above.

a. R-Value: 4.3 according to ASTM C1363.

Retain "Nailer" Subparagraph below if roofing membrane termination requires use of wood nailer.


Retain one of two "Hatch Lid" subparagraphs below; first is more common.

3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
4. Hatch Lid: Glazed, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.

Retain "Curb Liner" Subparagraph below if requiring a double-walled curb.

5. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
6. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.

Curb height in first subparagraph below may be determined by adding thickness of roof insulation to the minimum base flashing height recommended by roofing membrane manufacturer or established by office practice.

7. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
8. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

Galvanized-steel hardware in "Hardware" Paragraph below is standard; stainless steel may be available for corrosive environments. Keyed cylinders and high security locking are available from some manufacturers. Verify availability with manufacturers.

H. Hardware: Spring operators, hold-open arm, stainless steel spring latch with turn handles, stainless steel butt- or pintle-type hinge system, and padlock hasps inside and outside.

Retain one or both subparagraphs below to suit Project.

1. Provide two-point latch on lids larger than 84 inches.
2. Provide remote-control operation.
Retain one or both "Safety Railing System" and "Ladder-Assist Post" paragraphs below; revise to suit Project. If retaining both paragraphs, indicate location of each on Drawings or by inserts. Consult authorities having jurisdiction for their requirements. See the Evaluations.

I. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

Retain "Height" Subparagraph below if railing system is not fully detailed on Drawings. Option is based on OSHA fall protection requirements; revise to suit Project.

1. Height: 42 inches above finished roof deck.

Dimensions in "Posts and Rails" and "Flat Bar" subparagraphs below are typical; other diameters and thicknesses may be specified; revise to suit Project.

2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.

Retain "Maximum Opening Size" Subparagraph below if railing system is not fully detailed on Drawings. Requirement is based on IBC for required guards; revise to suit Project.


Retain "Chain Passway Barrier" or "Self-Latching Gate" Subparagraph below if railing system is not fully detailed on Drawings. Some authorities having jurisdiction do not permit chain passway barrier.

5. Chain Passway Barrier: Galvanized proof coil chain with quick link on fixed end.
7. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
8. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
9. Fabricate joints exposed to weather to be watertight.
10. Fasteners: Manufacturer's standard, finished to match railing system.

   a. Color: As selected by Architect from manufacturer's full range.

J. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.

Option in "Height" Subparagraph below is typical height.

2. Height: 42 inches above finished roof deck.
5. Finish: Manufacturer's standard baked enamel or powder coat.
   
a. Color: As selected by Architect from manufacturer's full range.

2.3 METAL MATERIALS

A. Aluminum Sheet: ASTM B209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
   1. Exposed Coil-Coated Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   
Finish in "Two-Coat Fluoropolymer Finish" Subparagraph below is most manufacturers' standard fluoropolymer finish; three-coat fluoropolymer and other finishes may be available for custom orders. To obtain a proprietary finish system, insert names of coating manufacturers and products.
   
a. Two-Coat Fluoropolymer Finish: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.
   
Finish in "Concealed Finish" Subparagraph below is frequently retained as a factory finish for interior surfaces of coil-coated sheet. Usually delete for other finishes.
   2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

B. Aluminum Extrusions and Tubes: ASTM B221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

C. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.

Retain three paragraphs below if requiring ladder safety railings or assist posts for roof hatches.

D. Steel Tube: ASTM A500/A500M, round tube.

E. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.


2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Glass-Fiber Board Insulation: ASTM C726, nominal density of 3 lb/cu. ft., thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F, thickness as indicated.
See the Evaluations in Section 061000 "Rough Carpentry" for information about waterborne preservatives.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

Retain "Underlayment" Paragraph below for roof specialties applied directly over dissimilar metal or corrosive substrates.

E. Underlayment:
   1. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
   3. Slip Sheet: Building paper, 3 lb/100 sq. ft. minimum, rosin sized.
   4. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

F. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
   1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
   2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
   3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

Revise "Elastomeric Sealant" Paragraph below if sealant of specific type, grade, class, and use is required.

H. Elastomeric Sealant: ASTM C920, elastomeric [polyurethane] [silicone] polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.


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. 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, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.

C. Roof-Hatch Installation:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
2. Attach safety railing system to roof-hatch curb.
3. Attach ladder-assist post according to manufacturer's written instructions.

ROOF ACCESSORIES

077200 - 9
D. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

Retain "Galvanized Surfaces" Paragraph below for galvanized-steel surfaces.

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.

Retain first paragraph below for primed surfaces.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200
SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes through-penetration firestop systems for penetrations through the following fire-resistance-rated assemblies, including both empty openings and openings containing penetrating items:
   1. Walls and partitions.

B. Related Sections:
   1. Section 078446 "Fire-Resistive Joint Systems" for joints in or between fire-resistance-rated construction and in smoke barriers.

1.3 PERFORMANCE REQUIREMENTS

A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.
   1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
   2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
   3. Smoke barriers.

B. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
   1. Penetrations located outside wall cavities.
   2. Penetrations located outside fire-resistive shaft enclosures.
   3. Penetrations located in construction containing fire-protection-rated openings.
   4. Penetrating items larger than 4-inch- diameter nominal pipe or 16 sq. in. in overall cross-sectional area.

D. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

2. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

E. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of through-penetration firestop system product indicated.

B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.

2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer.

a. Engineer shall be legally qualified to practice in the state in which the project is located.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.

C. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain through-penetration firestop systems from a single manufacturer.

B. Installer's Qualifications: An experienced installer who is qualified by having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Firm shall hold current certification by third party attesting to its ability to select and install firestopping in accordance with performance requirements, have established management...
system for firestopping and employ trained supervisor (DRI) to maintain oversight of firestopping installation.

1. Certification for firestopping firms: Firm shall be certified by one of the following:
   b. Hilti Accredited Firestop Contractor.
   c. UL Qualified Firestop Contractor.

2. Qualification for Superintendent: Superintendent shall have a minimum of 3 years experience in firestopping.

3. Qualification for Firestop Installer: Trained individual in accordance with requirements of certification of firm.
   a. Firestop Installers Training (FIT) Level 1 by Specified Technologies, Inc.
   c. Hilti Basic Firestop Training
   d. Similar training by manufacturers listed in Part 2.

4. A manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to an installer engaged by Contractor does not in itself confer qualification on buyer.

C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.

2. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:
   a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
   b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
      1) UL in "Fire Resistance Directory."

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1. Before installation of fire-resistance-rated assemblies and penetrating items, review through-penetration firestop system and examine procedures for ensuring quality of installed systems. Require representatives of each entity directly concerned with through-penetration firestop system to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for through-penetration firestop system.
   c. Through-penetration firestop system Manufacturer’s service representative.
   d. Through-penetration firestop system Installer.
   e. Fire-resistance-rated masonry Installer.
   g. Mechanical piping Installer.
   h. HVAC ductwork Installer.
1. Electrical wireway Installer.

2. Review inspection and testing and inspecting agency procedures for field quality control, through-penetration firestop system installation, and coordination of penetrating item configurations with available rated through-penetration firestop system assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hilti Construction Chemicals, Inc.
2. Specified Technologies Inc.
3. 3M Fire Protection Products.
4. Tremco.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

2.3 PENETRATION FIRESTOPPING

A. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
   1. Fire-resistance-rated walls include fire walls, fire-barrier walls, and fire partitions.
   2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

B. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

C. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

D. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
   1. Permanent forming/damming/backing materials, including the following:
      a. Slag-/rock-wool-fiber insulation.
      b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
      c. Fire-rated form board.
   2. Temporary forming materials.
   5. Steel sleeves.

2.4 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers,
mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer and the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrations as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrations.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect through-penetration firestop systems in accordance with ASTM E 2174 and to prepare test reports.
   1. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.

B. Compliance Inspections: One week prior to inspections by authorities having jurisdiction, Manufacturer's Representative shall perform compliance inspection with General Contractor's designated representative present. Reports shall be provided to General Contractor, with a copy to the Owner, Architect, and Firestopping Installer.

C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued.

D. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

3.5 IDENTIFICATION

A. Penetration Identification: Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
   1. The words: "Warning--Through-Penetration Firestop System--Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Through-penetration firestop system designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Through-penetration firestop system manufacturer's name.
   6. Installer's name.

B. Wall Identification: Refer to Section 099123 "Interior Painting" for identification of fire-rated walls and smoke barriers.
3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

END OF SECTION 078413
SECTION 078446 - FIRE-RESISTIVE JOINT 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. This Section includes fire-resistive joint systems for the following:
      1. Floor-to-floor joints.
      2. Floor-to-wall joints.
      3. Head-of-wall joints.
      4. Wall-to-wall joints.
      5. Joints in smoke barriers.
   B. Related Sections include the following:
      1. Section 072100 "Thermal Insulation" for closed-cell spray polyurethane foam insulation used as head-of-wall sealant for non-rated walls.
      2. Section 078413 "Penetration Firestop Systems" for systems installed in openings in walls and floors with and without penetrating items.
      3. Section 079200 "Joint Sealants" for non-fire-resistive joint sealants.

1.3 PERFORMANCE REQUIREMENTS
   A. General: For joints in the following constructions, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed:
      1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
      2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
      3. Fire-resistance-rated floor assemblies.
      4. Smoke barriers.
   B. Fire Resistance of Joint Systems: Assembly ratings and movement capabilities indicated, but with assembly ratings not less than that equaling or exceeding fire-resistance rating of constructions in which joints are located, as determined by UL 2079.
      1. Load-bearing capabilities as determined by evaluation during the time test.
   C. Fire Resistance of Perimeter Fire-Containment Systems: Integrity and insulation ratings indicated as determined by UL 2079.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.
B. Shop Drawings: For each fire-resistive joint system, show relationships to adjoining construction. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.

B. Qualification Data: For Installer.

C. Research/Evaluation Reports: For each type of fire-resistive joint system.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Comply with requirements of Section 078413 "Penetration Firestopping."

B. Source Limitations: Obtain fire-resistive joint systems for each kind of joint and construction condition indicated through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in "Performance Requirements" Article:

1. Fire-resistive joint systems are identical to those tested per UL 2079. Perimeter fire-containment systems are identical to those tested per both UBC Standard 26-9 and UL 2079. Provide rated systems complying with the following requirements:

   a. Fire-resistive joint systems correspond to those indicated by referencing system designations listed by the following:

      1) UL in its "Fire Resistance Directory."

D. Preinstallation Conference: Refer to requirements of Section 078413 "Penetration Firestop Systems."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.
1.8 PROJECT CONDITIONS
   A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
   B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.9 COORDINATION
   A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
   B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
   C. Notify Owner's inspecting agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on days preceding each series of installations.
   D. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1. Hilti Construction Chemicals, Inc.
      2. Specified Technologies Inc.
      3. 3M Fire Protection Products.
      4. Tremco.

2.2 FIRE-RESISTIVE JOINT SYSTEMS, GENERAL
   A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.
   B. Accessories: Provide components of fire-resistive joint systems, including forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

2.3 PERIMETER FIRE-CONTAINMENT SYSTEMS
   A. Where UL-classified perimeter fire-containment systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHDG.
B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
   1. Joints include those installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
   2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.

C. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.
   1. L-Rating: Not exceeding 5.0 cfm/ft of joint at 0.30 inch wg at both ambient and elevated temperatures.

2.4 HEAD OF WALL SEALING

A. Head of Wall Sealing: Comply with requirements of UL HW-D-0042 or equivalent design.
   1. Contractor's Option: Spray or sealant products may be used.
      a. 3M; FireDam Spray or FD 150+ Sealant
      b. Grace Construction Products; FlameSafe 3000 Spray or FS 900 Sealant
      c. Hilti; CP672 Firestop Spray or CP 606 Sealant

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to
remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.

B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify fire-resistive joint systems with preprinted metal or plastic labels or self-adhesive vinyl labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:


3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect fire-resistive joint systems and to prepare inspection reports.

1. Inspecting agency will state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.

B. Compliance Inspections: One week prior to inspections by authorities having jurisdiction, Manufacturer's Representative shall perform compliance inspection with General Contractor's designated representative present. Reports shall be provided to General Contractor, with a copy to the Owner, Architect, and Firestopping Installer.

C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and inspecting agency has approved installed fire-resistive joint systems.
D. If deficiencies are found, repair or replace fire-resistive joint systems so they comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION 078446
SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
2. Exterior joints in horizontal traffic surfaces.
3. Interior joints in vertical surfaces and horizontal nontraffic surfaces.
4. Interior joints in horizontal traffic surfaces.

B. Related Sections include the following:

1. Section 042000 "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
2. Section 078446 "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction and for head-of-wall sealants.
3. Section 088000 "Glazing" for glazing sealants.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants and joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: For each type 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.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.

1.5 INFORMATIONAL SUBMITTALS

A. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

B. Qualification Data: For qualified installer.

C. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

D. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
   3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
   5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

B. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
   1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

1.7 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
   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.
1.8 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range of available colors including premium colors.

2.2 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Single Component, Nonsag, Neutral-Curing Silicone Sealant:
   1. Products:
      a. Dow Corning Corporation; 790
      b. Pecora Corporation; 890
      c. Sika Corporation; 290
      d. Tremco Incorporated; Spectrem 1
   2. Type and Grade: S (single component) and NS (nonsag).
   3. Class: 100/50.
   4. Use Related to Exposure: NT (nontraffic).
   5. Uses Related to Joint Substrates: M (Masonry), G (Glass), A (Aluminum), and, as applicable to joint substrates indicated, O (Other).
7. Field-tintable to match adjacent substrates.
8. Exterior Joint Locations:
   a. Cast-in-place concrete, vertical construction joints,
   b. Unit masonry, vertical control and expansion joints,
   c. Metal panels,
   d. Exterior vertical joints between different materials listed above,
   e. Exterior perimeter joints between materials listed above and frames of doors windows and louvers,
   f. Exterior control and expansion joints in ceilings and other overhead surfaces,
   g. Other vertical or horizontal non-traffic joints.
9. Interior Joint Locations:
   a. Vertical control and expansion joints on exposed interior surfaces of exterior walls,
   b. Interior perimeter joints of exterior openings.

C. Single-Component, Traffic Exposure, Neutral-Curing Silicone Sealant:
1. Products:
   a. Dow Corning Corporation; 890-SL
   b. Pecora Corporation; 300 SL
   c. Sika Corporation; 728 SL
   d. Tremco Incorporated; Spectrem 900 SL
2. Type and Grade: S (single component) and P (pourable).
3. Class: 100/50.
4. Uses Related to Exposure: T (traffic).
5. Uses Related to Joint Substrates: M, A, and O, as applicable to joint substrates indicated.
6. Exterior Joint Locations:
   a. Cast-in-place concrete slabs, horizontal nontraffic and traffic isolation and contraction joints,
   b. Other exterior horizontal traffic joints.
7. Interior Joint Locations:
   a. Interior ceramic and dimension stone tile expansion, control, contraction, and isolation joints in horizontal traffic surfaces.

D. Single Component Pick-Resistant Aliphatic Polyurethane:
1. Basis of Design Product: BASF; MasterSeal CR 195
2. Type and Grade: S (single component) and NS (nonsag).
4. Use Related to Exposure: NT (non-traffic).
5. Uses Related to Joint Substrates: M, G, A, and O as applicable to joint substrates indicated.
6. Color: Paintable white and limestone, as selected by Architect.
7. Interior Joint Locations:
   a. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances,
   b. Joints between interior wall surfaces and casework,
c. Interior exposed wall joints, including joints between walls and integral wall base, ceramic tile wall base, visual display surfaces, toilet and bath accessories, and fire protection specialties,
d. Interior exposed ceiling joints, including joints between gypsum board ceilings and curtain track, and non-tapeable mechanical grilles, light fixtures, and access doors,
e. Interior joints between plumbing fixtures and adjoining walls, floors, and counters.

E. Butyl-Rubber-Based, Solvent-Release-Curing Sealant:
   1. Products:
      a. Bostik, Inc.; Chem-Calk 300
      b. Pecora Corporation; BC-158
      c. Tremco; Butyl Sealant
   2. Location: Under exterior door thresholds.

2.3 ACOUSTICAL JOINT SEALANTS
A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 that 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. BASF Building Systems
      b. Hilti
      c. Pecora Corporation
      d. Tremco
   2. Interior Joint Locations: Acoustical interior joints for concealed and exposed joints.

2.4 JOINT-SEALANT BACKING
A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), or B (bicellular material with a surface skin), as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance. Consult the sealant manufacturer to confirm the specific backer material to be used for the specific project and application, and submit to Architect the manufacturer's written recommendations.
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 where such adhesion would result in sealant failure. 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 joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.
   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, blast cleaning, 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.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on 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 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

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 type recommended by manufacturer 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 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 configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer’s written recommendations.

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 and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200
SECTION 079500 - EXPANSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Interior expansion control systems.

B. Related Requirements:
   1. Section 033000 "Cast-In-Place Concrete" for cast-in architectural joint system frames furnished, but not installed, in this Section.
   2. Section 042000 "Unit Masonry" for masonry wall joint systems.
   4. Section 079200 "Joint Sealants" for liquid-applied joint sealants.

1.3 ACTION SUBMITTALS

A. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, blockout requirement, attachments to other work, and line diagrams showing entire route of each expansion control system. Where expansion control systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

B. Samples: For each exposed expansion control system and for each color and texture specified, full width by 6 inches long in size.

1.4 INFORMATIONAL SUBMITTALS

A. Product Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
   1. Manufacturer and model number for each expansion control system.
   2. Expansion control system location cross-referenced to Drawings.
   3. Nominal joint width.
   5. Classification as thermal or seismic.
   7. Product options.
B. Product Test Reports: For each fire barrier provided as part of an expansion control system, for tests performed by a qualified testing agency.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of expansion control system from single source from single manufacturer.

B. Fire-Resistance Ratings: Where indicated, provide expansion control systems with fire barriers identical to those of systems tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.

C. Seismic Performance: Expansion control systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
   2. Contractor shall verify Project's seismic design category and component importance factor and provide products accordingly.

1.6 COORDINATION

A. Coordination: Coordinate installation of exterior wall expansion control systems with roof expansion control systems to ensure that wall transitions are watertight. Roof expansion joint assemblies are specified in Division 07 Sections.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Balco, Inc.
   2. Construction Specialties, Inc.
   3. JointMaster/InPro Corporation
   4. MM Systems Corporation
   5. Watson Bowman Acme Corp.; a BASF Construction Chemicals business

2.2 SYSTEM DESCRIPTION

A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
   1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
   2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.
3. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.

2.3 MATERIALS

A. Aluminum: ASTM B 221, Alloy 6063-T5 for extrusions; ASTM B 209, Alloy 6061-T6 for sheet and plate.
   1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.

C. Elastomeric Seals: ASTM E 1783; preformed elastomeric membranes or extrusions to be installed in metal frames.

D. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required fire-resistance rating.

E. Moisture Barrier: Flexible elastomeric material, Santoprene or Elastoprene.

F. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

G. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.4 INTERIOR EXPANSION CONTROL SYSTEMS

A. Floor-to-Floor:
   1. Product: Balco, Inc.; 75 FPE Series, Smooth Surface Mount
   2. Design Criteria:
      a. Nominal Joint Width: Field verify.
      b. Movement Capability: 25 percent.
      c. Type of Movement: Thermal.
   3. Type: Elastomeric.

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 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 surfaces where expansion control systems will be installed for installation tolerances and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Prepare substrates according to expansion control system manufacturer's written instructions.
B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion control systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion control systems.
C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary to secure joint systems to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

3.3 INSTALLATION
A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.
B. Terminate exposed ends of expansion control systems with factory-fabricated termination devices.

3.4 PROTECTION
A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion control systems. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION 079500
SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Standard and stiffened hollow metal doors and frames.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.

B. Shop Drawings: Include the following:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
   7. Details of accessories.
   8. Details of moldings, removable stops, and glazing.
   9. Details of conduit and preparations for power, signal, and control systems.

C. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.
C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

D. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

E. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
   1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
   1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Subject to compliance with requirements, provide basis of design indicated or comparable products by one of the following:
   1. Ceco Door Products; an Assa Abloy Group company; Medallion (Basis of Design)
   2. Amweld Building Products, LLC.
   3. Curries Company; an Assa Abloy Group company.
   4. Kewanee Corporation (The).
   5. Mesker Door Inc.
   7. Steelcraft; an Ingersoll-Rand company.
2.2 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 A40 (galvannealed) metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Section 088853 "Security Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
   1. Design: Flush panel.
   2. Core Construction:
      a. Level 4 Doors: Steel-stiffened core with polystyrene insulation.
      b. Fire Door Core: As required to provide fire-protection ratings indicated.
5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-thick, end closures or channels of same material as face sheets.
7. Steel-Stiffened Core: 0.042-inch-thick, steel vertical stiffeners extending full-door height, with vertical webs spaced not more than 4 inches apart, spot welded to face sheets a maximum of 3 inches o.c. Fill spaces between stiffeners with insulation.
8. Vertical Edge Channels for Stiffened Doors: 0.123-inch-thick, continuous channel of same material as detention door face sheets, extending full-door height at each vertical edge; welded to top and bottom channels to create a fully welded perimeter channel. Noncontiguous channel is permitted to accommodate lock-edge hardware only if lock reinforcement is welded to and made integral with channel.

B. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 4 and Physical Performance Level A (Maximum Duty), Model 2 (Seamless). Provide 14 gauge steel face sheets.

C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
4. Frames for Borrowed Lights: Same as adjacent door frame.
5. Frames for Level 4 Steel Doors: 12 gauge steel sheet.

C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
   1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
   2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6  STOPS AND MOLDINGS

A. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

B. Loose Stops for Glazed Lites in Frames: Minimum 0.032-inch-thick, fabricated from same material as frames in which they are installed.

C. Provide where indicated fixed moldings on patient side of glazed openings and removable stops on non-patient side.
   1. Height: As required to provide minimum 1-inch glass engagement, but not less than 1-1/4 inches.
   2. Fixed Moldings: Formed from same material as detention door and frame face sheets, but not less than 0.093 inch thick, and spot welded to face sheets a maximum of 5 inches o.c.
   3. Removable Stops: Formed from 0.123-inch thick angle, of same material as detention door face sheets. Secure with button head security fasteners spaced uniformly not more than 6 inches o.c. and not more than 2 inches from each corner, and as necessary to satisfy performance requirements. Form corners with notched or mitered hairline joints.

2.7  ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch wide steel.

C. Grout Guards: Formed from same material as frames, not less than 0.016-inch thick.

2.8  FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:
   2. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
   2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
   3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
   5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
   6. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
         1) Two anchors per jamb up to 60 inches high.
         2) Three anchors per jamb from 60 to 90 inches high.
         3) Four anchors per jamb from 90 to 120 inches high.
         4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
      b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
         1) Three anchors per jamb up to 60 inches high.
         2) Four anchors per jamb from 60 to 90 inches high.
         3) Five anchors per jamb from 90 to 96 inches high.
         4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
         5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
      c. Compression Type: Not less than two anchors in each jamb.
      d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
8. Terminated Stops (Hospital Stops): Terminate stops at height above finish floor as required to match existing. Provide a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 087100 "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.9 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/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, leaving surfaces smooth and undamaged.
      a. At fire-protection-rated openings, install frames according to NFPA 80.
      b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      c. Install frames with removable glazing stops located on secure side of opening.
      d. Install door silencers in frames before grouting.
      e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
      f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
   a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.


4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.

5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.

6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:
   a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
   b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
   c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 088853 “Security Glazing” and with hollow metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113
SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid-core with wood-veneer faces.
   2. Factory finishing of flush wood doors.
   3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
   1. Dimensions and locations of blocking.
   2. Dimensions and locations of mortises and holes for hardware.
   3. Dimensions and locations of cutouts.
   4. Requirements for veneer matching.
   5. Doors to be factory finished and finish requirements.
   6. Fire-protection ratings for fire-rated doors.

C. Samples for Verification:
   1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of 3 samples showing typical range of color and grain to be expected in finished Work.
   2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
      a. Provide samples for each species of veneer and solid lumber required.
      b. Finish veneer-faced door samples with same materials proposed for factory-finished doors.

D. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames for each floor separately.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting
   1. Stack wood doors as recommended by door manufacturer.
   2. Use opaque plastic sheeting for natural finished doors.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.
1.4 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
1. Failures include the following:
   a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
   b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Graham Wood Doors; an Assa Abloy Group company.
3. VT Industries, Inc.

B. Source Limitations: Obtain flush wood doors 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."

B. WDMA I.S.1-A Performance Grade.
1. Extra Heavy Duty.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure per NFPA 252 or UL 10C.
1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 degrees F above ambient after 30 minutes of standard fire-test exposure.
2. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
4. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing per UL 1784.

E. Structural-Composite-Lumber-Core Doors:
      a. Screw Withdrawal, Face: 700 pound-force.
      b. Screw Withdrawal, Edge: 400 pound-force.

F. Mineral-Core Doors:
   1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
   2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
   3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:
   1. Basis of Design: Subject to compliance with requirements, provide basis of design indicated or comparable product by one of the following:
      a. Graham; An Assa Abloy Company
      b. Marshfield Door Systems, Inc.
      c. VT Industries, Inc.
   2. Grade: Premium, with Grade A faces.
   6. Assembly of Veneer Leaves on Door Faces: Running match.
   7. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
   8. Door Edges: Match veneer of door faces.
   9. Core: Glued wood stave, unless otherwise indicated.
   10. Construction: 5 plies. Solid lumber stiles, rails and blocking. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.

2.4 LIGHT FRAMES AND LOUVERS

A. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
B. Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated.

C. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
   1. Wood Species: Same species as door faces.
   2. Profile: As selected by Architect from manufacturer's full line of profiles.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates as furnished by door hardware supplier.

C. Openings: Cut and trim openings through doors in factory.
   1. Light Openings: Trim openings with moldings of material and profile that matches door veneer.
   2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088100 – Glass Glazing.

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   1. Finish faces, all 4 edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory to receive transparent finish.

C. Transparent Finish:
   1. Grade: Premium.
   2. Finish: AWI catalyzed polyurethane system.
   3. Staining: None required.
   4. Sheen: Satin unless indicated otherwise.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 - Door Hardware.

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
   1. Install fire-rated doors per NFPA 80.
   2. Install smoke- and draft-control doors per NFPA 105.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
   1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
      a. Comply with NFPA 80 for fire-rated doors.
   2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
   3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely. If door cannot be made to operate properly, remove and install new door.

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.
   1. Restore finish before installation, if fitting or machining is required at Project site.

3.4 PROTECTION

A. Protect doors as recommended by door manufacturer to ensure that wood doors are without damage or deterioration at time of Substantial Completion.
   1. Remove doors damaged during installation and install new doors.

END OF SECTION 081416
SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

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

1.2 SUMMARY
   A. This Section includes the following:
      1. Fire-rated access doors and frames for walls and ceilings.
      2. Stainless steel access panels.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of access door and frame indicated. Include construction details, materials, individual components and profiles, and finishes.
   B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
   C. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.4 INFORMATIONAL SUBMITTALS
   A. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.5 QUALITY ASSURANCE
   A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.
   B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.
   C. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, according to NFPA 252 or UL 10B.

1.6 COORDINATION
   A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.
PART 2 - PRODUCTS

2.1 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   1. ASTM A 123/A 123M, for galvanizing steel and iron products.
   2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Steel Sheet: Uncoated or cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 zinc-iron-alloy (galvannealed) coating or G60 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.

D. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.

2.2 FIRE-RATED ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cendrex
   2. J. L. Industries, Inc.

B. Fire-Rated, Flush Access Doors and Frames with Gypsum Drywall Trim:
   1. All access doors shall be fire-rated access doors.
   2. Basis of Design: J.L. Industries, Inc.; Series FDWB
   3. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with exposed flange, self-closing door, and concealed hinge.
   4. Locations: Wall and ceiling surfaces as indicated on Drawings.
   5. Door: 2 inches thick, insulated 20 gauge steel.
   6. Size: As indicated on Drawings.
   7. Frame: 16 gauge steel with 1 inch drywall bead flange.
   8. Provide metallic coated steel sheet for high humidity applications.
   10. Latch and Lock: Self-latching door hardware, operated by key with interior release.
   11. Finish: Factory applied, baked enamel primer suitable for field applied finish.

2.3 STAINLESS STEEL ACCESS PANELS

A. Stainless Steel Access Panels: Provide 3/16 inch thick stainless steel access panels in the Patient Bathrooms in back of toilets where indicated. Edges shall be beveled and polished and corners shall have a 1/2 inch radius. Provide approximate 1-1/2 inch cut-out for flush valve push button; coordinate with Division 23.
   2. Install with Torx head tamper-resistant screws, pattern to match existing.
2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
   1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
   2. Provide mounting holes in frames for attachment of units to metal framing.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
   1. For cylinder lock, furnish two keys per lock and key all locks alike.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Steel Finishes:
   1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
   2. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

E. Stainless-Steel Finishes:
1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   a. Run grain of directional finishes with long dimension of each piece.
   b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
   c. Directional satin finish.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
A. Comply with manufacturer's written instructions for installing access doors and frames.
B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING AND CLEANING
A. Adjust doors and hardware after installation for proper operation.
B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113
SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

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 conventionally glazed aluminum curtain walls.

B. Related Sections:
   1. Section 079200 "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.
   2. Section 074243 “Metal Composite Wall and Soffit Panels” for metal composite wall panels installed in curtainwall system for spandrel.

C. Products installed, but not furnished, under this Section include the following:
   1. Door hardware furnished under Section 087100 "Door Hardware."

1.3 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of manufacturer's standard glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

   1. Glazed aluminum curtain walls 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.
      e. Failure of operating units.

B. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
1. Professional engineer shall be legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.

C. Wind Loads: As indicated on Structural Drawings.

D. Structural-Test Performance: 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, and 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.

E. Deflection of Framing Members: At design wind pressure, as follows:
   1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, 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.

F. Story Drift: Accommodate design displacement of adjacent stories indicated.
   1. Design Displacement: As indicated on Drawings.
   2. Test Performance: Meeting criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement.

G. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
   1. 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 that is drained to exterior.

H. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
   2. Test Interior Ambient-Air Temperature: 75 deg F.
   3. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

I. Energy Performance: Glazed aluminum curtain walls shall have certified and labeled energy performance ratings in accordance with NFRC.
GLAZED ALUMINUM CURTAIN WALLS 084413 - 3

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 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. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.
4. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 50 as determined according to NFRC 500.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Provide glazed aluminum curtain walls that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies by a qualified testing agency.

1. Preconstruction Testing Program: Perform tests specified in "Performance Requirements" Article on laboratory mockups in the following order:
   a. Structural-performance preloading at 50 percent of the specified wind-load design pressure when tested according to ASTM E 330.
   b. Air infiltration when tested according to ASTM E 283.
   c. Water penetration under static pressure when tested according to ASTM E 331.
   d. Structural performance at design load when tested according to ASTM E 330.
   e. Repeat air filtration when tested according to ASTM E 283.
   f. Repeat water penetration under static pressure when tested according to ASTM E 331.
   g. Structural performance at maximum 150 percent of positive and negative wind-load design pressures when tested according to ASTM E 330.
   h. Impact testing in accordance with AAMA 501.8 and as indicated in Section 085653 "Security Windows."

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For glazed aluminum curtain walls. 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. Show sill flashing.
3. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
4. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
   a. Joinery, including concealed welds.
   b. Anchorage.
   c. Expansion provisions.
5. Include laboratory mockup Shop Drawings, prepared by a qualified preconstruction testing agency, showing details of laboratory mockup.
   a. Resubmit Shop Drawings with changes made to glazed aluminum curtain walls to successfully complete preconstruction testing.

C. Samples for Verification:
   1. For each type of exposed finish required, in manufacturer's standard sizes.
   2. Sill flashing.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   5. Flashing and drainage.

E. Delegated-Design Submittal: For glazed aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and testing agency.

B. Welding certificates.

C. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components, from manufacturer.
   1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for glazed aluminum curtain walls, indicating compliance with performance requirements.

E. Field quality-control reports.

F. Warranties: Sample of special warranties.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.
1.9 QUALITY ASSURANCE

A. Source Limitations: Obtain glazed aluminum curtain wall and aluminum-framed storefront and entrances through one source from a single manufacturer.

B. Curtain wall work shall be directly sub-contracted by the General Contractor to a qualified installer who specializes in the installation of curtain wall, utilizing their own forces for installation, and has an on-going business relationship with one of the specified manufacturers, whose product is to be supplied. Brokering or sub-subcontracting of curtain wall work is unacceptable and will not be allowed.

C. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum curtain walls that meet or exceed energy performance requirements indicated and of documenting this performance by certification, labeling, and inclusion in lists. Manufacturer shall have not less than 10 years successful experience in the fabrication of assemblies of the type and quality required.

D. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Installer shall have successfully completed not less than two projects of similar size, scope, and complexity as that of this Project within the last three years.

E. Preconstruction Testing Agency Qualifications: Qualified according to ISO/IEC 17025 and accredited by ICC-ES for preconstruction testing indicated.

F. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

G. 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 revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.


I. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

J. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

1. Provide NFRC-certified glazed aluminum curtain walls with an attached label.
K. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical wall area as shown on Drawings.
   2. Include flashing, factory fabricated sill flashing, and other items indicated under sample submittals.
   3. Field testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
   4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

L. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to glazed aluminum curtain walls including, but not limited to, the following:
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review and discuss the finishing of glazed aluminum curtain wall that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
   3. Review, discuss, and coordinate the interrelationship of curtain wall with other exterior wall components. Include provisions for structural anchorage, flashing, weeping, sealants, and protection of finishes.
   4. Review and discuss the sequence of work required to construct a watertight and weather tight exterior building envelope.
   5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.10 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication and indicate measurements on Shop Drawings.

1.11 COORDINATION

A. Coordinate doors, frames, door hardware, and other work for proper installation of door hardware, furnished under other Sections and installed in glazed aluminum curtain wall systems. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.12 WARRANTY

A. Special Assembly Warranty: Standard form in which manufacturer agrees to repair or replace components of glazed aluminum curtain walls 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 and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 10 years from date of Substantial Completion.

1.13 MAINTENANCE SERVICE

A. Entrance Door Hardware:

1. 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 entrance door hardware.

2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

a. Coordinate with door hardware supplier for replacement of defective items.

3. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wausau Window and Wall Systems; SuperWall System (Basis of Design)
2. EFCO Corporation
3. Kawneer North America; an Alcoa Company
4. Oldcastle BuildingEnvelope (Vistawall)
5. YKK AP America Inc.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: 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.

   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.

2.3 FRAMING

A. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

   2. Glazing System: Retained mechanically with gaskets on four sides.
   3. Glazing Plane: Front, unless otherwise indicated on Drawings.
   4. Framing Depth: As indicated on Drawings.
   5. Finish: Clear anodized finish.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. 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.

D. 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.

E. Perimeter Filler: Provide perimeter filler / backer plate to close back of frame and facilitate placement of backer rod and sealant.

F. Concealed Flashing: Dead-soft, 0.018-inch- thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer.

G. Framing Sealants: Manufacturer's standard sealants.
2.4 GLAZING

A. Glazing: Comply with Section 088000 "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.

2.5 DOORS

A. Aluminum Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
   1. Door Construction: 2-inch overall thickness, with minimum 0.188-inch thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
      a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
   2. Door Design: Wide stile; 5-inch nominal width.
      a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
      a. Provide nonremovable glazing stops on outside of door.

2.6 ENTRANCE DOOR HARDWARE

A. General: Except for items specified in this Article, entrance door hardware to be furnished under Section 087100 "Door Hardware."
   1. All hardware preparation and installation to be performed as Work of this Section.

B. Weather Sweeps: Manufacturer’s standard exterior-door bottom sweep with concealed fasteners on mounting strip.

C. Silencers: BHMA A156.16, Grade 1.

D. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.7 ACCESSORY MATERIALS

A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.
2.8 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 cope 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 interior for vision glass and exterior for spandrel glazing and metal panels.
   6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Fabricate components that, when assembled, have the following characteristics:
   1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
   2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

E. Factory-Assembled Frame Units:
   1. Rigidly secure nonmovement joints.
   2. Seal joints watertight unless otherwise indicated.
   3. Install glazing to comply with requirements in Section 088000 "Glazing."

F. Sill Extension: Extruded aluminum. Profile as indicated on Drawings.

G. Sill Flashing: Manufacturer's tested and approved sill flashing system, finished to match curtainwall; designed to direct water away from building when installed horizontally at sill.
   1. PVC is not acceptable.

H. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
   1. At exterior doors, provide compression weather stripping at fixed stops.
   2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

I. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

J. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

K. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Apply finishes to formed metal after fabrication unless otherwise indicated.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 ALUMINUM FINISHES

A. General: Comply with the NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. 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 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. Provide fasteners at spacing as recommended by manufacturer.
7. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
8. Seal joints watertight unless otherwise indicated.

B. Metal Protection:
1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

D. Install components plumb and true in alignment with established lines and grades.

E. Installation of Sill Flushing: Extend sloped flashing to exterior face of building per manufacturer's instruction.
1. Set flashing in a continuous bed of sealant.
2. Do not apply sealant between flashing and bottom of curtain wall frame, except as required by manufacturer to comply with specified performance requirements.

F. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

G. Install glazing as specified in Section 088000 "Glazing."

3.3 ERECTION TOLERANCES
A. Erection Tolerances: Install glazed aluminum curtain walls 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.
3.4 FIELD QUALITY CONTROL

A. Contractor/Installer Testing: Contractor/Installer shall be prepared to provide the following minimum testing as part of the Work.

1. Testing shall be in compliance with AAMA 501.2. Testing shall be performed at approximately 10 percent and 50 percent completion. A minimum of 2 test areas to be tested at each phase. Additional testing may be required if installation crew changes or if construction is suspended and resumed after an extended period of time. Coordinate with Architect’s representative for areas to be tested, testing times, and representative’s availability to monitor tests.

B. Testing Agency: Owner may engage a qualified independent testing and inspecting agency to perform field tests and inspections.

C. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive phases as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft., of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.

2. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing under Part 1 "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.

D. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

F. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

END OF SECTION 084413
SECTION 085653 - SECURITY WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes interior security window screens.

1.2 REFERENCED STANDARDS

A. Standard/Specification for Windows, Doors, and Unit Skylights: AAMA/WDMA/CSA 101/I.S.2/A440-08, sponsored and published by the American Architectural Manufacturers Association (AAMA), the Window & Door Manufacturers Association (WDMA) and the Canadian Standards Association (CSA).


1.3 QUALITY ASSURANCE

A. Quality Control Testing - General:
  1. Provide certified independent laboratory test reports in full accord with referenced standards in Article 1.3 B of this Section.
  2. Tests shall be performed until all configurations that require testing pass all specified tests.

B. Test Units:
  1. Perform all tests, unless otherwise noted, on the following windows.
     a. The project's largest size window or largest size configuration of multiple windows in the same window opening including meeting rails and stacking mullions. If the largest window for the project does not exceed 24 square feet, the test may be performed on a minimum 4'-0" by 6'-0" window utilizing the hardware required for the project.
     b. For the Impact Test, in addition to 1.3 B above, prove adequacy of hardware and anchorage in units smaller than those tested, by one of the following.
        1) Calculations prepared by a registered professional engineer, taking into account energy absorption and load transfer.
        2) Project-specific testing of the smallest short dimension to be provided.
  2. Test all units using the supporting conditions and perimeter conditions which exist at the project installation, as part of the total system including glazed aluminum curtain walls as indicated on the Drawings.
  3. Test all units in conjunction with Section 084413 "Glazed Aluminum Curtain Walls."
  4. Anchors and Connections: Masonry anchors in concrete shall be designed for failure of anchors before failure of concrete in splitting, spalling, pull-out or bearing. In cases
where connections' failure mode is non-ductile (brittle), code or manufacturers' allowable design values must be used.

C. Test Procedures:
1. Impact Test
   a. Perform the Impact Test in accordance with the most recent version of AAMA 501.8 and as indicated in this section.
   b. For each type of glazing or window panel infill that is exposed to the inpatient environment, perform the full number of impacts required in AAMA 501.8.
   c. Perform the Impact Test with an impact energy of 2,000 foot-pounds.
   d. Provide Impact Test Reports in accordance with AAMA 501.8.12
   e. Window will have passed the impact load test when it complies with the performance requirements of AAMA 501.8.12 and the additional requirements indicated below:
      1) Impact test load has not broken through the interior glazing and made penetration contact with enclosed air space.
      2) Interior glazing, although damaged, remains firmly held in place within perimeter casement frame and glazing stops. Partial disengagement of the glazing from the frame is not permitted.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Shop drawings complete and full scale showing construction of all components, dimensions and details and proposed fastening systems. Indicate complete coordination with adjacent construction.

B. Samples:
   1. Samples of aluminum finishes, showing the range of color variation. Two of these will be selected by the architect to reflect the permissible range of variation for the project.
   2. Samples of mitered corners.
   3. Sample mock-up window unit installation in full detail. Mock-up is to be installed in the project at a location determined by the Architect. The mock-up will serve as quality control for the installation.

1.5 INFORMATIONAL SUBMITTALS

A. Certifications:
   1. Provide certifications required by Article 1.4 A.1 above.
   2. Provide certificate verifying that the manufacturer is AAMA certified.
   3. Provide manufacturer's certification that all windows will be, at minimum, manufactured to AAMA standards. Specific reference must be made to specification requirements that exceed AAMA requirements.

B. Test Reports/Calculations: Certified independent laboratory test reports verifying compliance with all test requirements and structural calculations prepared by registered structural engineer licensed in the State of North Carolina, for approval purposes to indicate adequacy of all installed materials to meet the specified uniform and structural load requirements. Test reports shall be submitted within 30 days after approval of Sample 1.
1.6 JOB CONDITIONS

A. Deliver windows marked with identification for window location.

B. Store and handle windows in a manner that will not cause damage to the finish.

1.7 WARRANTY

A. The aluminum windows and related materials shall be warranted for a period of fifteen years.

1.8 SYSTEMS DEMONSTRATION

A. Provide 8 hours of training provided by the window manufacturer and installer. Training shall cover interior and exterior glass replacement, hardware replacement, blind replacement, routine maintenance, finish touch-up and other procedures required for the maintenance and replacement of the windows.

1.9 EXTRA STOCK

A. Spare Parts: Furnish the following items in the manufacturer's original containers properly labeled with the names of the items and locations to be used. Store spare parts at the site where directed by the Owner's Representative. Finishes shall match installed products.
   1. Hardware: One set each of exterior and interior casement frame hinges, locks and fasteners.
   2. Window Blinds: One complete window blind replacement units, including controls for each different size provided on the project, clearly labeled as to type and size. Where there are less than ten (10) windows of a particular type and size, provide two (2) sets as described for this type and size.

B. Special Tools and Keys: Five complete sets of special tools and keys for each type of window installed. Set shall consist of all tools or keys necessary to unlock, open, lock and close one typical window unit.

C. Finish Touch-up Kits: Three window manufacturer's factory finish touch-up kit for the finish on window frames. Store touch-up kits at the site where directed. Label kits with the list of contents and directions for storage.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design: Subject to compliance with requirements, provide basis of design indicated or comparable product by one of the following:
   1. Wausau Window and Wall Systems; 2187-DT SEAL (Basis of Design)
3. Oldcastle BuildingEnvelope.

2.2 MATERIALS

A. Aluminum Windows and Components:
1. All window sections shall have a minimum of 3-1/4" in depth and shall have a maximum perimeter sightline of 3-1/2". Maximum sightlines at adjacent units shall not exceed 7-1/8". The maximum sightlines do not include starter channels, closures, etc. which may be required by certain installation conditions.
2. There shall be no change in sightlines between fixed and operable window units.
3. All windows shall be fabricated with a maximum of two perimeter extrusions exposed to the exterior.
4. All aluminum members shall be extruded from 6063 T5 prime billet.
5. All principal window members shall have a minimum wall thickness of .125". Interior glazing legs and beads shall have a minimum wall thickness of .187". Glazing shall be designed to eliminate access to all interior glazing materials.
6. All framing members shall be tubular in design including the window blind access panel.
7. Corner intersections shall be crimped and mechanically fastened in the factory. Corner construction shall be fabricated to meet all referenced test requirements and exposed miters shall be hairline and back-sealed.
8. Depth of glazing leg on interior sash shall provide a minimum rabbet depth as follows:
   a. For polycarbonate glazing: 1-1/4" rabbet depth for a 1" minimum dry glazed edge bite.

B. Hardware:
1. General:
   a. All locking hardware shall be 300 series stainless steel. All limited opening and friction arm hardware, all hinge pins and all locking hardware strikes shall be stainless steel or cast white bronze.
   b. All aluminum components shall be 6063 T5 alloy.
2. Hinges:
   a. Each operating sash shall be provided with a minimum of two extruded aluminum hinges. Windows over 4'-4" in height shall be provided with an intermediate hinge. All hinges must be concealed.
   b. The access vent hinge shall be a minimum of 1/8" in thickness and 4" in height.
   c. Each hinge shall have a 1/4" diameter stainless steel pin and shall be fastened with a minimum of five stainless steel screws per hinge assembly. Hinge pins shall be non-removable and mechanically secured.
   d. Each hinge shall be thermally separated with a 1/8" thick nylon separator.
3. Locks:
   a. Each operating sash shall be provided with a minimum of three stainless steel flush mounted, concealed tamper-proof cam locks and one Fort Lock Corp., Series 1000 Gem Lock. Windows greater than 4 ft. wide shall have an additional cam lock on each top and bottom rail.
   b. Cam locks shall be located at the top, bottom and center of the vertical rail.
   c. The Gem lock shall be located on the vertical rail, 6 in. below the center cam lock.
   d. For cam lock operation, supply one complete tool/key set consisting of the number of special tool/keys needed to open the largest window in the facility (i.e., equal to
the number of cam locks in the facility's largest window) for each floor of each building wing. In addition provide ten (10) spare tool/keys for each building.

e. For Gem lock operation, provide a quantity of three (3) unique 7 pin keys for each floor of each wing of the building.

f. Cam Locks shall have the following features:

1) The cam lock holder shall be fabricated of fiberglass reinforced nylon to provide a snug friction fit (free movement design is not acceptable).
2) Install all locks so that cams rotate upward to release.
3) Finish off the tool/key access hole very tightly; maximize the distance and minimize the working angle between the cam and the potential point of entry for an unauthorized tool. Furnish and install a white bronze escutcheon plate to frame the opening for the tool/key, approximately 1 in. x 3 in. x 3/16 in. thick with a dual strike hook extension molded into the back of the escutcheon plate for securing into one square hole above and one square hole below the tool/key opening. Secure to frame with fully concealed fasteners.
4) Cam lock tool/keys shall be made from hardened steel with T-shaped handle, strong enough to provide the leverage required to move the cam open against the required spring and friction resistance with no damage to the tool/key.
5) Cam locks shall capture the tool/key when the lock is in the opened (unlocked) position (tool/key can be removed only when lock cam has secured window sash in the closed position).

.g. Gem locks shall have the following features:

1) Operation shall require a unique 7 pin key.
2) The Gem lock shall capture the 7 pin key when the lock is in the open (unlocked) position (key can be removed only when lock has secured window sash in the closed position).

h. All locking hardware shall be provided with a stainless steel or die-cast Zamac strike backed up with an extruded aluminum leg at least 0.125 in. thick. Locking directly against aluminum will not be accepted.

4. Riser Blocks: Each access panel shall be equipped with nylon rise blocks at the sill.

C. Window Blinds:

1. Windows which shall receive blinds are shown on the drawings.
2. Each blind shall be equipped with a 5/8" wide extruded aluminum head and sill rail. Head and sill rails shall be end capped with a molded cap formed to fit the rail profile.
3. The blind slats shall be made of virgin aluminum alloy, and shall be 0.006" in thickness and 5/8" in width. The slats shall have rounded corners at the ends. The slat ladders shall be braided polyester Dacron yarn spaced 5" from the ends of the blinds and not over 16" on center.
4. The blind control shall be equipped with a special slip clutch safety feature which allows the blind to be tilted but prevents override.
5. Blind Control Knob:
   a. The knob shall be nylon and be designed to be tool operated.
   b. The knob shall have a profile that provides no ligature point or tie-off ability.
   c. The knob shall be non-removable and vandal resistant.
6. Raising and lowering of the blind shall be by authorized personnel only. Lift cords shall be 0.070 in diameter and shall consist of rayon cord.
D. Factory Installed Sealants:
1. Materials used between components, and ganged units to be elastomeric high range type, dependent upon specific application and manufacturer's recommendations. See Section 079200 – Joint Sealants for joint between window frame and surrounding construction.
2. All sealants used will be concealed within window unit. No sealant will be exposed to patient environment.

E. Glass and Glazing:
1. All window units shall be factory glazed.
2. Interior lite shall be one of the following:
   a. 1/2-inch thick clear Sabic Lexan Model #SL-4855
   b. 1/2-inch thick clear Sheffield Plastics Makralon AR, with scratch resistant coating.
3. All glazing shall be the type and strength to meet the load requirements specified.

2.3 FABRICATION

A. General:
1. All window units shall be factory fabricated including all sealing and installation of all hardware.
2. All frame members shall be fabricated with a flush exterior and interior surface between adjacent members.
3. All sash members shall be fabricated with a flush exterior and interior surface between adjacent members.
4. All units shall have an acceptable finish range between adjacent members.
5. All fasteners which penetrate the perimeter frame shall be completely sealed with an approved sealant.
6. Any projection beyond the surface of the frame greater than 0.125", but less than 0.375", shall be provided with a 0.090" minimum radiused edge that resists ligature and tie-off. No projections greater than 0.375" shall be permitted.

B. Access Sash: Miter all corners, reinforce with a solid 1/4" corner block, seal with two-part chemically curing epoxy and mechanically stake to corner blocks with a minimum of eight stakes per corner on the main sash member and a minimum of four stakes per corner on the access panel.

C. Joint Tolerances:
1. The maximum permitted width of open gaps across mitered and butt joints is 0.031".
2. Adjacent sections of sash and frames shall be no more than 0.031" out of plane across or along mitered and butt joints.
3. The amount of offset or non-alignment shift at fabricated corners shall not exceed 0.020"
4. The mitered joints that are visible in elevation of operable sash shall be offset from the mitered joint of the frame by no more than 3/16".

D. Glazing:
1. Windows shall be glazed at the factory in accordance with Section 088000 – Glazing and Section 088853 – Security Glazing.
2. Access panel glazing shall be held in place by removable aluminum stops which are removable from the interior of the assembly.
3. Access panel shall be glazed with a concealed gasket or tape on the interior and foam tape and silicone cap bead on the exterior of the inboard glass lite.

4. The glazing bead at the interior operating sash shall be a minimum of 3/16" thick and shall be mechanically fastened with 1/4 - 20 fasteners a minimum of 18" o.c. The mechanical fasteners shall provide thread engagement of at least 0.25". The glazing bead shall also lock against two extruded legs on the operating sash.
   a. All glazing bead material shall be concealed within window unit. No glazing bead material shall be exposed or accessible to the patient environment.

5. All aluminum sections shall be cleaned and/or primed in accordance with the sealant manufacturer's recommendations.

E. Finish:
   1. Finish of all exposed areas of aluminum windows and components shall be done in accord with the appropriate AAMA Voluntary Guide Specification shown.
      a. Clear Anodized Finish: AAMA 608.1, AAM10C21A41, Class I, 0.018 mm or thicker.
   2. All extrusions shall be finished in lineals prior to fabrication. Manufacturer's quality control shall provide close control on acceptable color variations between adjacent members as determined by the Architect. Units shall not vary from established limits.

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 security windows.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of security window connections before security window installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of security windows.

D. For glazing materials whose orientation is critical for performance, verify installation orientation.

E. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Coordination: Furnish layouts for anchors, clips, and other security window anchors whose installation is specified in other Sections.
   1. Furnish anchors and similar devices to other trades for installation well in advance of time needed for coordinating other Work.

3.3 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing security windows to in-place construction. Include threaded fasteners for inserts, security fasteners, and other connectors.


C. Removable Glazing Stops and Trim: Fasten components with security fasteners.

D. Fasteners: Install security windows using fasteners recommended by manufacturer with head style appropriate for installation requirements, strength, and finish of adjacent materials. Provide stainless-steel fasteners in stainless-steel materials.

E. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.4 FIELD QUALITY CONTROL

A. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.

B. Perform additional inspections to determine compliance of replaced or additional Work. Prepare inspection reports.

3.5 ADJUSTING

A. Adjust horizontal-sliding, transaction security windows to provide a tight fit at contact points for smooth operation and a secure enclosure.

B. Adjust transaction drawers to provide a tight fit at contact points for smooth operation and secure enclosure.

C. Remove and replace defective work, including security windows that are warped, bowed, or otherwise unacceptable.
3.6 CLEANING AND PROTECTION

A. Clean surfaces promptly after installation of security windows. Take care to avoid damaging the finish. Remove excess glazing and sealant compounds, dirt, and other substances.
   1. Lubricate sliding security window hardware.
   2. Lubricate transaction drawer hardware.

B. Clean glass of preglazed security windows promptly after installation. Comply with requirements in Section 088853 – Security Glazing for cleaning and maintenance.

C. Provide temporary protection to ensure that security windows are without damage at time of Substantial Completion.

END OF SECTION 085653
This page intentionally left blank.
SECTION 086200 - UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Unit skylights mounted on prefabricated curbs.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of unit skylight.

B. Shop Drawings: For unit skylight work. Include plans, elevations, sections, details, and connections to supporting structure and other adjoining work.

C. Samples: For each type of exposed finish required and each type of glazing.

D. Product Schedule: For unit skylights. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification data.

B. Product test reports.

C. Field quality-control reports.

D. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of unit skylights that fail in materials or workmanship within specified warranty period.

   1. Failures include, but are not limited to, the following:
      a. Water leakage.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

c. Deterioration of insulating-glass hermetic seal.

2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Basis-of-Design or a comparable product by one of the following:

1. Avaya
2. Bristolite Daylighting Systems; a Kingspan company.
3. Plasteco.
4. SunOptics.
5. Velux America; “Traditional Dome Skylight, CT2” (Basis of Design).

2.2 PERFORMANCE REQUIREMENTS

A. Unit Skylight Standard: Comply with AAMA/WDMA/CSA 101/LS.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Certification: AAMA-, WDMA-, or CSA-certified unit skylights with label attached to each.

2. Fall Protection Standard Compliance: 29 CFR 1910.23: Skylight dome, tested to support a minimum of 800 lb over 1 sq. ft. of the surface.

2.3 UNIT SKYLIGHTS

A. Unit Shape and Size: Square, dimensions as indicated on Drawings.

1. Basis of Design: “CCAM Commercial Curb” by Velux

B. Polycarbonate Glazing: Thermoformable, extruded monolithic sheets, UV resistant, burglar-resistance rated according to UL 972, and with average impact strength of 12 to 16 ft-lb/in. of width when tested according to ASTM D 256, Test Method A (Izod).


a. Thicknesses: Not less than thicknesses required to exceed performance requirements.

b. Inner Glazing Color: Internal white prismatic light refractor lens.

c. Outer Glazing Color: As selected by Architect from full range of industry colors.
2. Self-Ignition Temperature: 650 deg F or more for plastic sheets in thickness indicated when tested according to ASTM D 1929.

3. Smoke-Production Characteristics: Smoke-developed index of 450 or less when tested according to ASTM E 84, and smoke density of 75 or less when tested according to ASTM D 2843.

4. Burning Characteristics: Tested according to ASTM D 635. Class CC1, burning extent of 1 inch or less for nominal thickness of 0.060 inch or thickness indicated for use.

C. Glazing Gaskets: Manufacturer's standard.

D. Integral Curb: Extruded-aluminum, self-flashing type.

2. Height: 8-inch minimum, unless otherwise indicated.
3. Construction: Double wall.
4. Insulation: Manufacturer's standard rigid or semirigid type.
   a. Exposed Insulation: Cover face of insulation exposed to interior of building with aluminum liner.

E. Condensation Control: Fabricate unit skylights with integral drainage channels, internal gutters and nonclogging weeps to collect and drain condensation to the exterior.

F. Thermal Break: Fabricate unit skylights with thermal barrier separating exterior and interior metal framing.

G. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal as recommended by manufacturer. Finish exposed fasteners to match material being fastened. Provide nonremovable fastener heads.

2.4 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate installation of unit skylight with installation of substrates, vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.

B. Comply with recommendations in AAMA 1607 and with manufacturer's written instructions for installing unit skylights.
3.2 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. After completion of installation and nominal curing of sealant and glazing compounds but before installation of interior finishes, test for water leaks according to AAMA 501.2.

C. Perform test for total area of each unit skylight.

D. Work will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.3 CLEANING

A. Clean exposed unit skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes.

END OF SECTION 086200
SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Commercial door hardware for the following:
      a. Swinging doors.
      b. Other doors to the extent indicated.
   2. Special Requirements:
      a. Hardware Installation: The Door Hardware Distributor/Supplier shall be responsible for the proper installation of the door hardware supplied to this project. If supplier has staff trained and performing installations (service available) the supplier shall install the hardware with its own forces. If the door hardware supplier does not have installation capabilities then it shall contracted with an experienced hardware installation firm to install door hardware for this project. The General Contractor shall not install door hardware. The hardware supplier shall be financially responsible for damages and correction costs involved with improperly installed door hardware.
   3. Electrified door hardware.

B. Related Sections include the following:
   1. Section 081113 "Hollow Metal Doors and Frames" for astragals provided as part of fire-rated labeled assemblies.
   2. Section 081416 "Flush Wood Doors" for astragals and integral intumescent seals provided as part of fire-rated labeled assemblies.
   3. Section 083113 "Access Doors and Frames" for access door hardware, including cylinders.
   4. Division 26 Sections for connections to electrical power system and for low-voltage wiring work.
   5. Section 283111 "Fire Detection and Alarm System" for connections to building fire alarm system.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
   1. Hardware specified for other Sections.
   2. Door control system to be furnished and installed by the Owner, including operating system, logic sequence, and electronic card or FOB readers.
1.3 ACTION SUBMITTALS

A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:
   1. Wiring Diagrams: Power, signal, and control wiring. Include the following:
      a. System schematic.
      b. Point-to-point wiring diagram.
      c. Riser diagram.
      d. Elevation of each door.
   2. Detail interface between electrified door hardware and fire alarm, access control, security, and building control system.
   3. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Samples for Verification: For exposed door hardware of each type, in specified finish, full size. Tag with full description for coordination with the door hardware sets. Submit Samples before, or concurrent with, submission of the final door hardware sets.
   1. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

D. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant and sealed by the consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   1. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
   2. Content: Include the following information:
      a. Identification number, location, hand, fire rating, and material of each door and frame.
      b. Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
      c. Complete designations of every item required for each door or opening including name and manufacturer.
      d. Fastenings and other pertinent information.
      e. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
      f. Explanation of abbreviations, symbols, and codes contained in schedule.
      g. Mounting locations for door hardware.
      h. Door and frame sizes and materials.
      i. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
         1) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter;
authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.

j. List of related door devices specified in other Sections for each door and frame.

3. Submittal Sequence: Submit initial draft of final schedule along with essential Product Data to facilitate the fabrication of other work that is critical in Project construction schedule. Submit the final door hardware sets after Samples, Product Data, coordination with Shop Drawings of other work, delivery schedules, and similar information has been completed and accepted.

E. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.

1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

2. Installer shall have warehousing facilities in Project's vicinity.


4. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and is currently a DHI seal member, and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL 10C.

1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches or less above the sill.

E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Means of Egress Doors (NFPA 101):

1. Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
2. Door Closers: Not more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.

G. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1, including but not limited to the following:

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:
   a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
   b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
   c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high (NFPA 101).
4. Adjust door closer sweep periods as indicated in Part 3 of this Section.

H. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." In addition to Owner, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Address for delivery of keys.

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to electrified door hardware including, but not limited to, the following:

1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
2. Review sequence of operation for each type of electrified door hardware.
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 required testing, inspecting, and certifying procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to Owner by registered mail or overnight package service.

1.8 COORDINATION

A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system and building control system.

C. Coordinate door pulls with cylinder lock location to confirm pulls do not interfere with access to lock. Provide offset pulls if required.

D. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including excessive deflection, cracking, or breakage.
   b. Faulty operation of operators and door hardware.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion, except as follows:
   a. Electromagnetic Locks: Five years from date of Substantial Completion.
   b. Exit Devices: Two years from date of Substantial Completion.
   c. Manual Closers: 10 years from date of Substantial Completion.
   d. Locks and Latches: Five years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.
2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

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

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 HINGES, GENERAL

A. Quantity: Provide the following, unless otherwise indicated:

1. Two Hinges: For doors with heights up to 60 inches.
2. Three Hinges: For doors with heights 61 to 90 inches.
3. Four Hinges: For doors with heights 91 to 120 inches.
4. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

C. Hinge Weight: Unless otherwise indicated, provide the following:

1. Entrance Doors and Cross-Corridor Doors: Heavy-weight or continuous hinges.
2. Doors with or without Closers: Antifriction-bearing hinges.
3. Interior Doors: Heavy-weight or continuous hinges.

D. Hinge Height: Unless otherwise indicated, provide the following:

1. Doors up to 36” in with are to receive 4 ½” tall hinges.
2. Doors from 37” to 48” in width are to receive 5” tall hinges.

E. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Exterior and Wet Area Hinges: Stainless steel, with stainless-steel pin.
2. Interior Hinges: Steel, with steel pin.
3. Hinges for Fire-Rated Assemblies: Steel, with steel pin.

F. Hinge Options: Where indicated in door hardware sets or on Drawings:
   1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors and outswinging corridor doors with locks.
   2. Corners: Square.
   3. Hospital tips on all hinges.

G. Electrified Functions for Hinges: Comply with the following:
   1. Power Transfer: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle.
   2. Monitoring: Concealed magnetic monitoring switch. Where monitor hinges are indicated, provide Extra Heavy Magnets at openings with metal doors.
   3. Power Transfer and Monitoring: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle, and with concealed magnetic monitoring switch.
   4. Wire Through/Transfer Hinges: Provide hinges with sufficient number of wires and sufficient wire gauge for the proper operation of product supplied. If the product’s electric requirement dictate the use of an auxiliary power transfer method provide a non-transfer hinge and an auxiliary power transfer that conceals all wires and cabling, so they are not visible when the door is closed.

H. Fasteners: For all exposed fasteners provide Torx pin-reject, six-lobed, security head fasteners. For all fasteners not exposed to view. Comply with the following:
   2. Wood Screws: For wood doors and frames.
   3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
   4. Screws: Phillips flat-head; machine screws (drilled and tapped holes) for metal doors. Finish screw heads to match surface of hinges.

2.3 HINGES

A. Butts and Hinges: BHMA A156.1. Listed under Category A in BHMA’s "Certified Product Directory."

B. Template Hinge Dimensions: BHMA A156.7.

C. Manufacturers:
   1. Baldwin Hardware Corporation
   2. Bommer Industries, Inc.
   3. Hager Companies
   4. IVES Hardware; an Allegion Company
   5. McKinney Products Company; an ASSA ABLOY Group company
   6. Stanley Commercial Hardware; Div. of The Stanley Works

2.4 CONTINUOUS HINGES

A. Standard: BHMA A156.26, Grade 1-300.
1. Listed under Category N in BHMA's "Certified Product Directory."

B. General: Minimum 0.120-inch thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

C. Continuous, Barrel-Type Hinges: Hinge with knuckles formed around a pin that extends entire length of hinge. Geared type hinges are not acceptable.
   1. Base Metal for Exterior Hinges: Stainless steel, unless otherwise specified.
   4. Manufacturers:
      a. Hager Companies
      b. IVES Hardware; an Allegion Company
      c. Markar Architectural Products, Inc.
      d. McKinney Products Company; an ASSA ABLOY Group company
      e. Stanley Commercial Hardware; Div. of The Stanley Works
      f. Zero International

2.5 LOCKS AND LATCHES, GENERAL

A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with ANSI A117.1 and the N.C. Accessibility Code.
   1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

C. Electrified Locking Devices: BHMA A156.25.

D. Lock Trim:
   1. Levers: Solid Bar Stock. Hollow or filled tubular levers are not acceptable.
   2. Escutcheons (Roses): Wrought.
   3. Dummy Trim: Match lever lock trim and escutcheons.

E. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
   1. Bored Locks: Minimum 1/2-inch latchbolt throw.

F. Backset: 2-3/4 inches, unless otherwise indicated.
G. Strikes: Except where noted otherwise, provide Manufacturer’s standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:

1. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.5.

H. Custom Strikes: At door frames with wood trim, provide custom door strike plate with nominal 1-1/2 inch extension, or as required to protect wood trim.

2.6 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:

1. Bored Locks: BHMA A156.2.
3. Locks shall be field-reversible without opening the lock case.

B. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13, Grade 1; Series 1000. Listed under Category F in BHMA's "Certified Product Directory."

1. Manufacturers:
   a. Best Access Systems; Div. of The Stanley Works
   b. Corbin Russwin Arch. Hardware; an ASSA ABLOY Group company
   c. SARGENT Manufacturing Company; an ASSA ABLOY Group company
   d. Schlage Commercial Lock Division; an Allegion Company
   e. Yale Commercial Locks and Hardware; an ASSA ABLOY Group Co.
   f. Accurate Lock and Hardware.
   g. Townsteel Architectural Hardware Manufacturing.

2.7 ELECTROMAGNETIC AND ELECTROMECHANICAL LOCKS

A. General: BHMA A156.23; electrically powered, of strength and configuration indicated; with electromagnet attached to frame and armature plate attached to door. Listed under Category E in BHMA's "Certified Product Directory."

1. Type: Full exterior or full interior, as required by application indicated.
2. Strength Ranking: 1000 lbf. Min, unless noted otherwise.
3. Inductive Kickback Peak Voltage: Not more than 0 V.
4. Residual Magnetism: Not more than 0 lbf to separate door from magnet.

B. Manufacturers:

1. Door Controls International
2. Rutherford Controls Int'l. Corp.
3. SARGENT Manufacturing Company; an ASSA ABLOY Group company
4. Schlage Electronics; an Allegion Company
5. Securitron Magnalock Corporation; an ASSA ABLOY Group company
6. Security Door Controls
2.8 DOOR BOLTS

A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
   2. Fire-Rated Surface Bolts: Minimum 1-inch throw; listed and labeled for fire-rated doors.

B. Dustproof Strikes: BHMA A156.16, Grade 1.

C. Flush Bolts: BHMA A156.16, Grade 1.
   1. Flush Bolt: Minimum of 1/2-inch-diameter rods of brass, bronze, or stainless steel with minimum 12-inch-long rod for doors up to 84 inches in height. Provide longer rods as necessary for doors exceeding 84 inches.
   2. Cylinder-operated flush bolts shall be as indicated in sets: mount to exterior of door face at backset recommended by manufacturer. Coordinate cylinder requirements for size, cam type and tapered rings.
   3. Manufacturers:
      a. Adams Rite
      b. Don-Jo Mfg., Inc.
      c. Door Controls International
      d. Glynn-Johnson; an Allegion Company
      e. Hager Companies
      f. IVES Hardware; an Allegion Company
      g. McKinney Products Company; an ASSA ABLOY Group company
      h. Rockwood Manufacturing Company
      i. Stanley Commercial Hardware; Div. of The Stanley Works
      j. Trimco

D. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1; designed for mortising into door edge.
   1. Manufacturers:
      a. Door Controls International
      b. Glynn-Johnson; an Allegion Company
      c. Hager Companies
      d. IVES Hardware; an Allegion Company
      e. McKinney Products Company; an ASSA ABLOY Group company
      f. Rockwood Manufacturing Company
      g. Trimco

2.9 EXIT DEVICES

A. Exit Devices: BHMA A156.3, Grade 1. Listed under Category G in BHMA’s "Certified Product Directory."
B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with ANSI A117.1 and the N.C. Accessibility Code.
   1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

F. Electromechanical Exit Devices: Provide devices that match mechanical devices. Latch-retraction devices shall function using a linear motor with self-adjusting timer in the rail. It will be the responsibility of the Hardware Supplier to furnish or coordinate with Security Contractor to furnish the proper power supplies to match supplied devices for proper inrush, amperage, and voltage.

G. Removable Mullions (Keyed Type): BHMA A156.3.

H. Fire-Exit Removable Mullions: Provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions shall be used only with exit devices for which they have been tested.

I. Outside Trim: Refer to Door Hardware Schedule; material and finish to match locksets, unless otherwise indicated.
   1. Match design for locksets and latchsets, unless otherwise indicated.

J. Manufacturers:
   1. Corbin Russwin Architectural Hardware
   2. Precision Hardware, Inc.
   3. SARGENT Manufacturing Company
   4. Von Duprin; an Allegion Company

2.10 LOCK CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5, Grade 1.

B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
1. Cylinders and keying for interior mechanical locks shall be compatible with and tied to the Owner’s existing Yale GMK system. Furnish cylinders with proper cam type for each lock type and with tapered cylinder rings.

2. Cylinders for exterior openings and electronic access control locations will be furnished and installed by the owner. Provide temporary cylinders for these locations; to be replaced after construction.

3. Cylinders provided under this section shall be factory keyed and furnished with temporary Construction keys as required.

4. Consult with Owner to determine masterkey quantities, keying and masterkeying requirements. Supplier shall obtain a letter of authorization from the Owner prior to ordering cylinders.

5. Permanent keys shall be nickel-silver, factory issued and shall match the existing key system. Permanent keys shall be turned over to the owner at his request. Bitting list and permanent keys shall be shipped directly to the Wake County Lock Shop, 401 Capital Boulevard, Raleigh, NC 27601.

C. Manufacturer: Provide same manufacturer as for locks and latches.

2.11 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.5, Grade 1; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.

1. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

B. Cross-Index System: Single-index system for recording key information. Include three receipt forms for each key-holding hook. Set up by key control manufacturer.

1. Manufacturers:
   a. Key Control Systems, Inc.
   b. Lund Equipment Co., Inc.
   c. MMF Industries

C. Key Lock Box: Designed for storage of two keys, with tamper switches to connect to intrusion detection system.

1. Manufacturers:
   a. ABLOY Security, Inc.; an ASSA ABLOY Group company
   b. Knox Company
   c. Supra Products


   a. Color: As selected by Architect.

2.12 ELECTRIC STRIKES

A. Standard: BHMA A156.31, Grade 1.
B. General: Use fail-secure electric strikes with fire-rated devices.

C. Manufacturers:
   1. Folger Adam Security Inc.; an ASSA ABLOY Group company
   2. HES, Inc.; an ASSA ABLOY Group company
   3. Precision Hardware, Inc.
   4. Rutherford Controls Intl. Corp.
   5. Von Duprin; an Allegion Company

2.13 OPERATING TRIM

A. Standard: BHMA A156.6.

B. Materials: Fabricate from stainless steel, unless otherwise indicated.

C. Manufacturers:
   1. Burns Manufacturing Incorporated
   2. Forms + Surfaces
   3. Hager Companies
   4. Hiawatha, Inc.
   5. IVES Hardware; an Allegion Company
   6. McKinney Products Company; an ASSA ABLOY Group company
   7. Rockwood Manufacturing Company
   8. Trimco

2.14 ACCESSORIES FOR PAIRS OF DOORS

A. Carry-Open Bars: Provide carry-open bars for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
   1. Material: Polished brass or bronze, with strike plate.

B. Coordinators: BHMA A156.3.

2.15 CLOSERS

A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with ANSI A117.1 and the N.C. Accessibility Code.
   1. Comply with the following maximum opening-force requirements:
      a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
      b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

B. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide multi-sized, non-handed closers, adjustable to meet field conditions and requirements for opening force.
C. Surface Closers: BHMA A156.4, Grade 1. Listed under Category C in BHMA's "Certified Product Directory." Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.
   1. Manufacturers:
      a. Corbin Russwin Arch. Hardware; an ASSA ABLOY Group company
      b. LCN Closers; an Allegion Company
      c. Norton Door Controls; an ASSA ABLOY Group company
      d. SARGENT Manufacturing Company; an ASSA ABLOY Group company

2.16 PROTECTIVE TRIM UNITS

A. Size: 2 inches less than door width on push side and 1 inch less than door width on pull side, by height specified in door hardware sets.


C. Metal Protective Trim Units: BHMA A156.6; beveled top and all sides; fabricated from the following material:
   1. Material: 0.050-inch thick stainless steel.
   2. Manufacturers:
      a. Baldwin Hardware Corporation
      b. Burns Manufacturing Incorporated
      c. Don-Jo Mfg., Inc.
      d. Hager Companies
      e. Hiawatha, Inc.
      f. IVES Hardware; an Allegion Company
      g. McKinney Products Company; an ASSA ABLOY Group company
      h. Rockwood Manufacturing Company
      i. Trimco

2.17 STOPS AND HOLDERS

A. Stops and Bumpers: BHMA A156.16, Grade 1.
   1. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.

B. Mechanical Door Holders: BHMA A156.16, Grade 1.

C. Combination Overhead Stops and Holders: BHMA A156.8, Grade 1.

D. Electromagnetic Door Holders: BHMA A156.15. Listed under Category C in BHMA's "Certified Product Directory."
   1. Coordinate with fire detectors and interface with fire alarm system for labeled fire door assemblies.

E. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch; fabricated for drilled-in application to frame.
F. Manufacturers:
   1. Architectural Builders Hardware Mfg., Inc.
   2. Door Controls International
   3. Glynn-Johnson; an Allegion Company
   4. Hager Companies
   5. IVES Hardware; an Allegion Company
   6. Rixson Specialty Door Controls; an ASSA ABLOY Group company
   7. Rockwood Manufacturing Company
   8. SARGENT Manufacturing Company; an ASSA ABLOY Group company
   9. Stanley Commercial Hardware; Div. of The Stanley Works
   10. Trimco

2.18 DOOR GASKETING

A. Standard: BHMA A156.22. Listed under Category J in BHMA's "Certified Product Directory."

B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
   1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
   2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
   3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

C. Air Leakage: Not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

D. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.
   1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.

E. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL 10C.
   1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches or less above the sill.

F. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

G. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.


I. Manufacturers:
   1. Hager Companies
   2. National Guard Products
3. Pemko Manufacturing Co.
4. Reese Enterprises
5. Sealeze; a unit of Jason Incorporated
6. Zero International

2.19 THRESHOLDS


B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with ANSI A117.1 and the N.C. Accessibility Code.
   1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.


D. Exterior Door Thresholds: Provide gasketed threshold, equal to National Guard Products Model 896, for all exterior doors.

E. Manufacturers:
   1. Hager Companies
   2. National Guard Products
   3. Reese Enterprises
   4. Rixson Specialty Door Controls; an ASSA ABLOY Group company
   5. Sealeze; a unit of Jason Incorporated
   6. Zero International

2.20 MISCELLANEOUS DOOR HARDWARE

A. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosure; filtered and regulated; voltage rating and type matching requirements of door hardware served; and listed and labeled for use with fire alarm systems.

B. Auxiliary Hardware: BHMA A156.16, Grade 1.
   1. Manufacturers:
      a. Baldwin Hardware Corporation
      b. Don-Jo Mfg., Inc.
      c. Hager Companies
      d. Lawrence Brothers, Inc.
      e. Rockwood Manufacturing Company
      f. Schlage Electronics (power supplies)
      g. Stanley Commercial Hardware; Div. of The Stanley Works
      h. Trimco
      i. Von Duprin (power supplies)
2.21 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
   1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide security fasteners according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide security flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
   1. No self drill/tap fasteners
   2. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
   3. Steel Machine or Wood Screws: For the following fire-rated applications:
      a. Mortise hinges to doors.
      b. Strike plates to frames.
      c. Closers to doors and frames.
   4. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:
      a. Surface hinges to doors.
      b. Closers to doors and frames.
      c. Surface-mounted exit devices.
   5. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
   6. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.22 FINISHES

A. Standard: BHMA A156.18, as indicated in door hardware sets.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are
acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, 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. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 Series.
   1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

B. Wood Doors: Comply with DHI A115-W Series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated on Drawings and as follows unless otherwise indicated or required to comply with governing regulations.
   1. 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. Exit devices to be mounted at 37 inches AFF.

B. Install each door hardware item to comply with manufacturer's 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 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Key Control System:
   1. Key Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
   2. Key Lock Box: Locate as directed by authorities having jurisdiction. Coordinate with AHJ for quantity, locations, and mounting heights.
D. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Architect.
   1. Configuration: Provide one power supply for each door opening.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

F. Install gasketing with fasteners at 6-inches maximum on center and 1-inch from each end.

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner may engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
   1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
   2. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.
B. Clean operating items as necessary to restore proper function and finish.
C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 017900 "Demonstration and Training."

3.8 DOOR HARDWARE SETS

A. Refer to Door Hardware Schedule following this Section.
## DOOR HARDWARE SCHEDULE

<table>
<thead>
<tr>
<th>Item</th>
<th>Abbreviation</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Hinges (Alum)</td>
<td>SL</td>
<td>Select Hinges</td>
</tr>
<tr>
<td>Continuous Hinges (SS)</td>
<td>MA</td>
<td>Markar</td>
</tr>
<tr>
<td>Continuous Pivot Hinges</td>
<td>KG</td>
<td>Kingsway Group (or specified equivalent by Markar or Pemko)</td>
</tr>
<tr>
<td></td>
<td>MA</td>
<td>Markar</td>
</tr>
<tr>
<td></td>
<td>PK</td>
<td>Pemko</td>
</tr>
<tr>
<td>Emergency Stops</td>
<td>KG</td>
<td>Kingsway Group (or specified equivalent by Pemko)</td>
</tr>
<tr>
<td></td>
<td>PK</td>
<td>Pemko</td>
</tr>
<tr>
<td>Butt Hinges</td>
<td>MK</td>
<td>McKinney</td>
</tr>
<tr>
<td>Anti-ligature Locksets</td>
<td>TS</td>
<td>Townsteel (or specified equivalent by Sargent or Accurate)</td>
</tr>
<tr>
<td></td>
<td>SA</td>
<td>Sargent</td>
</tr>
<tr>
<td></td>
<td>AC</td>
<td>Accurate Lock and Hardware</td>
</tr>
<tr>
<td>Standard Locksets</td>
<td>SA</td>
<td>Sargent (or equal by Townsteel)</td>
</tr>
<tr>
<td>Multi-point Lockset</td>
<td>SC</td>
<td>Securitech</td>
</tr>
<tr>
<td>Exit Device</td>
<td>SA</td>
<td>Sargent</td>
</tr>
<tr>
<td>Auto-Flush Bolt</td>
<td>RO</td>
<td>Rockwood</td>
</tr>
<tr>
<td>Flush Pulls</td>
<td>RO</td>
<td>Rockwood</td>
</tr>
<tr>
<td>Door Closers</td>
<td>SA</td>
<td>Sargent</td>
</tr>
<tr>
<td></td>
<td>DO</td>
<td>Dorma (fire rated doors)</td>
</tr>
<tr>
<td>Protection/Kick Plates</td>
<td>RO</td>
<td>Rockwood</td>
</tr>
<tr>
<td>Door Stops</td>
<td>KG</td>
<td>Kingsway Group</td>
</tr>
<tr>
<td>Seals</td>
<td>PE</td>
<td>Pemko</td>
</tr>
<tr>
<td>Silencers</td>
<td>RO</td>
<td>Rockwood</td>
</tr>
<tr>
<td>Fasteners</td>
<td>SHS</td>
<td>Torx Hexobular Pin-Reject Security Head Screw</td>
</tr>
<tr>
<td>Electric Strikes</td>
<td>HS</td>
<td>HES/Securiton</td>
</tr>
<tr>
<td>Magnetic Locks</td>
<td>SU</td>
<td>Securiton</td>
</tr>
<tr>
<td>Existing To Remain</td>
<td>EXR</td>
<td></td>
</tr>
<tr>
<td>45 Minute Fire Rating</td>
<td>45FR</td>
<td></td>
</tr>
</tbody>
</table>

### General Notes:
1. Submit a sample of each exposed type of finished hardware to the Architect for evaluation.
2. Provide cores & cylinders for all hardware sets.
3. Provide SHS for all exposed fasteners.
4. Accurate LR-STK can be customized to work with locksets provided by other manufacturers.
5. Provide all continuous hinges with hospital tips.
6. Refer to Life Safety Plans for locations of additional Key Switches for master overrides and remote releases for systems of electromagnetic locks.
<table>
<thead>
<tr>
<th>Set #1</th>
<th>Ligature-Resistant, Anti-Barricade (Classroom Function)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Locations:</strong></td>
<td><strong>Patient Bedrooms, Toilet and Shower Rooms</strong></td>
</tr>
<tr>
<td>1 only</td>
<td>Continuous pivot hinge KG 202, or MA DSH1000, or PK DSHP01-C US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Emergency Stop KG 207, or PK ERS-MP-C-NOTCH-HT US28</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant lockset TS MRX-A-F05-SHS, or SA 9237-BHW-SHS, or AC CH 9145SEC-SP-L.PC-SHS US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant strike AC LR-STK US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Wall stop KG 182-SHS US28</td>
</tr>
<tr>
<td>None</td>
<td>Protection plates</td>
</tr>
<tr>
<td>3 only</td>
<td>Silencer RO 608 Grey</td>
</tr>
<tr>
<td>Notes:</td>
<td>Provide factory notch out on emergency stop for locking hardware. Coordinate notch size with locking hardware requirements.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set #2</th>
<th>Ligature-Resistant, Anti-Barricade, Electric Strike (Classroom Function)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Locations:</strong></td>
<td><strong>Quiet Rooms, Social/Dining, Multipurpose, Conference</strong></td>
</tr>
<tr>
<td>1 only</td>
<td>Continuous pivot hinge KG 202, or MA DSH1000, or PK DSHP01-C US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Emergency Stop KG 207, or PK ERS-MP-C-NOTCH-HT US28</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant lockset TS MRX-A-F05-SHS, or SA 9237-BHW-SHS, or AC CH 9145SEC-SP-L.PC-SHS US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Electric Strike HS 8500C-LBSM US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Wall stop KG 182-SHS US28</td>
</tr>
<tr>
<td>None</td>
<td>Protection plates</td>
</tr>
<tr>
<td>3 only</td>
<td>Silencer RO 608 Grey</td>
</tr>
<tr>
<td>Notes:</td>
<td>Provide factory notch out on emergency stop for locking hardware. Coordinate notch size with locking hardware requirements. GC provide back box with conduit and pull string to above ceiling at card reader locations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set #3</th>
<th>Ligature-Resistant, Security Door, Mag Lock, Closer (Passage Function)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Locations:</strong></td>
<td><strong>Secure Entrances and Vestibules</strong></td>
</tr>
<tr>
<td>1 only</td>
<td>Continuous hinge MA FM300-HT-SHS US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant lockset TS MRX-A-F01-SHS, or SA 9215-BHW-SHS, or AC CH 9125SEC-SP-L.PC-SHS US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant strike AC LR-STK US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Concealed closer SA 36-268-O-CSP-SHS US26D</td>
</tr>
<tr>
<td>1 only</td>
<td>Electromagnetic lock SE MM15-DPS-TS US32D</td>
</tr>
<tr>
<td>2 only</td>
<td>Keyswitch override SE MKA-C-KA-SHS US32D</td>
</tr>
</tbody>
</table>
1 only  Power Supply    SE  BPS-24
1 only  Battery Backup  SE  B-24-5
1 only  Wiring diagram  SA  WD-SYSPK
1 only  Wall stop       KG  182-SHS  US32D
2 only  12” high protection plates RO  K1062-SHS-B4E-CSK  US32D
3 only  Silencer        RO  608     Grey
2 only  Card Reader (By Owner)

Note: GC to provide back box with conduit and pull string to above ceiling at card reader locations.
Prepare frame for electromagnetic locks and concealed closers.
Electromagnetic locking system shall be fail-secure per NCBC 407.11.
Keyswitch shall interrupt the power to the electromagnetic lock. Power shall not be restored until the key is switched back into the operating position.
Where aluminum doors or frames are indicated, provide Select Hinges SL11-HD-SHS with Tipit-LG-SHS in lieu of continuous hinge specified above, and delete protection plates.

Set #4  Ligature-Resistant, Security Door, Electric Strike, Closer (Storeroom Function)

Locations: Controlled Access Locations
1 only  Continuous hinge   MA  FM300-HT-SHS  US32D
1 only  Ligature-resistant lockset   TS  MRX-A-F07-SHS, or  US32D
1 only  Ligature-resistant lockset   SA  9207-BHW-SHS, or  US32D
1 only  Ligature-resistant lockset   AC  CH 9159SEC-SP-L.PC-SHS  US32D
1 only  Concealed closer       SA  36-268-O-CSP-SHS  US26D
1 only  Electric strike        HS  8500C-LBSM  US32D
1 only  Wall stop             KG  182-SHS  US32D
2 only  12” high protection plates RO  K1062-SHS-B4E-CSK  US32D
3 only  Silencer              RO  608     Grey
2 only  Card Reader (By Owner)

Note: GC to provide back box with conduit and pull string to above ceiling at card reader locations.
Prepare frame for electromagnetic locks and concealed closers.
Electromagnetic locking system shall be fail-secure per NCBC 407.11.
Keyswitch shall interrupt the power to the electromagnetic lock. Power shall not be restored until the key is switched back into the operating position.

Set #5W  Pair - Ligature-Resistant, Security Door, Mag Lock, Closers

Locations: Secure Entrances and Vestibules (Wood Doors)
2 only  Continuous hinge   MA  FM300-HT-SHS  US32D
2 only  Exit device w/con vertical rod  SA  12-36-WD8615-BTRIM  US32D
2 only  Concealed closer   SA  36-268-O-CSP-SHS  US26D
2 only  Electromagnetic lock  SE  MM15-DPS-TS  US32D
4 only  Keyswitch override  SE  MKA-C-KA-SHS  US32D
2 only  Power Supply       SE  BPS-24
2 only  Battery Backup     SE  B-24-5
2 only  Wiring diagram     SA  WD-SYSPK
2 only Wall stop KG 182-SHS US32D
4 only 12” high protection plates RO K1062-SHS-B4E-CSK US32D
6 only Silencer RO 608 Grey
2 only Card Reader (By Owner)

Note: GC to provide back box with conduit and pull string to above ceiling at card reader locations.
Prepare frame for electromagnetic locks and concealed closers.
Electromagnetic locking system shall be failsafe per NCBC 407.11.
Keyswitch shall interrupt the power to the electromagnetic lock. Power shall not be restored until the key is switched back into the operating position.

**Set #5M**

**Pair - Ligature-Resistant, Security Door, Mag Lock, Closers**

**Locations:** Secure Entrances and Vestibules (Hollow Metal Doors)

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item Description</th>
<th>Manufacturer</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 only</td>
<td>Continuous hinge</td>
<td>MA</td>
<td>US32D</td>
</tr>
<tr>
<td>2 only</td>
<td>Exit device w/con vertical rod</td>
<td>SA</td>
<td>US32D</td>
</tr>
<tr>
<td>2 only</td>
<td>Concealed closer</td>
<td>SA</td>
<td>US26D</td>
</tr>
<tr>
<td>2 only</td>
<td>Electromagnetic lock</td>
<td>SE</td>
<td>US32D</td>
</tr>
<tr>
<td>4 only</td>
<td>Keyswitch override</td>
<td>SE</td>
<td>US32D</td>
</tr>
<tr>
<td>2 only</td>
<td>Power Supply</td>
<td>SE</td>
<td>BPS-24</td>
</tr>
<tr>
<td>2 only</td>
<td>Battery Backup</td>
<td>SE</td>
<td>B-24-5</td>
</tr>
<tr>
<td>2 only</td>
<td>Wiring diagram</td>
<td>SA</td>
<td>WD-SYSPK</td>
</tr>
<tr>
<td>2 only</td>
<td>Wall stop</td>
<td>KG</td>
<td>US32D</td>
</tr>
</tbody>
</table>

None Protection plates

6 only Silencer RO 608 Grey
2 only Keyswitch override
2 only Card Reader (By Owner)

**Set #5A**

**Pair - Ligature-Resistant, Security Door, Mag Lock, Closers**

**Locations:** Secure Entrances and Vestibules (Aluminum Doors)

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item Description</th>
<th>Manufacturer</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 only</td>
<td>Continuous hinge</td>
<td>SL</td>
<td>US28</td>
</tr>
<tr>
<td>2 only</td>
<td>Hinge Protector</td>
<td>SL</td>
<td>Grey</td>
</tr>
<tr>
<td>2 only</td>
<td>Exit device w/con vertical rod</td>
<td>SA</td>
<td>US32D</td>
</tr>
<tr>
<td>2 only</td>
<td>Concealed closer</td>
<td>SA</td>
<td>US26D</td>
</tr>
<tr>
<td>2 only</td>
<td>Electromagnetic lock</td>
<td>SE</td>
<td>US32D</td>
</tr>
<tr>
<td>4 only</td>
<td>Keyswitch override</td>
<td>SE</td>
<td>US32D</td>
</tr>
<tr>
<td>2 only</td>
<td>Power Supply</td>
<td>SE</td>
<td>BPS-24</td>
</tr>
<tr>
<td>2 only</td>
<td>Battery Backup</td>
<td>SE</td>
<td>B-24-5</td>
</tr>
<tr>
<td>2 only</td>
<td>Wiring diagram</td>
<td>SA</td>
<td>WD-SYSPK</td>
</tr>
<tr>
<td>2 only</td>
<td>Wall stop</td>
<td>KG</td>
<td>US32D</td>
</tr>
</tbody>
</table>

None Protection plates

DOOR HARDWARE SCHEDULE 087100A - 4
None  Silencer
2 only Keyswitch override
2 only Card Reader (By Owner)

Note: GC to provide back box with conduit and pull string to above ceiling at card reader locations.
Prepare frame for electromagnetic locks and concealed closers.
Electromagnetic locking system shall be fail-secure per NCBC 407.11.
Keyswitch shall interrupt the power to the electromagnetic lock. Power shall not be restored until the key is switched back into the operating position.

<table>
<thead>
<tr>
<th>Set #6</th>
<th>Ligature-Resistant, Security Door, Electric Strike, Closer Hold Open (Storeroom)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locations:</td>
<td>Kitchen, Pantry</td>
</tr>
<tr>
<td>1 only</td>
<td>Continuous hinge MA FM300-HT-SHS US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant lockset TS MRX-A-F07-SHS, or US32D SA 9207-BHW-SHS, or US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant strike AC CH 9159SEC-SP-L.PC-SHS US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Concealed closer SA 36-268-H-CSP-SHS US26D</td>
</tr>
<tr>
<td>1 only</td>
<td>Electric strike HS 8500C-LBSM US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Wall stop KG 182-SHS US32D</td>
</tr>
<tr>
<td>2 only</td>
<td>12” high protection plates RO K1062-SHS-B4E-CSK US32D</td>
</tr>
<tr>
<td>3 only</td>
<td>Silencer RO 608 Grey</td>
</tr>
<tr>
<td>2 only</td>
<td>Card Reader (By Owner)</td>
</tr>
</tbody>
</table>

Note: GC to provide back box with conduit and pull string to above ceiling at card reader locations.

<table>
<thead>
<tr>
<th>Set #7</th>
<th>Ligature Resistant (Passage Function)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locations:</td>
<td>Vestibules, Charting</td>
</tr>
<tr>
<td>1 only</td>
<td>Continuous hinge MA FM300-HT-SHS US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant lockset TS MRX-A-F01-SHS, or US32D SA 9215-BHW-SHS, or US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant strike AC CH 9125SEC-SP-L.PC-SHS US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Wall stop KG 182-SHS US32D</td>
</tr>
<tr>
<td>2 only</td>
<td>12” high protection plates RO K1062-SHS-B4E-CSK US32D</td>
</tr>
<tr>
<td>3 only</td>
<td>Silencer RO 608 Grey</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set #8</th>
<th>Standard Hardware (Storeroom Function)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locations:</td>
<td>Utility Rooms in Non-Patient Areas</td>
</tr>
<tr>
<td>3 only</td>
<td>Butt Hinges MK T4A3386 4.5x4.5 US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Mortise Lockset SA 8204-L-B US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Wall Stop LG 182-SHS US32D</td>
</tr>
<tr>
<td>2 only</td>
<td>12” High Protection Plates RO K1062-SHS-B4E-CSK US32D</td>
</tr>
<tr>
<td>3 only</td>
<td>Silencer RO 608 Grey</td>
</tr>
</tbody>
</table>
## Set #9  Ligature-Resistant, (Storeroom Function)

**Locations:** Shell space

<table>
<thead>
<tr>
<th>Set #</th>
<th>Ligature-Resistant (Storeroom Function)</th>
<th>Locations</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 only</td>
<td>Continuous hinge</td>
<td>MA FM300-HT-SHS</td>
<td>US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant lockset</td>
<td>TS MRX-A-F07-SHS, or SA 9207-BHW-SHS, or AC CH 9159SEC-SP-L.PC-SHS</td>
<td>US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant strike</td>
<td>AC LR-STK</td>
<td>US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Concealed closer</td>
<td>SA 36-268-O-CSP-SHS</td>
<td>US26D</td>
</tr>
<tr>
<td>1 only</td>
<td>Wall Stop</td>
<td>LG 182-SHS</td>
<td>US32D</td>
</tr>
<tr>
<td>2 only</td>
<td>12” high protection plates</td>
<td>RO K1062-SHS-B4E-CSK</td>
<td>US32D</td>
</tr>
<tr>
<td>3 only</td>
<td>Silencer</td>
<td>RO 608</td>
<td>Grey</td>
</tr>
</tbody>
</table>

## Set #10  Ligature-Resistant, Anti-Barricade, Electric Strike (Storeroom Function)

**Locations:** Staff Toilet, Secure Waiting

<table>
<thead>
<tr>
<th>Set #</th>
<th>Ligature-Resistant, Anti-Barricade, Electric Strike (Storeroom Function)</th>
<th>Locations</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 only</td>
<td>Continuous pivot hinge</td>
<td>KG 202, or MA DSH1000, or PK DSHP01-C</td>
<td>US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant lockset</td>
<td>TS MRX-A-F07-SHS, or SA 9207-BHW-SHS, or AC CH 9159SEC-SP-L.PC-SHS</td>
<td>US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Emergency Stop</td>
<td>KG 207, or PK ERS-MP-C-NOTCH-HT</td>
<td>US28</td>
</tr>
<tr>
<td>1 only</td>
<td>Electric strike</td>
<td>HS 8500C-LBSM</td>
<td>US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Wall Stop</td>
<td>LG 182-SHS</td>
<td>US32D</td>
</tr>
<tr>
<td>None</td>
<td>Protection plates</td>
<td>RO 608</td>
<td>Grey</td>
</tr>
<tr>
<td>1 only</td>
<td>Card Reader (By Owner)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** Provide factory notch out on emergency stop for locking hardware. Coordinate notch size with locking hardware requirements. GC provide back box with conduit and pull string to above ceiling at card reader locations.

## Set #11  Pair – Cross Corridor

**Locations:** Adolescent Crisis

<table>
<thead>
<tr>
<th>Set #</th>
<th>Pair – Cross Corridor</th>
<th>Locations</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 only</td>
<td>Continuous hinge</td>
<td>MA FM300-HT-SHS</td>
<td>US32D</td>
</tr>
<tr>
<td>2 only</td>
<td>Ligature-resistant pull</td>
<td>AC U7001AL</td>
<td>US32D</td>
</tr>
<tr>
<td>2 only</td>
<td>Push plates</td>
<td>RO 70REA-SHS</td>
<td>US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Concealed closer</td>
<td>SA 36-268-H-CSP-SHS</td>
<td>US26D</td>
</tr>
<tr>
<td>2 only</td>
<td>Electromagnetic lock</td>
<td>SE MM15-DPS-TS</td>
<td>US32D</td>
</tr>
<tr>
<td>2 only</td>
<td>Keyswitch override</td>
<td>SE MKA-C-KA-SHS</td>
<td>US32D</td>
</tr>
<tr>
<td>2 only</td>
<td>Power Supply</td>
<td>SE BPS-24</td>
<td></td>
</tr>
<tr>
<td>2 only</td>
<td>Battery Backup</td>
<td>SE B-24-5</td>
<td></td>
</tr>
<tr>
<td>2 only</td>
<td>Wiring diagram</td>
<td>SA WD-SYSPK</td>
<td></td>
</tr>
<tr>
<td>2 only</td>
<td>Wall stop</td>
<td>KG 182-SHS</td>
<td>US32D</td>
</tr>
<tr>
<td>4 only</td>
<td>12” high protection plates</td>
<td>RO K1062-SHS-B4E-CSK</td>
<td>US32D</td>
</tr>
<tr>
<td>3 only</td>
<td>Silencer</td>
<td>RO 608</td>
<td>Grey</td>
</tr>
</tbody>
</table>

DOOR HARDWARE SCHEDULE  087100A - 6
2 only Card Reader (By Owner)
Note: GC to provide back box with conduit and pull string to above ceiling at card reader locations.

<table>
<thead>
<tr>
<th>Set #12</th>
<th>Existing Doors New Cores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locations:</td>
<td>Loading Dock</td>
</tr>
<tr>
<td>Provide new cores and cylinders to match keying system. All other hardware existing to remain.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set #13</th>
<th>Ligature-Resistant, Anti-Barricade, Electric Strike (Storeroom Function)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locations:</td>
<td>Consult Rooms, Offices, Interview</td>
</tr>
<tr>
<td>1 only</td>
<td>Continuous pivot hinge</td>
</tr>
<tr>
<td></td>
<td>MA DSH1000, or US32D</td>
</tr>
<tr>
<td></td>
<td>PK DSHP01-C US28</td>
</tr>
<tr>
<td>1 only</td>
<td>Emergency Stop</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant lockset</td>
</tr>
<tr>
<td></td>
<td>SA 9207-BHW-SHS, or US32D</td>
</tr>
<tr>
<td></td>
<td>AC CH 9159SEC-SP-L.PC-SHS US32D</td>
</tr>
<tr>
<td></td>
<td>PK ERS-MP-C-NOTCH-HT US28</td>
</tr>
<tr>
<td>1 only</td>
<td>Electric strike</td>
</tr>
<tr>
<td>1 only</td>
<td>Wall Stop</td>
</tr>
<tr>
<td>None</td>
<td>Protection plates</td>
</tr>
<tr>
<td>3 only</td>
<td>Silencer</td>
</tr>
<tr>
<td>1 only</td>
<td>Card Reader (By Owner)</td>
</tr>
<tr>
<td>Notes:</td>
<td>Provide factory notch out on emergency stop for locking hardware. Coordinate notch size with locking hardware requirements. GC provide back box with conduit and pull string to above ceiling at card reader locations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set #14</th>
<th>Ligature-Resistant, Anti-Barricade (Passage Function)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locations:</td>
<td>Urgent Care Patient Rooms, Exam Room</td>
</tr>
<tr>
<td>1 only</td>
<td>Continuous pivot hinge</td>
</tr>
<tr>
<td></td>
<td>MA DSH1000, or US32D</td>
</tr>
<tr>
<td></td>
<td>PK DSHP01-C US28</td>
</tr>
<tr>
<td>1 only</td>
<td>Emergency Stop</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant strike</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant lockset</td>
</tr>
<tr>
<td></td>
<td>SA 9215-BHW-SHS, or US32D</td>
</tr>
<tr>
<td></td>
<td>AC CH 9125SEC-SP-L.PC-SHS US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Wall Stop</td>
</tr>
<tr>
<td>None</td>
<td>Protection plates</td>
</tr>
<tr>
<td>3 only</td>
<td>Silencer</td>
</tr>
</tbody>
</table>
**Set #15**  
**Ligature-Resistant, Electric Strike, Dutch Door (Storeroom Function)**

**Locations:** Nurse Stations

- 1 only Continuous hinge: MA FM300-HT-SHS, US32D
- 1 only Ligature-resistant lockset: TS MRX-A-F07-SHS, or SA 9207-BHW-SHS, or AC CH 9159SEC-SP-L.PC-SHS US32D
- 1 only Surface bolt: RO 582-8-SHS US32D
- 1 only Electric strike: HS 8500C-LBSM US32D
- 1 only Wall Stop: LG 182-SHS US32D

None: Protection plates

3 only Silencer: RO 608 Grey

1 only Card Reader (By Owner)

**Note:** GC to provide back box with conduit and pull string to above ceiling at card reader locations.

---

**Set #16**  
**Ligature-Resistant, Anti-Barricade, Institutional-Privacy Function**

**Locations:** Waiting Toilet Rooms

- 1 only Continuous pivot hinge: KG 202, or MA DSH1000, or PK DSHP01-C US32D
- 1 only Emergency Stop: KG 207, or PK ERS-MP-C-NOTCH-HT US28
- 1 only Ligature-resistant lockset: TS MRX-A-F46-SHS, or SA 9267-BHW-SHS, or AC CH 9143iSEC-SP-L.PC-SHS US32D
- 1 only Ligature-resistant thumbturn: Provide by lockset mfgr
- 1 only Ligature-resistant strike: AC LR-STK US32D
- 1 only Wall stop: KG 182-SHS US32D

None: Protection plates

3 only Silencer: RO 608 Grey

**Notes:** Provide factory notch out on emergency stop for locking hardware. Coordinate notch size with locking hardware requirements.

---

**Set #17**  
**Ligature Resistant, Pair with Inactive Leaf (Storeroom Function)**

**Locations:** Basement Access

- 2 only Continuous hinge: MA FM300-HT-SHS US32D
- 1 only Ligature-resistant lockset: TS MRX-A-F07-SHS, or SA 9207-BHW-SHS, or AC CH 9159SEC-SP-L.PC-SHS US32D
- 2 only Auto-flush bolt: RO 2845
- 1 only Ligature-resistant pull: AC U7001AL US32D
- 1 only Push plate: RO 70REA-SHS US32D
- 2 only Closer: SA 36-MC-TB-422-CT2B US15
- 2 only Wall stop: KG 182-SHS US32D

None: Protection plates

6 only Silencer: RO 608 Grey
### Set #18  
**Ligature-Resistant, Electric Strike, Half Door (Storeroom Function)**

<table>
<thead>
<tr>
<th>Locations</th>
<th>Registration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 only</td>
<td>Continuous hinge</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant lockset</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>1 only</td>
<td>Electric strike</td>
</tr>
<tr>
<td>1 only</td>
<td>Wall stop</td>
</tr>
<tr>
<td>None</td>
<td>Protection plates</td>
</tr>
<tr>
<td>3 only</td>
<td>Silencer</td>
</tr>
<tr>
<td>1 only</td>
<td>Card Reader (By Owner)</td>
</tr>
</tbody>
</table>

**Note:** GC to provide back box with conduit and pull string to above ceiling at card reader locations.

### Set #19  
**Pair – Push/Pull**

<table>
<thead>
<tr>
<th>Locations</th>
<th>Entrance Vestibule</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 only</td>
<td>Continuous hinge</td>
</tr>
<tr>
<td>2 only</td>
<td>Hinge Protector</td>
</tr>
<tr>
<td>2 only</td>
<td>Push-pull</td>
</tr>
<tr>
<td>2 only</td>
<td>Closer</td>
</tr>
</tbody>
</table>

### Set #20  
**Pair – Entrance Doors with Electric Exit Device**

<table>
<thead>
<tr>
<th>Locations</th>
<th>Entrance Vestibule</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 only</td>
<td>Continuous hinge</td>
</tr>
<tr>
<td>2 only</td>
<td>Hinge Protector</td>
</tr>
<tr>
<td>2 only</td>
<td>Exit device w/con vertical rod</td>
</tr>
<tr>
<td>2 only</td>
<td>Closer</td>
</tr>
<tr>
<td>2 only</td>
<td>Electromagnetic lock</td>
</tr>
<tr>
<td>3 only</td>
<td>Keyswitch override</td>
</tr>
<tr>
<td>2 only</td>
<td>Power Supply</td>
</tr>
<tr>
<td>2 only</td>
<td>Battery Backup</td>
</tr>
<tr>
<td>1 only</td>
<td>Wiring diagram</td>
</tr>
<tr>
<td>None</td>
<td>Silencer</td>
</tr>
<tr>
<td>2 only</td>
<td>Card Reader (By Owner)</td>
</tr>
</tbody>
</table>

**Note:** GC to provide back box with conduit and pull string to above ceiling at card reader locations. Provide proximity sensor to automatically release electro-magnetic locks when person approaches door from exterior, except when proximity sensor is disabled by timer. Provide remote release at reception desk to release electro-magnetic locks to permit persons to exit or enter.
### Set #21  
**Ligature-Resistant, Security Door, Elec Strike, Fire Rated w/ Closer (Storeroom Function)**

<table>
<thead>
<tr>
<th>Locations</th>
<th>Fire Rated Controlled Access Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 only</td>
<td>Continuous hinge MA FM300-HT-SHS US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant lockset TS MRX-A-F07-SHS, or US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Concealed closer DO ITS96-INV-13-NHO-BRKTMD-SHS US26D</td>
</tr>
<tr>
<td>1 only</td>
<td>Electric strike HS 8500C-LBSM US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Wall stop KG 182-SHS US32D</td>
</tr>
<tr>
<td>2 only</td>
<td>12” high protection plates RO K1062-SHS-B4E-CSK US32D</td>
</tr>
<tr>
<td>3 only</td>
<td>Silencer RO 608 Grey</td>
</tr>
<tr>
<td>2 only</td>
<td>Card Reader (By Owner)</td>
</tr>
</tbody>
</table>

**Note:** GC to provide back box with conduit and pull string to above ceiling at card reader locations.

### Set #22  
**Pair - Ligature-Resistant, Security Door, Mag Lock, Fire Rated w/ Closer (Passage Function)**

<table>
<thead>
<tr>
<th>Locations</th>
<th>Smoke Barrier Cross-Corridor Door</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 only</td>
<td>Continuous hinge MA FM300-HT-SHS US32D</td>
</tr>
<tr>
<td>2 only</td>
<td>Exit device w/con vertical rod SA 12-36-WD8615-BTRIM US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Concealed closer DO ITS96-INV-13-NHO-BRKTMD-SHS US26D</td>
</tr>
<tr>
<td>2 only</td>
<td>Electromagnetic lock SE MM15-DPS-TS US32D</td>
</tr>
<tr>
<td>2 only</td>
<td>Astragal RO 306-AST-SHS US32D</td>
</tr>
<tr>
<td>4 only</td>
<td>Keyswitch override SE MKA-C-KA-SHS US32D</td>
</tr>
<tr>
<td>1 only</td>
<td>Power Supply SE BPS-24</td>
</tr>
<tr>
<td>1 only</td>
<td>Battery Backup SE B-24-5</td>
</tr>
<tr>
<td>1 only</td>
<td>Wiring diagram SA WD-SYSPK</td>
</tr>
<tr>
<td>2 only</td>
<td>Wall stop KG 182-SHS US32D</td>
</tr>
<tr>
<td>4 only</td>
<td>12” high protection plates RO K1062-SHS-B4E-CSK US32D</td>
</tr>
<tr>
<td>6 only</td>
<td>Silencer RO 608 Grey</td>
</tr>
<tr>
<td>4 only</td>
<td>Card Reader (By Owner)</td>
</tr>
</tbody>
</table>

**Note:** GC to provide back box with conduit and pull string to above ceiling at card reader locations.  
Prepare frame for electromagnetic locks and concealed closers.  
Electromagnetic locking system shall be fail-secure per NCBC 407.11.  
Keyswitch shall interrupt the power to the electromagnetic lock. Power shall not be restored until the key is switched back into the operating position.
<table>
<thead>
<tr>
<th>Set #23</th>
<th>Ligature-Resistant, Security Door, Electric Strike, Fire Rated w/ Closer (Storeroom Function)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Locations:</strong></td>
<td>Fire Rated Controlled Access Locations</td>
</tr>
<tr>
<td>1 only</td>
<td>Continuous hinge</td>
</tr>
<tr>
<td>1 only</td>
<td>Ligature-resistant lockset</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>1 only</td>
<td>Concealed closer</td>
</tr>
<tr>
<td>1 only</td>
<td>Electric strike</td>
</tr>
<tr>
<td>1 only</td>
<td>Wall stop</td>
</tr>
<tr>
<td>2 only</td>
<td>12” high protection plates</td>
</tr>
<tr>
<td>3 only</td>
<td>Silencer</td>
</tr>
</tbody>
</table>

**Note:**
- GC to provide back box with conduit and pull string to above ceiling at card reader locations.
- Prepare frame for electromagnetic locks and concealed closers.
- Electromagnetic locking system shall be fail-secure per NCBC 407.11.
- Keyswitch shall interrupt the power to the electromagnetic lock. Power shall not be restored until the key is switched back into the operating position.

END OF DOOR HARDWARE SCHEDULE
This page intentionally left blank.
SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Doors.
2. Curtain wall framing.
3. Interior borrowed lites.

B. Related Sections:

1. Section 085653 "Security Windows".
2. Section 088853 "Security Glazing" for polycarbonate glazing types.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer, using the following design criteria:

1. Design Wind Pressures: As indicated on Drawings.
2. Design Snow Loads: As indicated on Drawings.
3. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
4. 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.
5. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of the following products; 12 inches square.
   1. Insulating glass.
   2. Insulating spandrel glass.
   3. Laminated glass; for each type and film for Architect approval.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass and glazing products, from manufacturer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for coated glass, insulating glass, glazing sealants and glazing gaskets.
   1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

C. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Glass: Obtain tinted float glass, coated float glass, and insulating glass from single source from single manufacturer for each glass type.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications: GANA's "Glazing Manual."
E. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

F. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.

G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

H. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Install glazing in mockups specified in Section 084413 "Glazed Aluminum Curtain Walls" to match glazing systems required for Project, including glazing methods.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

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 recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   1. Warranty Period: 10 years from date of Substantial Completion.
B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

1.11 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged for storage and identified with labels describing content.

1. Glazing: Five sets of interior and exterior glazing for each window type and size, clearly labeled as to type and size.

a. Where there are less than ten windows of a particular type and size, provide two sets as described for type and size.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

1. Provide safety glazing labeling.

C. 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 monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. 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.
4. 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.
5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of Kind FT (Fully Tempered) and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.3 SPANDREL GLASS

A. Fully tempered clear float glass with metallic opacifier film located on third surface.

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, and complying with other requirements specified.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
2. Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or blend of both.

B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article.

2.5 FIRE-RATED GLAZING PRODUCTS

A. Manufacturers: The proprietary products listed in this Article establish the performance requirements for heat transfer, fire-resistance, impact safety and resistance to thermal shock. Comparable products by the following manufacturers will be also considered prior to Bid:

1. AGC Interedge Technologies
2. Safti-First
3. Technical Glass Products
4. Vetrotech Saint Gobain

B. Fire-Protection-Rated Tempered Glass: Proprietary product in the form of clear flat sheets of 1/4-inch nominal thickness weighing 3.0 lb/sq. ft., and as follows:

1. Fire-Protection Rating: As indicated for the location in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
2. Product: "FireLite Premium" (polished on both surfaces) by Technical Glass Products.

C. Safety Ceramic Glazing Material: Proprietary product in the form of clear flat sheets of 5/16-inch nominal thickness weighing 4 lb/sq. ft., and as follows:

1. Fire-Protection Rating: As indicated for the fire window or door in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
3. Product: "Premium FireLite Plus" (polished on both surfaces) by Nippon Electric Glass Co., Ltd., and distributed by Technical Glass Products.
2.6 PVB INTERLAYS
A. Available Manufacturers: Subject to compliance with requirements where indicated provide PVB interlayers as Scheduled by one of the following:
   1. PVB Interlayer Manufacturers:
      a. Vanceva (Basis of Design)
      b. Viracon
   2. Color Schedule: Film thickness shall be 0.060” – 4 layers, unless otherwise indicated.
      a. C1 = Translucent Frosted white = #AAAA
      b. C2 = Translucent True Blue = #116A
      c. C3 = Translucent Purple = #252A
      d. C4 = Translucent Green = #242A
      e. C5 = Translucent Pink = #151A
      f. C6 = Translucent Orange = #454A
      g. C7 = Translucent Coral = #358A
      h. C8 = Translucent Turquoise = #036A
      i. C9 = Translucent Yellow = #014A; thickness 0.045” - 3 layers

2.7 GLAZING GASKETS
A. Compression Gaskets: Molded or extruded gaskets of type and material indicated below and of profile and hardness required to maintain watertight seal:
   1. Silicone dense compression gaskets complying with ASTM C 1115.
   2. Silicone soft compression gaskets complying with ASTM C 509, Type II, black.

2.8 GLAZING SEALANTS
A. General:
   1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will 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 the following:
      a. Dow Corning Corporation; 790.
      b. GE Advanced Materials - Silcons; SilPruf LM SCS2700.
      d. Pecora Corporation; 890.
      e. Sika Corporation, Construction Products Division; SikaSil-C990.
      f. Tremco Incorporated; Spectrem 1.
C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.9 GLAZING TAPES

A. Back-Beding 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.

2.10 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.
2.11 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

2.12 MONOLITHIC-GLASS TYPES

A. Glass Type PC1: Polycarbonate glazing.
   1. Thickness: 1/2 inch.

B. Glass Type PC2: Polycarbonate glazing.
   1. Thickness: 3/8 inch.

2.13 INSULATING-GLASS TYPES

A. Glass Type NG: Low-e-coated, tinted tempered insulating glass.
   1. Overall Unit Thickness: 1 inch.
   2. Thickness of Each Glass Lite: 6.0 mm.
   3. Outdoor Lite: Fully tempered tinted float glass.
      a. Basis of Design: PPG; Solarban 70XL (2) Optigray.
   4. Low-E Coating: Sputtered on second surface.
   5. Interspace Content: Argon.
   6. Indoor Lite: Fully tempered clear float glass
   7. Performance Requirements: Provide insulated units with values within two percent of the following:
      b. Winter Nighttime U-Factor: .28 maximum.
      c. Summer Daytime U-Factor: .26 maximum.
      e. Shading Coefficient: 0.28 minimum.

B. Glass Type AG1: Low-e-coated, tinted insulating glass, with anti-spall film.
   1. Overall Unit Thickness: 1-1/8” inch.
   2. Thickness of Each Glass Lite: 6.0 mm.
      a. Basis of Design: PPG; Solarban 70XL (2) Optigray.
   4. Low-E Coating: Sputtered on second surface.
   5. Interspace Content: Argon.
6. Indoor Lite: Laminated glass with colored PVB-film interlayer as scheduled in other Part 2 areas.

C. Glass Type AG2: Low-e-coated, tinted insulating glass, with anti-spall film.
   1. Overall Unit Thickness: 1 inch.
   2. Thickness of Each Glass Lite: 6.0 mm.
      a. Basis of Design: PPG; Solarban 70XL (2) Optigray.
   4. Low-E Coating: Sputtered on second surface.
   5. Interspace Content: Argon.
   6. Indoor Lite: Laminated glass with anti-spall film on interior surface (3M Ultra S600).
   7. Performance Requirements: Provide insulated units with values within two percent of the following:
      b. Winter Nighttime U-Factor: .28 maximum.
      c. Summer Daytime U-Factor: .26 maximum.
      e. Shading Coefficient: 0.28 minimum.

D. Glass Type AG3: Low-e-coated, tinted insulating glass, with anti-spall film.
   1. Overall Unit Thickness: 1-1/8” inch.
   2. Thickness of Each Glass Lite: 6.0 mm.
      a. Basis of Design: PPG; Solarban 70XL (2) Optigray.
   4. Low-E Coating: Sputtered on second surface.
   5. Interspace Content: Argon.
   6. Indoor Lite: Laminated glass with colored PVB film interlayers as Scheduled in other Part 2 areas, and anti-spall film on interior surface no. 4 (3M Ultra S600).

E. FR: Fire-rated ceramic glass with an anti-spall film (3M Ultra-S600) on both sides.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints 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 and then to jambs. Cover horizontal framing joints by applying tapes to jambs and 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 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C716 and gasket manufacturer’s written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 0880000
SECTION 088853 - SECURITY GLAZING

PART 1 - GENERAL

1.1 SUMMARY
   A. Section includes monolithic polycarbonate.

1.2 COORDINATION
   A. Coordinate glazing channel dimensions to provide necessary bite on security glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
   B. Review temporary protection requirements for security glazing during and after installation.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Security Glazing Samples: For each type of security glazing; 12 inches square.
   C. Security Glazing Schedule: List security glazing types and thicknesses for each size opening and location. Use same designations indicated on Drawings. Indicate coordinated dimensions of security glazing and construction that receives security glazing, including clearances and glazing channel dimensions.

1.4 INFORMATIONAL SUBMITTALS
   A. Product Test Reports: For each type of security glazing, for tests performed by a qualified testing agency.
   B. Preconstruction adhesion and compatibility test reports.

1.5 PRECONSTRUCTION TESTING
   A. Preconstruction Adhesion and Compatibility Testing: Test each security glazing type, tape sealant, gasket, glazing accessory, and glazing-framing member for adhesion to and compatibility with elastomeric glazing sealants.
      1. Testing will not be required if data based on previous testing of current sealant products and glazing materials match those submitted.

1.6 WARRANTY
   A. Polycarbonate Sheet at Exterior Windows: Provide a 10-year written limited warranty that offers coverage in the first ten years against breakage, yellowing and loss of light transmission, abrasion, and coating failure or delamination. Warranty coverage shall include material and labor costs assuming results of a failure analysis are confirmed and completed by the
manufacturer. Coverage against yellowing and loss of light transmission shall be extended for years 11 to 15 for material replacement only.

B. Polycarbonate Sheet at Interior Windows and Doors: Provide a 10-year written limited warranty that offers coverage in the first ten years against breakage, yellowing and loss of light transmission, abrasion, and coating failure and delamination. Warranty coverage shall include material and labor costs assuming results of a failure analysis are confirmed by the manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Security Glazing: Obtain security glazing from single source from single manufacturer using same type of lites, plies, interlayers, and spacers for each security glazing type indicated.

B. Source Limitations for Glazing Gaskets: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE CRITERIA

A. General:

1. Installed security glazing shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing; or other defects in construction.

2. Installed security glazing shall withstand security-related loads and forces without damage to glazing beyond that allowed by referenced standards.

B. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

2.3 SECURITY GLAZING, GENERAL

A. Glazing Publications: Comply with published recommendations of security glazing and glazing material manufacturers and organizations unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the Safety Glazing Certification Council another certification agency acceptable to authorities having jurisdiction, or manufacturer. Label shall indicate manufacturer's name, type of glazing, thickness, and safety glazing standard with which glazing complies.

C. Fire-Test-Response Characteristics of Plastic Sheets: As determined by testing polycarbonate sheets identical to those used in security glazing products by qualified testing agency acceptable to authorities having jurisdiction.
1. Self-ignition temperature of 650 degrees F or more when tested per ASTM D1929 on plastic sheets in thicknesses indicated for Work.
2. Smoke-developed index of 450 or less when tested per ASTM E84, or smoke density of 75 or less when tested per ASTM D2843 on plastic sheets in thicknesses indicated for Work.
3. Burning extent of 1 inch or less when tested per ASTM D635 at nominal thickness of 0.060 inch or thickness indicated for Work.

2.4 POLYCARBONATE SECURITY GLAZING
A. Polycarbonate Sheet: ASTM C1349, Appendix X1, Type II, coated, mar-resistant, UV-stabilized polycarbonate with coating on exposed surfaces and Type I, standard, UV-stabilized polycarbonate where no surfaces are exposed.
   1. Exterior Thickness: 1/2-inch.
   2. Interior Thickness: 3/8-inch.

2.5 GLAZING SEALANTS
A. General:
   1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they contact, including security glazing, seals of insulating security glazing and air-gap security glazing, 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 security glazing 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:
      b. Momentive Performance Materials: SCS2700 Silpruf LM.
      c. Pecora Corporation: 890NST.
      e. Tremco Incorporated: Spectrem 1.

2.6 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 security glazing manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. 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.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by security glazing manufacturer to maintain security glazing lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit security glazing 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.

2.8 FABRICATION OF SECURITY GLAZING

A. Fabricate security glazing 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.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in completed Work.
3.2 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of security glazing, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect edges of security glazing from damage during handling and installation. Remove damaged security glazing from Project site and legally dispose of off Project site. Damaged security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing and impair performance and 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 glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by security glazing manufacturers for installing 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 security glazing from moving sideways in glazing channel, as recommended in writing by security glazing manufacturer and according to requirements in referenced glazing publications.

3.3 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by security glazing, 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 and then to jambs. Cover horizontal framing joints by applying tapes to jambs and 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 just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center security glazing 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.
3.4 GASKET GLAZING (DRY)
   A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
   B. Insert soft compression gasket securely in place between glazing unit 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 security glazing 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 security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.
   D. Installation with Pressure-Glazing Stops: Center security glazing 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 security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.
   E. Install gaskets so they protrude past face of glazing stops.

3.5 CLEANING AND PROTECTION
   A. Immediately after installation remove nonpermanent labels and clean surfaces.
   B. Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter.
      1. If, despite such protection, contaminating substances do come into contact with security glazing, remove substances immediately as recommended in writing by security glazing manufacturer. Remove and replace security glazing that cannot be cleaned without damage.
   C. Wash security glazing on exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash security glazing as recommended in writing by security glazing manufacturer.

3.6 MONOLITHIC POLYCARBONATE SECURITY GLAZING TYPES
   A. Security Glazing-1: Monolithic polycarbonate with mar-resistant coating on both surfaces.
      1. Products: Subject to compliance with requirements, provide one of the following:
         a. SABIC Innovative Plastics: Lexan MR 10 with Marguard II coating.
         b. Covestro: Makrolon AR.
      2. Location: Interior doors and borrowed lites.
      3. Thickness: 3/8 inch. Actual thickness should be plus 5 percent of the gauge selected.
      5. Masking: Protective masking on both faces and ripple orientation noted.
      6. Distortion: Maximum roll wave distortion of 0.005 inch.
B. Security Glazing-2: Monolithic polycarbonate with mar-resistant coating on both surfaces.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. SABIC Innovative Plastics: Lexan MR 10 with Marguard II coating.
   b. Covestro: Makrolon AR.

2. Location: Security windows.

3. Thickness: 1/2 inch. Actual thickness should be plus 5 percent of the gauge selected.


5. Masking: Protective masking on both faces and ripple orientation noted.

6. Distortion: Maximum roll wave distortion of 0.005 inch.

END OF SECTION 088853
SECTION 089000 - LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Fixed, extruded-aluminum exterior louvers.

B. Related Sections:
   1. Section 072726 "Fluid-Applied Membrane Air Barriers" for penetration and barrier flashings required at exterior openings.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.

C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
   1. Wind Loads: As indicated on Structural Drawings.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, over stressing of components, failure of connections, or other detrimental effects.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
1.5 ACTION SUBMITTALS

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

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
   1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
   2. Show mullion profiles and locations.

C. Samples: For units with factory-applied color finishes.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

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


1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.
   1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
   2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 MANUFACTURERS

A. Basis of Design: Subject to compliance with requirements, provide basis of design indicated or comparable products by one of the following:

1. Airolite Company, LLC (The)
2. American Warming and Ventilating, Inc.; a Mestek company
3. Architectural Louvers
4. Arrow United Industries; a division of Mestek, Inc.
5. Construction Specialties, Inc.
6. Greenheck Fan Corporation
7. Industrial Louvers, Inc.
8. Nystrom Building Products
9. Reliable Products, Inc.
10. Ruskin Company; Tomkins PLC.
11. United Enertech Corporation

2.3 FIXED, EXTRUDED-ALUMINUM EXTERIOR LOUVERS

A. Horizontal, Drainable Louver:

1. Basis of Design: Construction Specialties; Model A4097
2. Louver Depth: 4 inches, unless otherwise indicated on Drawings.
   a. Provide deeper panels where required to accommodate additional support angle.
3. Blade Profile: Plain blade without center baffle.
4. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.080 inch for blades and 0.080 inch for frames.
5. Mullion Type: Exposed.
6. Performance Requirements:
   a. Free Area: Not less than 8.07 sq. ft. for 48-inch wide by 48-inch high louver.
   b. Point of Beginning Water Penetration: Not less than 1000 fpm.
   c. Air Performance: Not more than 0.15-inch wg static pressure drop at 1000 fpm free-area velocity.
7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

A. General: Provide insect screen on the interior face of each exterior louver.

B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.
2. Finish: Same finish as louver frames to which louver screens are attached.
3. Type: Non-rewirable, U-shaped frames.

D. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

2.5 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
   1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.
   2. Horizontal Mullions: Provide horizontal mullions at joints where indicated.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
   1. Frame Type: Channel unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.
   1. Fully Recessed Mullions: Where width of panel requires additional vertical support, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
   2. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.

G. Provide subsills made of same material as louvers or extended sills for recessed louvers.

H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.6 FINISHES, GENERAL

A. Comply with NAAMM’s "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
2.7 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect unpainted nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 CLEANING

A. Clean exposed surfaces of louvers that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089000
SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes non-load-bearing steel framing members for the following applications:
   1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
   2. Grid suspension systems for interior gypsum ceilings and soffits.

B. Related Sections include the following:
   2. Section 092900 "Gypsum Board" for gypsum panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Indicate yield strength of steel, section properties, limiting heights and spans.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For dimpled steel studs and runners and firestop tracks, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Structural Properties: Manufacturer's published data on Structural Properties are calculated based on allowable stress design conforming to AISI "Specification of the Design of Cold-Formed Steel Structural Members."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Conventional Steel Framing: Subject to compliance with requirements, provide products by one of the following:
1. Allsteel & Gypsum Products, Inc.
2. Craco Manufacturing Inc.
3. Southeastern Stud and Components
4. Steel Construction Systems
5. The Formetal Co. Inc.
6. The Steel Network
7. Steelform USA

B. Dimpled Studs: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. ClarkDietrich; ProStud 20 and ProStud 22.
2. MarinoWARE; Viper 20S.
3. Telling Industries; Viper 20S.

2.2 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
   a. Steel having a yield strength greater than 33 KSI is permitted.

   a. Equivalent coatings are not acceptable and not allowed.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: Minimum 0.0312 inch (20 gauge) unless otherwise indicated on Drawings, or greater as indicated in the manufacturer's published performance data based on the following criteria:
   b. Deflection Limits:
      1) Gypsum Wallboard: L/240.
      2) Ceramic Tile: L/360.
   c. Limiting Heights: As indicated on Drawings.
   d. Spans: As indicated on Drawings or as recommended by manufacturer.
   e. Applied loads:
      1) Gypsum Wallboard: 10 psf.
      2) Ceramic tile, one side: 15 psf.
      3) Ceramic tile, two sides: 30 psf.
   f. Depth: As indicated on Drawings.

2. Minimum base-metal thickness may be reduced if yield strength of steel is greater than 33 KSI. Minimum base-metal thickness for dimpled steel studs and runners is 0.179 inch. Dimpled steel studs and runners must comply with requirements above.
B. Slip-Type Head Joints: 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.

C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   1. Minimum Base-Metal Thickness: 0.033 inch.
   2. Backing Plates (Contractor's Option): In lieu of flat steel straps, provide ClarkDietrich Danback fire-retardant treated flexible wood backing plates system for the attachment of cabinets, handrails, and wall fixtures.

E. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch wide flanges.
   1. Depth: 1-1/2 inches or as indicated on Drawings.
   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: 0.033 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 or hat shaped.

H. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch wide flanges.
   1. Depth: 3/4 inches or as indicated on Drawings.
   2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch.
   3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch diameter wire, or double strand of 0.0475-inch diameter wire.

2.4 SUSPENSION SYSTEM

A. Suspended Ceiling and Soffit Framing:
1. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.

2. Hanger Attachments to Concrete:
   a. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.
      1) Type: Postinstalled, expansion anchor.
   b. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.

3. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

4. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch, a minimum 1/2-inch-wide flange, and in depth indicated.

5. Furring Channels (Furring Members):
      1) Minimum Base Metal Thickness: 0.033 inch or as required.

B. Contractor's Option - 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

2.5 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.

B. Isolation Strip at Exterior Walls: Provide the following:

   1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
   2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.
3.1 EXAMINATION
A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
   1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
B. Coordination with Sprayed Fire-Resistive Materials:
   1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
   2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL
A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, furnishings, or similar construction.
C. Install bracing at terminations in assemblies.
D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES
A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
B. Install studs so flanges within framing system point in same direction. Space studs as indicated on Drawings.
C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to
terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. **Slip-Type Head Joints:** Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

2. **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 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.

4. **Fire-Resistance-Rated Partitions:** Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
   a. **Firestop Track:** Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. **Sound-Rated Partitions:** Install framing to comply with sound-rated assembly indicated.

D. **Direct Furring:**
   1. Screw to framing.
   2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

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 in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. **Suspend hangers from building structure as follows:**
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension
system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

4. Do not attach hangers to steel roof deck.

5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.

7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

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 0922162216
This page intentionally left blank.
SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Interior gypsum board.
   2. Tile backing panels.

B. Related Sections include the following:
   1. Section 012300 "Alternates" for alternates related to products specified in this section. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
   2. Section 072100 "Thermal Insulation" for insulation installed in assemblies that incorporate gypsum board.
   3. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Source Limitations: Provide gypsum products manufactured within the United States from materials free of sulfur, formaldehyde or other deleterious chemicals. Natural gypsum ore shall be mined in North America. Synthetic (by-product) gypsum shall be pure calcium sulfate from domestic sources.

B. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
   1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory".

C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

D. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Install mockups for each level of gypsum board finish indicated for use in exposed locations.
2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 1396.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Gypsum.
   b. Certainteed Corporation
   c. Georgia-Pacific Gypsum
   d. Lafarge North America Inc.
   e. National Gypsum Company
   f. USG Corporation.
B. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
   1. Thickness: 1/2 inch, unless otherwise indicated on Drawings.
   2. Long Edges: Tapered.
   3. All gypsum board ceiling to be impact resistant gypsum board.

C. Impact-Resistant Gypsum Board: ASTM C 1629 and as follows:
   1. Type and Thickness: Type X, 5/8 inch.
   2. Long Edges: Tapered.
   3. Products: Provide one of the following:
      a. National Gypsum; Gold Bond Hi-Impact XP
      b. United States Gypsum; Sheetrock Mold Tough VHI
   4. Location: As indicated.
   5. Surface Abrasion Resistance: Classification Level 3 in accordance with ASTM C 1629.
   6. Indentation Resistance: Classification Level 1 in accordance with ASTM C 1629.
   7. Soft Body Impact Resistance: Classification Level 3 in accordance with ASTM C 1629.

2.3 PAPERLESS INTERIOR GYPSUM WALLBOARD

   1. Provide one of the following:
      a. Fiber-reinforced gypsum board, complying with ASTM C 1278.
         1) Product: USG Corporation: Fiberock IR Interior Panels. (Alternate Basis of Design)
   2. Core: 5/8 inch, Type x.
   5. Primer (Alternate Basis of Design): Provide “Tuff-Hide” by USG Corporation or gypsum board manufacturers approved equal.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. C-Cure; C-Cure Board 990
      b. CertainTeed Corp.; FiberCement BackerBoard
      c. Custom Building Products; Wonderboard
      d. FinPan, Inc.; Util-A-Crete Concrete Backer Board
      e. James Hardie Building Products, Inc.; Hardiebacker
      f. National Gypsum Company, Permabase Cement Board
      g. USG Corporation; DUROCK Cement Board
   2. Thickness: 5/8 inch.
   3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
2.5 TRIM ACCESSORIES

A. Gypsum Control Joints: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Expansion (Control) Joint: Use where indicated.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Fry Reglet Corp.
      b. Gordon, Inc.
      c. MM Systems Corporation.
      d. Pittcon Industries.
   2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
   3. Aluminum Reveals: Refer to Drawings for locations.
      a. Where Indicated: Provide reveals equal to Fry Reglet “Model No. DRMF-50-625, 1/2 inch deep by 5/8 inch wide”.
   4. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

C. Interior Trim: Provide impact-resistant NO-COAT structural laminate corners and trim with tapered, high-strength copolymer core by Certainteed/Saint-Gobain.
   1. Outside corners: outside 90 deg
   2. Inside corners: inside 90 deg
   3. Exposed terminations of gypsum panels: L-trim, 5/8” or 1/2”

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.
   2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound.
   4. Finish Coat: For third coat, use setting-type, sandable topping compound.
D. Joint Compound for Tile Backing Panels: As recommended by backing panel manufacturer.

E. Spot Grout: ASTM C 475, setting-type joint compound recommended for spot-grouting hollow metal door frames.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate. Provide acoustic-dampening green Glue by Saint-Gobain.

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Provide Torx rejection pin, 6-lobe head fasteners.

D. Sound Attenuation Blankets: 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. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
   2. Provide sound attenuation blankets free of formaldehyde.

E. Acoustical Sealant: As specified in Section 079200 "Joint Sealants."

F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine weathertight building enclosure, with Installer present, and verify that delivery, storage, and installation of gypsum panel products will not be affected by exposure to moisture beyond limits recommended by manufacturer.

C. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

D. 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 sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
C. 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.

D. 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.

E. 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.

F. Form control and expansion joints with space between edges of adjoining gypsum panels.

G. 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.

H. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

I. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

K. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
   1. Space screws a maximum of 12 inches o.c. for vertical applications.

L. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
   a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
   b. At 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.

B. Multilayer Application:
   1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 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.

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with manufacturer's written recommendations for gypsum board and laminating adhesive. Fasten gypsum board panels to substrate before laminating adhesive has set.

3.4 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings, or, if not shown, according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
   1. Outside corners: outside 90 deg
   2. Inside corners: insider 90 deg
   3. Exposed terminations of gypsum panel
D. Aluminum Trim: Install in locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:

1. Level 0: This level of finish shall be used in temporary construction only. No taping, finishing, or accessories required unless indicated or specified as in dust proof partitions.

2. Level 1: This level shall be used in ceiling plenum areas and concealed areas unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies. Embed tape at joints.

3. Level 2: This level of finish shall be used where water resistant gypsum backing board is used as a substrate for tile. Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where indicated.

4. Level 3: This level of finish shall be used in areas to receive heavy textured, thick (1/8 inch or greater) wall coverings and where indicated. Embed tape and apply separate first and finish coats of joint compound to tape, fasteners, and trim flanges.

5. Level 4: This level of finish shall be used for areas to receive smooth paint finish. Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces.

   a. Tape joints require joint compound and feathering of joint to a minimum of 12 inches each side of joint.
   b. Tape joints that are visible through finished walls are not acceptable.

E. Cementitious Panels: Finish according to manufacturer’s written instructions.

3.7 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

   1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.

   2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:

      a. Installation of 80 percent of lighting fixtures, powered for operation.
      b. Installation, insulation, and leak and pressure testing of water piping systems.
      c. Installation of air-duct systems.
      d. Installation of air devices.
e. Installation of mechanical system control-air tubing.
f. Installation of ceiling support framing.
g. Installation of through-penetration firestopping and fire-resistant joint sealants, with identification labels.

3.8 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900
This page intentionally left blank.
SECTION 093000 - TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Porcelain tile.
   2. Ceramic tile.

B. Related Sections:
   1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
   2. Section 092900 "Gypsum Board" for tile backing panels.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
   1. Level Surfaces: Minimum 0.6.
   2. Step Treads: Minimum 0.8.
   3. Ramp Surfaces: Minimum 0.8.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

D. Samples for Verification:
   1. Full-size units of each type of trim and accessory for each color and finish required.
   2. Stone thresholds in 6-inch lengths.
   3. Metal edge strips in 6-inch lengths.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

1.7 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
   1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
   1. Stone thresholds.
   2. Waterproof membrane.
   3. Crack isolation membrane.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of each type of floor tile installation.
   2. Build mockup of each type of wall tile installation.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site.
   1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.10 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 2 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: Subject to compliance with requirements, provide products indicated or comparable product in performance and appearance by one of the following:

1. Ceramic Tile:
   a. American Olean; Division of Dal-Tile International Inc.
   b. Crossville, Inc.
   c. Daltile; Division of Dal-Tile International Inc.
   d. Portobello America, Inc.
   e. Interceramic USA.

2. Setting and Grouting Material
   a. Bonsal American; an Oldcastle company.
   b. Custom Building Products.
   c. Laticrete International, Inc.
   d. MAPEI Corporation.
   e. Southern Grouts & Mortars, Inc.
   f. Summitville Tiles, Inc.
   g. TEC; a subsidiary of H. B. Fuller Company.
2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
   1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.3 TILE PRODUCTS

A. Porcelain Wall Tile (PTW-1 THOUGH PTW-10):
   1. Basis of Design: As indicated on Finish Legend.
   2. Grout Color: As selected by Architect from manufacturer's full range.
   3. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
      a. Base: As Scheduled.

B. Ceramic Wall Tile (CTW-1, CTW-2, CTW-3):
   1. Basis of Design: As indicated on Finish Legend.
   2. Grout Color: As selected by Architect from manufacturer’s full range.
   3. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
      a. Base: As Scheduled

2.4 MEMBRANE WATERPROOFING

A. General: Provide products that comply with ANSI A118.10 and the descriptions in this Article.

B. Polyethylene-Sheet Waterproofing: Manufacturer's standard proprietary product consisting of nonplasticized, chlorinated polyethylene sheets, 60 inches wide by a nominal thickness of 0.040 inches.
C. PVC-Sheet Waterproofing: Manufacturer's standard proprietary product consisting of flexible PVC sheets, 60 inches wide by a nominal thickness of 0.040 inches.

D. Products: Subject to compliance with requirements, provide one of the following:
   1. Polyethylene-Sheet Waterproofing: Chloraloy; Noble Company.
   2. PVC-Sheet Waterproofing: Blue Vinyl 40; Compositre Corporation.

   1. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

   1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
   2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.5 GROUT MATERIALS
A. Water-Cleanable Epoxy Grout: ANSI A118.3.
B. Grout for Pregrounted Tile Sheets: Same product used in factory to pregrout tile sheets.

2.6 ELASTOMERIC SEALANTS
A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Section 079200 "Joint Sealants."
   1. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

2.7 MISCELLANEOUS MATERIALS
A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
B. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
   1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.
   2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Manufacturer’s standard silicone product for sealing grout joints that is acceptable to manufacturer of grout and that does not change color or appearance of grout.

E. Transition Profile: Transition profile from slate to resilient flooring shall be equal to Schluter Systems RENO-TK. Finish shall be anodized aluminum.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers’ written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that concrete substrates for tile floors installed with thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
   a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
   b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.

4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-
setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: When recommended by manufacturer to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
4. Tile shall be laid in a running bond pattern.

E. Joint Widths: Unless otherwise indicated or if recommended otherwise by the tile manufacturer, install tile with the following joint widths:

1. Wall Tile: 1/16 inch.

F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 “Joint Sealants.”

H. Stone Sills: Install stone sills with organic adhesive unless otherwise indicated.

I. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer’s written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.6 INTERIOR TILE INSTALLATION SCHEDULE

A. B. Interior Wall Installations, Metal Studs or Furring:
1. Tile Installation: Thin-set mortar on cementitious backed unit; TCNA W244C.
   a. Tile Type: Ceramic wall tile.
   b. Thin-Set Mortar: Latex- portland cement mortar; with waterproof membrane in showers.
   c. Grout: Water-cleanable epoxy grout.

END OF SECTION 093000
This page intentionally left blank.
SECTON 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes acoustical panels and exposed suspension systems for ceilings.
B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.3 DEFINITIONS
A. AC: Articulation Class.
B. CAC: Ceiling Attenuation Class.
C. LR: Light Reflectance coefficient.
D. NRC: Noise Reduction Coefficient.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of product indicated.
B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Panel: Set of full-size Samples of each type, color, pattern, and texture.
   2. Exposed Suspension System Members, Molding and Trim: Set of 12-inch-long Samples of each type, finish, and color.

1.5 INFORMATIONAL SUBMITTALS
A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Ceiling suspension system members.
   2. Method of attaching hangers to building structure.
   3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

1.6 CLOSEOUT SUBMITTALS
A. Maintenance Data: For finishes to include in maintenance manuals.
1.7 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

B. Source Limitations:
   1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
   2. Suspension System: Obtain each type through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
   1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
      a. Identify materials with appropriate markings of applicable testing and inspecting agency.
   2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E1264 for Class A materials as determined by testing identical products per ASTM E84:
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 50 or less.

D. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:

E. Preinstallation Conference: Conduct conference at Project site.

1.8 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.
1.9 PROJECT CONDITIONS

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.

1.10 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.11 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide the products indicated in Part 3 of this section or comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. CertainTeed, Inc.
3. USG Interiors, Inc.

2.2 ACOUSTICAL PANELS, GENERAL

A. 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 reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

C. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21, where indicated.
2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: 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.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
   4. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch diameter wire.

E. Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
   1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
   2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
   3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.4 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Acoustical Sealant for Exposed and Concealed Joints:
      a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
      b. USG Corporation; SHEETROCK Acoustical Sealant.
   2. Acoustical Sealant for Concealed Joints:
      a. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
      b. Pecora Corporation; BA-98.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.

6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

7. Do not attach hangers to steel deck tabs.

8. Do not attach hangers to steel roof deck. Attach hangers to structural members.

9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
11. Install hanger wire as specified above within 6 inches of each corner of the grid at every light, air diffuser, air return grill, and other equipment items which are installed within or penetrate the ceiling system.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
   1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
   2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
   3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
   1. Arrange directionally patterned acoustical panels as follows:
      a. Install panels in a basket-weave pattern.
   2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
   3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
   4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
   5. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
   6. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.5 ACOUSTICAL PANEL CEILING SCHEDULE

A. ACT-1:
   1. Basis of Design: As indicated on Finished Legend.
   2. Classification: Classification: Type IV, membrane with membrane-faced overlay; Form 2, water felted; pattern E (lightly textured).
   3. Description:
a. Color: As scheduled.
b. Edge Detail: Tegular.
c. Thickness: 5/8 inch.
d. Size: 24 by 24 inches.

4. Performance Requirements:
   a. Light Reflectance Coefficient: Not less than LR 0.80.
   b. Noise Reduction Coefficient: NRC 0.5.

B. ACT-2:
   1. Basis of Design: “Clean Room with Climaplus” by USG.
   2. Classification: Type X, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face; pattern G I.
   3. Description:
      a. Color: As scheduled.
      b. Edge Detail: Square, Lay-In.
      c. Thickness: 3/4 inch.
      d. Size: 24 by 24 inches.
   4. Performance Requirements:
      a. Light Reflectance Coefficient: Not less than LR 0.79.

3.6 SUSPENSION SYSTEM SCHEDULE

A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation, with prefinished 15/16-inch- wide metal caps on flanges.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Armstrong World Industries, Inc.; Prelude Exposed Tee, 15/16" system.
      b. USG Interiors, Inc.; Donn Brand DX, 15/16" System.
   2. Structural Classification: Heavy-duty system.
   3. End Condition of Cross Runners: Override (stepped) type.
   5. Cap Material: Steel cold-rolled sheet.

END OF SECTION 0951133
This page intentionally left blank.
SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Resilient base.
   2. Resilient molding accessories.

1.3 ACTION SUBMITTALS

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

B. Samples: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide Basis of Design products as indicated on Finish Legend or comparable products by one of the following:
   1. Armstrong
   2. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
   3. Johnsonite
   4. Mannington Commercial
   5. Roppe Corporation, USA

2.2 RESILIENT BASE (RSB-1 THROUGH RSB-6)

A. Resilient Base:
   2. Material Requirement: Type TS (rubber, vulcanized thermoset) or Type TP (rubber, thermoplastic).
   4. Style: Cove (base with toe) unless otherwise indicated.

B. Minimum Thickness: 0.080 inch.

C. Height: 4 inches.

D. Lengths: Coils in lengths standard with manufacturer, but not less than 96 feet.

E. Outside and Inside Corners: Job formed.

F. Colors: As indicated on Drawings.

2.3 RESILIENT MOLDING ACCESSORY

A. Description: Carpet edge for glue-down applications, transition strips, reducer strip for resilient flooring.

B. Material: Rubber.

C. Profile and Dimensions:
   1. Reducer strip for resilient floor covering
   2. Transition strips.

D. Colors and Patterns: As selected by Architect from manufacturer’s full range.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Accessories: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
   4. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

END OF SECTION 096513
SECTION 096529 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Vinyl sheet floor covering, without backing.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of
      seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
      1. Show details of special patterns.
   C. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch sections
      of each different color and pattern of floor covering required.
      1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches
         long, of each color required.
      2. Seam Samples: For seamless-installation technique indicated and for each floor covering
         product, color, and pattern required; with seam running lengthwise and in center of 6-by-
         9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS
   A. Product Schedule: For floor coverings.
   B. Qualification Data: For qualified Installer.

1.5 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For each type of floor covering to include in maintenance manuals.

1.6 QUALITY ASSURANCE
   A. Installer Qualifications: A qualified installer who employs workers for this Project who are
      competent in techniques required by manufacturer for floor covering installation and seaming
      method indicated.
      1. Engage an installer who employs workers for this Project who are trained or certified by
         floor covering manufacturer for installation techniques required.
B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups for floor coverings including accessories.
      a. Size: Minimum 100 sq. ft. for each type, color and pattern in locations directed by Architect.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store floor coverings 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 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive floor coverings during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor covering installation and for 48 hours after floor covering installation.

D. Install floor coverings after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL SHEET FLOOR COVERING (RSF-1 THOUGH RSF-5)

A. Manufacturers: Subject to compliance with requirements, provide Basis of Design products indicated on Finish Legend or Architect approved comparable products by one of the following:
   1. Armstrong World Industries, Inc.
   2. Johnsonite
   3. Mannington Commercial
4. Tarkett, Inc.
5. TOLI International

B. Unbacked Vinyl Sheet Floor Covering: ASTM F 1913, 0.080 inch thick.

C. Wearing Surface: Smooth.

D. Sheet Width: As standard with manufacturer, but not less than 6 feet.


F. Colors and Patterns: As Scheduled.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor covering and substrate conditions indicated.

C. Seamless-Installation Accessories:
      a. Color: Match floor covering.

D. Integral-Flash-Cove-Base Accessories:
   1. Cove Strip: 1-inch radius provided or approved by manufacturer.
   2. Cap Strip: Square vinyl cap strip provided or approved by manufacturer.
   3. Corners: Provide heat welded inside and outside corners and end stops.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor coverings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.

B. Concrete Substrates: Prepare according to ASTM F 710.
1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor coverings until they are same temperature as space where they are to be installed.
   1. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.3 FLOOR COVERING INSTALLATION

A. Comply with manufacturer's written instructions for installing floor coverings.

B. Unroll floor coverings and allow them to stabilize before cutting and fitting.

C. Lay out floor coverings as follows:
   1. Maintain uniformity of floor covering direction.
   2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
   3. Match edges of floor coverings for color shading at seams.
   4. Avoid cross seams.

D. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.

E. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere floor coverings 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 use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.
I. Integral-Flash-Cove Base: Cove floor coverings 4 inches up vertical surfaces. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.

1. Install vinyl cap strip with theft-proof screws.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor coverings.

B. Perform the following operations immediately after completing floor covering installation:

1. Remove adhesive and other blemishes from floor covering surfaces.
2. Sweep and vacuum floor coverings thoroughly.
3. Damp-mop floor coverings to remove marks and soil.

C. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover floor coverings until Substantial Completion.

END OF SECTION 096529
This page intentionally left blank.
SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section includes modular, tufted carpet.
   B. Related Requirements:
      1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories
         installed with carpet tile.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
      1. Include manufacturer's written data on physical characteristics, durability, and fade
         resistance.
      2. Include installation recommendations for each type of substrate.
   B. Shop Drawings: Show the following:
      1. Columns, doorways, enclosing walls or partitions, and locations where cutouts are
         required in carpet tiles.
      2. Carpet tile type, color, and dye lot.
      3. Pattern of installation.
      4. Pattern type, location, and direction.
      5. Type, color, and location of insets and borders.
      6. Type, color, and location of edge, transition, and other accessory strips.
      7. Transition details to other flooring materials.
   C. Samples: For each of the following products and for each color and texture required. Label
      each Sample with manufacturer's name, material description, color, pattern, and designation
      indicated on Drawings and in schedules.
      2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch long Samples.

1.4 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For Installer.
   B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
   C. Sample Warranty: For special warranty.
1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
   3. Warranty Period: 10 years from date of Substantial Completion.
1.10 EXTRA MATERIALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Basis of Design: Subject to compliance with requirements, provide basis of design indicated on Finish Legend comparable product by one of the following:
   1. Interface
   2. Mannington Commercial
   3. Milliken
   4. Patcraft
   5. Shaw Industries, Inc.

B. Carpet Tile (CPT-1):
   1. Basis of Design: As Scheduled
   2. Fiber: Type 6 6.
   4. Pile Thickness: 0.25 inches.
   5. Gauge: 5/32
   6. Stitches per Inch: 5.5
   7. Yarn Weight: 28 oz./sq. yd.
   9. Size: Nominal 20 by 20 inches.
   10. Applied Soil-Resistance Treatment: Manufacturer's standard material.
   11. Antimicrobial Treatment: Manufacturer's standard material.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other
conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
   2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
   3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer’s written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

   1. Installation: Quarter turn.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.

2. Remove yarns that protrude from carpet tile surface.


B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813
SECTION 097200 - WALL COVERINGS

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
1. Vinyl wall covering.
B. Related Sections:
1. Section 099123 "Interior Painting" for priming wall surfaces to prepare for installation of wall covering.

1.3 SUBMITTALS
A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.
B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement, seams and termination points.
C. Samples for Verification: Full width by 36-inch-long section of wall covering.
1. Sample from same print run or dye lot to be used for the Work. Show complete pattern repeat. Mark top and face of fabric.
2. Sample from same flitch to be used for the Work, with specified finish applied.
D. Product Schedule: For wall coverings. Use same designations indicated on Drawings.
E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for wall covering.
F. Maintenance Data: For wall coverings to include in maintenance manuals.

1.4 QUALITY ASSURANCE
A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Surface-Burning Characteristics: As follows, per ASTM E 84:
a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 50 or less.
B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Build mockups for each type of wall covering on each substrate required. Comply with requirements in ASTM F 1141.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
1.5 PROJECT CONDITIONS
   A. Environmental Limitations: Do not deliver or install wall coverings 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. Lighting: Do not install wall covering until a permanent level of lighting Insert requirement is provided on the surfaces to receive wall covering.
   C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 WALL COVERINGS
   A. General: Provide rolls of each type of wall covering from same print run or dye lot.

2.2 VINYL WALL COVERING (VWC-1, VWC-2, VWC-3, VWC-4):
   A. Vinyl Wall-Covering Standards: Provide mildew-resistant products complying with the following:
      1. ASTM F 793 for strippable wall coverings that qualify as Category V, Type II, Commercial Serviceability products.
      2. Products: Subject to compliance with requirements, provide the product indicated on Finish Schedule or Architect approved comparable.
   B. Colors, Textures, and Patterns: As indicated on Finish Schedule.

2.3 ACCESSORIES
   A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer. Retain first paragraph below and insert primer requirements in the appropriate painting Section or revise and insert requirements here.
   B. Primer/Sealer: Mildew resistant, complying with requirements in Division 09 Section "Interior Painting" and recommended in writing by wall-covering manufacturer for intended substrate.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.
   B. 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 that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.
C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
   1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
   2. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
   3. Painted Surfaces: Treat areas susceptible to pigment bleeding.
D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.
E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION
   A. General: Comply with wall-covering manufacturers’ written installation instructions applicable to products and applications indicated except where more stringent requirements apply.
   B. Cut wall-covering strips in roll number sequence. Install strips in same order as cut from roll.
   C. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.
   D. Match pattern 72 inches above the finish floor.
   E. Install seams vertical and plumb at least 6 inches from outside corners and 3 inches from inside corners unless a change of pattern or color exists at corner. No horizontal seams are permitted.
   F. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.
   G. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

3.4 CLEANING
   A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.
   B. Use cleaning methods recommended in writing by wall-covering manufacturer.
   C. Replace strips that cannot be cleaned.
   D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
This page intentionally left blank.
SECTION 097700 - FIBERGLASS REINFORCED PLASTIC (FRP) PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Plastic sheet paneling.

1.3 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's product data, specifications, and installation instructions.
   1. Include certifications as may be required to show compliance with specifications.

B. Shop Drawings: Submit shop drawings indicating location and size of each panel, and other pertinent data.

C. Submit samples to the Architect for approval.
   1. Two sets of samples showing complete, full range of colors for Architect's selection.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.5 WARRANTY

A. The manufacturer shall warrant each panel installation against manufacturing defects within specified warranty period:
   1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

1.2 PLASTIC SHEET PANELING

1. Manufacturers: Subject to compliance with requirements, provide Basis of Design products indicated on Finish Legend or approved comparable products by one of the following:
   a. Crane Composites, Inc.
   b. Glasteel
   c. Kemlite Company Inc.
   d. Marlite
   e. Newcourt, Inc.
   f. Nudo Products, Inc.
   g. Parkland Plastics, Inc.

2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.

3. Nominal Thickness: Not less than 0.12 inch.
5. Color: As selected by Architect from manufacturer's full range.

1.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
   1. Color: As selected by Architect from manufacturer's full range.

B. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

C. Adhesive: As recommended by plastic paneling manufacturer.

D. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

PART 2 - EXECUTION

2.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
2.2 PREPARATION

A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

D. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.
   1. Mark plumb lines on substrate at panel joint locations for accurate installation.
   2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

2.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install trim accessories with adhesive.

D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

F. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.

G. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 097700
This page intentionally left blank.
SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the exterior substrates indicated in the Exterior Painting Schedule at the end of this Section.

B. Related Sections include the following:
   1. Division 5 Sections for shop priming of metal substrates with primers specified in this Section.
   2. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.2 ACTION SUBMITTALS

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

B. Samples for Verification: Labeled sample with stepped coats, for each type of paint system and each color and gloss of topcoat indicated.

1.3 QUALITY ASSURANCE

A. Single-Source Responsibility: For each painting system, use a single manufacturer for primer and topcoats.

B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

C. Material Quality: Provide products of indicated quality or better for each coating type specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
   1. Products: Proprietary names used to designate colors or materials are not intended to exclude equal or better products of other manufacturers. Equivalents products may submitted for approval by Architect through Product Requirements process indicated in Division 1, with executed Substitution Request Form, complete with point-by-point comparison filled out for each proposed product compared with an MPI listed product. Proposed products must meet or exceed the test results of the MPI listed product, including abrasion resistance, adhesion, corrosion weathering, salt fog resistance, dry heat resistance, and other requirements of this Section.

1.4 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.

1.5 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide indicated products from the following, or comparable products approved by Design Builder:

2. PPG Industries (PPG).
3. The Sherwin-Williams Company (S-W).

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: As indicated on Drawings, or as selected by Architect from manufacturer's full range.

2.3 PRIMERS/SEALERS

A. Primer, Alkali Resistant, Water Based: MPI #3.

2. Or Equal.

2.4 EXTERIOR LATEX PAINTS

A. Flat Acrylic Latex:

2. Or Equal

2.5 WATER-BASED PAINTS

A. Latex, Exterior High Build (Gloss Level 1): MPI #40.

1. Sherwin-Williams Company: Loxon XP, A24W00451
2. Or Equal.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
   1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
   2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Apply field primer to unfinished shop primed surfaces.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

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 EXTERIOR PAINT SCHEDULE

A. CMU Substrates:
   1. Latex System: MPI EXT 4.2A.
      c. Topcoat: Latex, exterior, low sheen (Gloss Level 3-4), MPI #15.

B. Exterior Insulation Finish System Substrates:
   1. Latex System:

C. Clay-Masonry Substrates:
   1. High-Build Latex System: MPI EXT 4.1H. Dry film thickness not less than 10 mils.
      a. Prime Coat: As recommended in writing by topcoat manufacturer.
      b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
      c. Topcoat: Latex, exterior, high build.

END OF SECTION 0991133
SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:
   1. Concrete.
   2. Aluminum (not anodized or otherwise coated).

B. Related Requirements:
   1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
   2. Section 099600 "High-Performance Coatings" for high-performance and special-use coatings.
   3. Section 099113 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.3 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. 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. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
   3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS
A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE
A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING
A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS
A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
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. Akzo Nobel (formerly ICI Paints).
2. Benjamin Moore & Co.
4. Duron, Inc.
5. PPG Architectural Finishes, Inc.
7. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.

D. Colors: As indicated on Interior Finish Legend.

2.3 BLOCK FILLERS

A. Block Filler:

1. Products, General: Subject to compliance with requirements, provide the following or comparable products:
2.4 PRIMERS/SEALERS

A. Primer Sealer, Interior, Institutional Low Odor/VOC: MPI #149.

   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Akzo Nobel; Glidden Professional Lifemaster No VOC Interior Primer, 9116
      b. Benjamin Moore; Eco Spec WB Interior Latex Primer, N372/F372
      c. Benjamin Moore; Natura Waterborne Interior Primer, 511/K511
      d. Benjamin Moore; Ultra Spec 500 Waterborne Interior Primer Sealer, N534/K534
      e. PPG; Pure Performance Interior Latex Primer, 9-900
      f. Sherwin-Williams; Multi-Purpose Zero VOC Primer/Sealer, B51W00450
      g. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex

B. Primer, Latex, for Interior Wood: MPI #39.

   b. Benjamin Moore; Fresh Start 100% Acrylic Superior Primer, 046/K046.
   c. PPG; Seal Grip, Interior/Exterior Stain Blocking Primer, 17-921.

2.5 METAL PRIMERS

A. Primer, Alkyd, Anti-Corrosive, for Metal: MPI #79. (Shop Applied)

   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Akzo Nobel; Devoe Coatings Devshield 4160 Multi-Purpose Tank & Structural Primer, 4160
      b. Benjamin Moore; Super Spec HP Alkyd Metal Primer, P06/KP06
      c. PPG; Speedhide Int/Ext Rust Inhibitive Steel Primer, 6-212
      d. Sherwin-Williams; Protective & Marine Kem Bond HS, B50WZ4

B. Primer, Galvanized, Water Based: MPI #134.

   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Akzo Nobel; Devoe Coatings Devflex 4020 Direct to Metal Primer & Flat Finish, 4020PF
      b. Benjamin Moore; Super Spec HP Acrylic Metal Primer, P04/KP04
      c. PPG; Pitt-Tech Plus 100% Acrylic DTM Industrial Primer, 90-912
      d. Sherwin-Williams; Pro Industrial Pro-Cryl Universal Primer, B66W310

C. Primer, Quick Dry, for Aluminum: MPI #95.

   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Akzo Nobel; Devoe Coatings Devguard 4360 Low VOC Universal Primer, 4360
      b. PPG; Speedhide Int/Ext Zinc Chromate Metal Primer
      c. Sherwin-Williams; Protective & Marine Kem Kromik Universal Primer, B50WZ1

D. Primer, Rust-Inhibitive, Water Based: MPI #107.

   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Azko Nobel; Devoe Paint Mirrolac WB Int/Ext Waterborne DRM Flat Primer and Finish, DP8502
      b. Benjamin Moore; Super Spec HP Acrylic Metal Primer P04/KP04
c. PPG; Pitt-Tech Plus Int/Ext DTM Industrial Primer, 90-908/909/912

   d. Sherwin-Williams; Pro Industrial Pro-Cryl Universal Primer, B66W310

2.6 EPOXY’S

   A. Epoxy’s: Subject to compliance with requirements, provide the following or equal:

      1. Sherwin-Williams: Pro Industrial Waterbased Catalyzed Epoxy Gloss, B73-300


      3. Sherwin-Williams: Pro Industrial Waterbased Catalyzed Epoxy Eg-Shel, B73-360

2.7 WATER-BASED PAINTS

   A. Latex, Interior, Institutional Low Odor/VOC, Flat (Gloss Level 1): MPI #143.

      1. Products: Subject to compliance with requirements, provide one of the following:

         a. Azko Nobel; Devoe Paint Wonder Pure Interior Flat Paint, DRN31XX

         b. Akzo Nobel; Glidden Professional Lifemaster No VOC Interior Acrylic Flat, 9100

         c. Benjamin Moore; Eco Spec WB Interior Latex Flat Finish, N373/K373

         d. Benjamin Moore; Natura Waterborne Interior Flat, 512/K512

         e. PPG; Pure Performance Interior 100% Acrylic Flat, 9-100

         f. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Flat, B30W02651

   B. Latex, Interior, Institutional Low Odor/VOC, Eggshell (Gloss Level 3): MPI #145.

      1. Products: Subject to compliance with requirements, provide one of the following:

         a. Akzo Nobel; Glidden Professional Diamond 450 No VOC Interior Eggshell, 7200

         b. Benjamin Moore; Eco Spec WB Interior Latex Eggshell, N374/F374

         c. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Eg-Shel, B20W02651

   C. Latex, Interior, Institutional Low Odor/VOC, Semi-Gloss (Gloss Level 5): MPI #147.

      1. Products: Subject to compliance with requirements, provide one of the following:

         a. Azko Nobel; Devoe Paint Wonder Pure Semi-Gloss Interior Latex Enamel, DRN33XX

         b. Akzo Nobel; Glidden Professional Diamond 450 No VOC Semi-Gloss Paint, 7400

         c. Benjamin Moore; Natura Waterborne Interior Semi-Gloss, 514/K514

         d. PPG; Pure Performance Interior Semi-Gloss Latex, 9-500

         e. Sherwin-Williams; Pro Industrial Zero VOC Acrylic Semi-Gloss, B66W00651

2.8 DRY FOG/FALL COATINGS

   A. Dry Fall, Latex, Flat: MPI #118.

      1. Products: Subject to compliance with requirements, provide one of the following:

         a. Akzo Nobel; Devoe Paint Multi-Plex-WB Acrylic Dry Fog Primer & Finish, CP318XX

         b. Benjamin Moore; Super Spec Sweep Up Latex Flat, 153/K153

         c. PPG; Speedhide Int. Dry-Fog Spray Paint - Flat Latex, 6-715XI

         d. Sherwin-Williams; Dryfall Low VOC Waterborne Acrylic, B42W81

2.9 INTERIOR WALLS

   A. Scrubbable Polyurethane:

      1. Primer: Scuffmaster Primer/Sealer.

3. Top Coat: Scuffmaster ScrubTough with Microban.

2.10 HOLLOW METAL FRAMES, STAIRS AND RAILS

A. Scrubbable Polyurethane:
   1. Primer: Scuffmaster Primemaster Primer/Sealer or Scuttmaster Primemaster Bonding Primer; as recommended by manufacturer.
   3. Top Coat: Scuffmaster ScrubTough Max with Microban.
      a.

2.11 FLOOR COATINGS

A. Sealer, Water Based, for Concrete Floors: MPI #99.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Behr Paint; Behr Wet-Look Sealer Low Lustre No. 986
      b. Duron Paints; Dura Crete, WB, U/V Masonry Waterproofing Sealer, 80-071
      c. Rainguard International; Clear Seal Acrylic Urethane, CU-0201
      d. Sherwin-Williams; H & C Concrete & Masonry Waterproofing Sealer, 50.043054

B. Epoxy Based Traffic Coatings for Concrete Floors (EPX-1, EPX-2, EPX-3, EPX-4):
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Sherwin-Williams; Trafficote

2.12 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
   1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Concrete: 12 percent.
3. Wood: 15 percent.
4. Plaster: 12 percent.

C. Plaster Substrates: Verify that plaster is fully cured.

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 Manual" applicable to substrates 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. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
   1. SSPC-SP 2, "Hand Tool Cleaning."
   2. SSPC-SP 3, "Power Tool Cleaning."

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.
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. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
   1. Paint the following work where exposed in equipment rooms:
      a. Equipment, including panelboards and switch gear.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Pipe hangers and supports.
      e. Metal conduit.
      f. Plastic conduit.
      g. Tanks that do not have factory-applied final finishes.
      h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   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 FIRE RATED ASSEMBLIES

A. Permanently identify corridor partitions, smoke stop partitions, horizontal exit partitions, exit enclosures and fire walls. Above decorative ceiling line and in concealed spaces, on both sides of wall, apply a minimum one-inch wide red line interrupted at maximum 12-ft spacing with the wording “X HOUR FIRE AND SMOKE BARRIER - PROTECT ALL OPENINGS” in 4-inch high letters with “X” designating the appropriate hourly rating.

3.5 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.6 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.

3.7 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Traffic Surfaces:
   1. Water-Based Clear Sealer System: MPI INT 3.2G.
      a. First Coat: Sealer, water based, for concrete floors, MPI #99.
      b. Topcoat: Sealer, water based, for concrete floors, MPI #99.

B. Concrete Substrates, Traffic Surfaces Where Indicated:
   1. Epoxy Based Floor Coating: MPI INT 3.2G.
      a. First Coat: Epoxy floor coating with aggregate.
      b. Topcoat: Epoxy floor coating with aggregate.

C. CMU Substrates:
   1. Institutional Low-odor/VOC Latex System: MPI INT 4.2E.
c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 3), MPI #145.

2. CMU at locker room/shower.
   a. Block Filler: Block filler.
   c. Topcoat: EPX-1.

3. CMU at non-wet areas.
   a. Block Filler: Block filler.

D. Steel Substrates (Exposed Structure):
   1. Water-Based Dry-Fall System: MPI INT 5.1C.
      a. Shop Applied Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
      b. Topcoat: Dry fall, latex, flat, MPI #118.

E. Aluminum (Not Anodized or Otherwise Coated) Substrates:
   1. Institutional Low-Odor/VOC Latex System: MPI INT 5.4G.
      a. Prime Coat: Primer, quick dry, for aluminum, MPI #95.
      c. Topcoat: Latex, interior, institutional low odor/VOC, flat (Gloss Level 1), MPI #143.

END OF SECTION 099123
SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

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

1.2 SUMMARY
   A. This Section includes surface preparation and application of high-performance coating systems
      on the following substrates:
      1. Interior Substrates:
         a. Concrete masonry units (CMU).
         b. Steel.
         c. Galvanized Metal.
         d. Gypsum board.
   B. Related Sections include the following:
      1. Division 05 Sections for shop priming of metal substrates with primers specified in this
         Section.
      2. Division 09 painting Sections for special-use coatings and general field painting.

1.3 SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Samples for Verification: For each type of coating system and in each color and gloss of finish
      coat indicated.
      1. Submit Samples on rigid backing, 8 inches square.
      2. Step coats on Samples to show each coat required for system.
      3. Label each coat of each Sample.
      4. Label each Sample for location and application area.
   C. Product List: For each product indicated. Cross-reference products to coating system and
      locations of application areas. Use same designations indicated on Drawings and in schedules.

1.4 QUALITY ASSURANCE
   A. Master Painters Institute (MPI) Standards:
      1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products
         List."
      2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting
         Specification Manual" for products and coating systems indicated.
   B. Mockups: Apply benchmark samples of each coating system indicated to verify preliminary
      selections made under sample submittals and to demonstrate aesthetic effects and set quality
      standards for materials and execution.
      1. Architect will select one surface to represent surfaces and conditions for application of each
         type of coating and substrate.
         a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft.
         b. Other Items: Architect will designate items or areas required.
2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
3. Final approval of color selections will be based on benchmark samples.
   a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.5 DELIVERY, STORAGE, AND HANDLING
   A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
      1. Maintain containers in clean condition, free of foreign materials and residue.
      2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS
   A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F.
   B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS
   A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
      1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 HIGH-PERFORMANCE COATINGS, GENERAL
   A. Material Compatibility:
      1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
      2. Provide products of same manufacturer for each coat in a coating system.
   B. Colors: As indicated on Finish Schedule.

2.2 INTERIOR COLUMNS
   A. Shop Primer: Zinc-Rich Aromatic Urethane primer applied at 2.5 – 3.5 dry mils.
      2. Or equal.
   B. Spot Touch Up: Inorganic Hybrid Water-Based Epoxy applied at 3.0 – 5.0 dry mils.
      2. Or equal.
   C. Intermediate Coat: Inorganic Hybrid Water-Based Epoxy applied at 4.0 – 6.0 dry mils.
      2. Or equal.
   D. Finish Coat: Waterborne Acrylic Polyurethane applied at 2.0 – 3.0 dry mils.
1. Tnemec Series: 1081 Endura-Shield

2.3 EXTERIOR COLUMNS
   
   A. Shop Primer: Zinc-Rich Aromatic Urethane primer applied at 2.5 – 3.5 dry mils.
      1. Tnemec Series 90-97 Tneme-Zinc
      2. Or equal.

   B. Spot Touch Up: Mio/Zinc Filled Aromatic Polyurethane primer applied at 2.5 – 3.5 dry mils.
      1. Tnemec Series 1 Omnithane
      2. Or equal.

   C. Intermediate Coat: Aliphatic Acrylic Polyurethane applied at 2.0 – 3.0 dry mils.
      1. Tnemec Series 73 Endura-Shield
      2. Or equal.

   D. Finish Coat: Advanced Thermoset Solution Fluoropolymer applied at 2.0 – 3.0 dry mils.
      1. Tnemec Series 1070 Fluoronar
      2. Or equal.

PART 3 - EXECUTION

3.1 EXAMINATION
   
   A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
      1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
         a. Masonry (Clay and CMU): 12 percent.
         b. Gypsum Board: 12 percent.
      2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
      3. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
      4. Coating application indicates acceptance of surfaces and conditions.

3.2 PREPARATION, GENERAL
   
   A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

   B. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
      1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

   C. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.
      1. Remove incompatible primers and reprime substrate with compatible primers as required to produce coating systems indicated.

   D. CMU Substrates: Remove efflorescence and chalk, dust, dirt, release agents, grease and oils. Mechanically remove glaze, if necessary to ensure bonding. Do not coat surfaces if moisture
content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer’s written instructions.

E. Steel Substrates: Remove rust and loose mill scale.
   1. Clean using methods recommended in writing by coating manufacturer.
   2. Blast clean according to SSPC-SP 6/NACE No. 3, “Commercial Blast Cleaning.”

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer’s written instructions.
   1. Use applicators and techniques suited for coating and substrate indicated in accordance with manufacturer's directions and as specified.
      a. For epoxy coating, use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
   2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when coatings are being applied:
   1. Owner will engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will perform tests for compliance with specified requirements.
   3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, 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 coated surfaces.

END OF SECTION 099600
This page intentionally left blank.
SECTION 101100 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Markerboards.
   2. Tackboards.
   3. Dry-erase wall coverings.

1.3 DEFINITIONS

A. Tackboard: Framed or unframed, tackable, visual display board assembly.

B. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes markerboards and tackboards.

C. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of chalkboards, markerboards, tackboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.

B. Shop Drawings: For visual display surfaces.
   1. Include dimensioned elevations. Show location of joints between individual panels where unit dimensions exceed maximum panel length.
   2. Include sections of typical trim members.
   3. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

C. Samples: For each type of visual display surface with factory-applied color finishes.
   1. Visual Display Surface: Not less than 8-1/2 by 11 inches, mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For dry-erase wall coverings to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for installation.
   1. Build mockup of typical visual display surfaces.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display surfaces, including factory-applied trim, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display surfaces vertically with packing materials between each unit.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.
1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.10 WARRANTY

A. General Warranty: The special porcelain enamel markerboard warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. 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 MATERIALS, GENERAL

A. Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; uncoated thickness indicated.

1. Gloss Finish: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser.

B. Plastic-Impregnated Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout with surface-burning characteristics indicated.

C. Particleboard: ANSI A208.1, Grade M-1, made with binder containing no urea formaldehyde.

D. Extruded Aluminum: ASTM B 221, Alloy 6063.

2.2 MARKERBOARD AND TACKBOARD MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AARCO Products, Inc.
2. American Visual Display Products
3. Best-Rite Manufacturing
5. Ghent Manufacturing, Inc.
6. Newline Products Inc.
7. Platinum Visual Systems  
8. PolyVision Corporation  
9. Tri-Best Visual Display Products  

2.3 MARKERBOARD ASSEMBLIES  

A. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and porcelain-enamel face sheet with low-gloss finish.  
   1. Particleboard Core: 3/8 inch thick; with 0.005-inch thick, aluminum backing.  
   2. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.  

B. Markerboards: Factory assembled  
   2. Corners: Square.  
   3. Length: As indicated on Drawings.  
   4. Height: 4 feet, unless noted otherwise.  
   5. Mounting: Wall.  
   6. Mounting Height: As indicated on Drawings.  
   7. Factory-applied aluminum trim.  

2.4 TACKBOARD ASSEMBLIES  

A. Plastic-Impregnated-Cork Tackboard: 1/4-inch thick, plastic-impregnated cork sheet factory laminated to 1/4-inch thick particleboard backing.  

B. Tackboards: Factory assembled.  
   1. Color: As selected by Architect from full range of industry colors.  
   2. Corners: Square.  
   3. Length: As indicated on Drawings.  
   4. Height: 4 feet, unless noted otherwise.  
   5. Mounting: Wall.  
   6. Mounting Height: As indicated on Drawings.  
   7. Edges: Concealed by trim.  

2.5 MARKERBOARD AND TACKBOARD ACCESSORIES  

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch thick, extruded aluminum; standard size and shape.  
   2. Finish: Clear anodized.  

B. Markertray: Manufacturer's standard, continuous.  
   1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.
2.6 DRY-ERASE WALL COVERINGS

A. Dry-Erase Wall Covering: Intended for use with dry-erase markers and consisting of high-gloss polyester film with adhesive backing.
   1. Basis of Design: 3M; DI-NOC Whiteboard Finish WH-111
   2. Koroseal; Walltalkers Erase Rite

B. Primer/Sealer: Mildew-resistant primer/sealer as recommended in writing by dry-erase wall covering manufacturer for intended substrate.

2.7 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Assembly: Provide factory-assembled markerboard and tackboard units, unless field-assembled units are required.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
   1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
   2. Provide manufacturer's standard vertical-joint system between abutting sections of markerboards.
   3. Provide manufacturer's standard mullion trim at joints between markerboards and tackboards of combination units.
   4. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

A. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as
fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display surfaces.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.

   1. Prime wall surfaces indicated to receive tackable wall covering panels and dry-erase wall coverings and as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.

3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.4 INSTALLATION OF VISUAL DISPLAY BOARDS AND ASSEMBLIES

A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.

   1. Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at not more than 24 inches o.c.

      a. Attach markertrays to boards with fasteners at not more than 12 inches o.c.
3.5 INSTALLATION OF DRY-ERASE WALL COVERING

A. Dry-Erase Wall Covering: Comply with dry-erase wall-covering manufacturers' written installation instructions.
   1. Install seams horizontal and level, with lowest seam 24 inches above finished floor. Railroad wall covering (reverse roll direction) to ensure color matching.
   2. Double cut seams, with no gaps or overlaps. Remove air bubbles, wrinkles, blisters, and other defects.
   3. After installation, clean dry-erase wall covering according to manufacturer's written instructions. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

3.6 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 101100
SECTION 102600 - WALL AND DOOR PROTECTION

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. Corner guards.
   2. Impact-resistant wall coverings.
B. Related Sections:
   1. Section 087100 "Door Hardware" for metal armor, kick, mop, and push plates.

1.3 ACTION SUBMITTALS
A. Product Data: Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.
   1. For adhesives, documentation including printed statement of VOC content.
B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.
C. Samples for Initial Selection: For each type of impact-resistant wall protection unit indicated.
D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Corner Guards: 12 inches long. Include examples of joinery, corners, and field splices.
   2. Impact-Resistant Wall Covering: 6 by 6 inches square.

1.4 INFORMATIONAL SUBMITTALS
A. Material Certificates: For each impact-resistant plastic material, from manufacturer.
B. Material Test Reports: For each impact-resistant plastic material.
C. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS
A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
   1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.
1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Section 014000 "Quality 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.

D. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.


F. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
   2. Keep plastic sheet material out of direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Deterioration of plastic and other materials beyond normal use.
   2. Warranty Period: Five years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 MATERIALS

A. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; sheet material, thickness as indicated.
   1. Impact Resistance: Minimum 25.4 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
   2. Chemical and Stain Resistance: Tested according to ASTM D 543 or ASTM D 1308.
   3. Self-extinguishing when tested according to ASTM D 635.
   4. Flame-Spread Index: 25 or less.
   5. Smoke-Developed Index: 450 or less.

B. Stainless-Steel Sheet: ASTM A 240/A 240M.

C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.2 CORNER GUARDS

A. Surface-Mounted, Metal Corner Guards CG: Fabricated from one-piece, formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
   1. Basis-of-Design Product: Subject to compliance with requirements, Flush Mount Stainless Steel Corner Guard model “SSEW-FM” by Inpro Corporation or comparable product by one of the following:
      a. American Floor Products Co., Inc.
      b. Arden Architectural Specialties, Inc.
      c. Balco, Inc.
      d. Boston Retail Products.
      e. Construction Specialties, Inc.
      f. IPC Door and Wall Protection Systems; Division of InPro Corporation.
      g. Inpro Corporation.
      h. Korogard Wall Protection Systems; a division of RJF International Corporation.
      i. Pawling Corporation.
      j. Tepromark International, Inc.
      k. WallGuard.com.
   2. Material: Stainless steel, Type 304.
      a. Thickness: Minimum 0.0500 inch.
      b. Extrusion Length: Minimum 10'-0”.
      c. Finish: Directional satin, No. 4.
   3. Wing Size: Nominal 2 inch by 2 inch.

2.3 IMPACT-RESISTANT WALL COVERINGS

A. Impact-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall-covering material.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Construction Specialties, Inc.
b. IPC Door and Wall Protection Systems; Division of InPro Corporation.
c. Korogard Wall Protection Systems; a division of RJF International Corporation.
d. Pawling Corporation.
e. Tepromark International, Inc.

2. Size: 48 by 96 inches for sheet.
3. Sheet Thickness: 0.040 inch.

B. Primer: Manufacturer’s standard.

C. Adhesive: Manufacturer’s standard, complying with VOC limitations.

D. Sealant: Manufacturer’s standard, color matched to sheet wall covering.

2.4 FABRICATION

A. Fabricate impact-resistant wall protection units to comply with requirements indicated for
design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly.
Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide
surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate
members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements
for installation tolerances and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking,
grounds, and other solid backing that have been installed in the locations required for secure
attachment of support fasteners.

1. For impact-resistant wall protection units attached with adhesive or foam tape, verify
compatibility with and suitability of substrates, including compatibility with existing
finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall
protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

C. Prime gypsum wallboard scheduled to receive impact resistant wall covering in accordance
with manufacturer’s written instructions.
3.3 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
   1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.
   2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
      a. Provide anchoring devices to withstand imposed loads.
      b. Adjust end and top caps as required to ensure tight seams.

B. Impact-Resistant Wall Covering: Comply with manufacturer’s installation instructions. Provide 1/16-inch gap at butt joints. Seal. Install top and edge moldings and corners as required for a complete installation.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600
This page intentionally left blank.
SECTION 102600 - WALL PROTECTION

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Wall guards.
      2. Corner guards.
      3. Handrails.
      4. Impact-resistant wall coverings.

   B. Related Sections:
      1. Section 087100 "Door Hardware" for door protection, including metal armor, kick, mop, and push plates.

1.3 PERFORMANCE REQUIREMENTS
   A. Structural Performance: Provide handrails capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
      1. Uniform load of 50 lbf/ft. applied in any direction.
      2. Concentrated load of 200 lbf applied in any direction.
      3. Uniform and concentrated loads need not be assumed to act concurrently.

1.4 ACTION SUBMITTALS
   A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

   B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.
      1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

   C. Samples: For each type of exposed finish required, prepared on Samples of size indicated below. Include Samples of accent strips to verify color selected.
      1. Wall and Corner Guards: 12 inches long. Include examples of joinery, corners, end caps, and field splices.
      2. Handrails: 12 inches long. Include examples of joinery, corners, and field splices.
1.5 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
   1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Wall-Guard and Handrail Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of units installed, but no fewer than two, 8-foot long units.
   2. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of units installed, but no fewer than two, 4-foot long units.

B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

B. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
   2. Keep plastic sheet material out of direct sunlight.
   3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
      a. Store corner-guard covers in a vertical position.
      b. Store wall-guard covers in a horizontal position.
1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures.
   b. Deterioration of plastic and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; extruded material, thickness as indicated.

1. Impact Resistance: Minimum 25.4 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
2. Chemical and Stain Resistance: Tested according to ASTM D 543 or ASTM D 1308.
3. Self-extinguishing when tested according to ASTM D 635.
4. Flame-Spread Index: 25 or less.
5. Smoke-Developed Index: 450 or less.

B. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 for Alloy 6063-T5.

C. Stainless-Steel Sheet: ASTM A 240/A 240M.

D. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

E. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Babcock-Davis
2. Construction Specialties, Inc.
3. IPC Door and Wall Protection Systems; Division of InPro Corporation
4. Korogard Wall Protection Systems; a division of RJF International Corporation
5. Koroseal Interior Products
6. Pawling Corporation
7. Tepromark Architectural Products

2.3 END WALL GUARDS

A. Flush-Mounted, Stainless Steel End-Wall Guard: Type 304, 16 gauge stainless steel fabricated from one-piece, that covers entire end of wall; with formed edges.

1. Basis of Design: InPro Corporation; SSEW-FM
   a. Profile: Return leg as indicated on Drawings.
   b. Height: As indicated on Drawings.
   d. Finish: No. 4 satin finish.

2.4 CORNER GUARDS

A. Surface-Mounted, Stainless Steel Corner Guards: Type 304, 16 gauge stainless steel corner guard fabricated as one piece with formed edges; with 90- or 135-degree turn to match wall condition.

1. Basis of Design: InPro Corporation; 183124H
   a. Profile: Nominal 3-1/2-inch long leg.
   b. Height: As indicated on Drawings.
   d. Finish: No. 4 satin finish.

2.5 HANDRAILS

A. Impact-Resistant Plastic Handrails: Assembly consisting of snap-on plastic cover installed over continuous retainer.

1. Basis of Design: InPro Corporation; 1000 Handrail
3. Cover: Minimum 0.078-inch thick, extruded rigid plastic; as follows:
   a. Handrail with Bumper-Rail Profile: Top tube with nominal 1-1/2-inch- diameter gripping surface and finger recess on back side; supported by concealed, continuous retainer and extended mounting brackets.
      1) Bumper-Rail Dimensions: Nominal 4-1/2 inches high by 1-1/2 inches deep.
      2) Bumper Surface: Smooth.
   b. Color and Texture: As selected by Architect from manufacturer's full range.
4. Retainer: Minimum 0.080-inch thick, one-piece, extruded aluminum.
5. End Caps and Corners: Prefabricated, injection-molded plastic; matching color cover; field adjustable for close alignment with snap-on cover.
6. Accessories: Concealed splices, cushions, and mounting hardware.
2.6 IMPACT-RESISTANT WALL COVERINGS

A. Impact-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall-covering material.
   1. Manufacturers: Subject to compliance with requirements, provide “Fusion Protective Wallcovering” by Koroseal Interior Products or Architect approved comparable products by one of the following:
      a. Construction Specialties, Inc.
      b. IPC Door and Wall Protection Systems; Division of InPro Corporation.
      c. Korogard Wall Protection Systems; a division of RJF International Corporation.
      d. Koroseal Interior Products
      e. Pawling Corporation.
      f. Tepromark International, Inc.
   2. Size: 48 by 96 inches for sheet.
   3. Sheet Thickness: 0.040 inch.
   4. Texture: As indicated by manufacturers designation.

B. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
   1. Inside and outside corners, wainscot cap.

C. Primer: Manufacturer’s standard.

D. Adhesive: Manufacturer’s standard, complying with VOC limitations.

E. Sealant: Manufacturer’s standard, color matched to sheet wall covering.

2.7 FABRICATION

A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.8 METAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Remove tool and die marks and stretch lines, or blend into finish.
   2. Grind and polish surfaces to produce uniform finish, free of cross scratches.
   3. Run grain of directional finishes with long dimension of each piece.
   4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

B. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
   1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

   1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.
   2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
      a. Provide anchoring devices to withstand imposed loads.
      b. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches.
      c. Adjust end and top caps as required to ensure tight seams.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600
SECTION 102800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes the following:
   1. Staff and public-use washroom accessories.
   2. Custodial accessories.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product indicated. Include the following:
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.
B. Product Samples: Provide full size sample of each product type for evaluation. Samples may or may not be returned for incorporation in the work at the discretion of the architect.
C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated on Drawings.
   2. Identify products using designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS
A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.5 QUALITY ASSURANCE
A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

1.6 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Subject to compliance with requirements, provide Basis-of-Design products as scheduled, or comparable products approved by Architect, from one of the following:
   1. Toilet and Bath Accessories:
a. A & J Washroom Accessories, Inc.
b. Acorn Engineering
c. American Specialties, Inc.
d. Bobrick
e. Bradley Corporation
f. BSP Behavioral Safety Products
g. Kingsway
h. Whitehall

2.2 MATERIALS
A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.
B. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
D. 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.
   1. Exposed fasteners shall be Torx rejection pin, 6-lobe head fasteners.

2.3 FABRICATION
A. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.
B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.
C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.
D. 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. Secure mirrors to walls with laminating adhesive. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.
C. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in 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 recommendations.
### 3.3 TOILET AND BATH ACCESSORY SCHEDULE

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Basis-of-Design Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT</td>
<td>Recessed Toilet Roll Holder</td>
<td>WhiteHall, #WH1845B Roll Size 5” L</td>
</tr>
<tr>
<td>PTD</td>
<td>Paper Towel Dispenser, #KG02</td>
<td>Ligature Resistant, Lockable, Kingsway</td>
</tr>
<tr>
<td>SD</td>
<td>Liquid Soap Dispenser</td>
<td>Ligature Resistant, BSP, #SD750</td>
</tr>
<tr>
<td>GB18</td>
<td>18” Vertical Patient Grab Bar</td>
<td>Cascade Specialty Hardware; Safebar</td>
</tr>
<tr>
<td>GB36</td>
<td>36” Patient Grab Bar</td>
<td>Cascade Specialty Hardware; Safebar</td>
</tr>
<tr>
<td>GB42</td>
<td>42” Patient Grab Bar</td>
<td>Cascade Specialty Hardware; Safebar</td>
</tr>
<tr>
<td>PM</td>
<td>Polycarbonate Mirror - Frameless Lexan Duramir, laminated.</td>
<td>Polycarbonate Mirror w/ 0.25inch min.</td>
</tr>
<tr>
<td>SGB</td>
<td>Shower Grab Bar</td>
<td>Cascade Specialty Hardware; Safebar</td>
</tr>
<tr>
<td>SD</td>
<td>Soap Dish, Recessed</td>
<td>Odd Ball Industries; SP-13</td>
</tr>
<tr>
<td>EHD</td>
<td>Electric Hand Dryer #0198-MH by American Specialties.</td>
<td>SAFE-Dri recessed ligature resistant,</td>
</tr>
<tr>
<td>RH</td>
<td>Robe/Towel Hook</td>
<td>Ligature Resistant, Kingsway, #KG180</td>
</tr>
<tr>
<td>SSD</td>
<td>Soft Suicide Prevention Door</td>
<td>by Kennon <a href="http://www.suicideproofing.com">www.suicideproofing.com</a></td>
</tr>
<tr>
<td>Mop and Broom Holder</td>
<td>B-224 x 36</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION 102800
This page intentionally left blank.
SECTION 104400 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Portable fire extinguishers.
   2. Cabinets for the following:
      a. Portable fire extinguishers.
   3. Fire-protection accessories.

1.3 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.
   1. Fire Extinguishers: Include rating and classification.
   2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.6 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire hoses, hose valves, and hose racks indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.

C. Provide fire rated cabinets where indicated to be installed in fire rated walls.
1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Failure of hydrostatic test according to NFPA 10.
   b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fire Extinguishers and Cabinets:
   a. Amerex Corporation.
   b. Badger Fire Protection; a Kidde company.
   c. J.L. Industries, Inc.
   d. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
   e. Larsen's Manufacturing Company, “Series 2712” (Basis of Design)
   f. Potter-Roemer; Div. of Smith Industries, Inc.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Polycarbonate Sheet: ASTM C 1349, Appendix X1, Type II, coated, mar-resistant, UV-stabilized polycarbonate with coating on exposed surfaces

C. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

2.3 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.

B. Multipurpose Dry-Chemical Type: UL-rated 4-A:60-B:C, 10-lb nominal capacity, in enameled-steel container.

2.4 FIRE PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.
B. Cabinet Construction: Rated and Nonrated.

C. Cabinet Material: Steel sheet.

D. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
   1. Trimless with Hidden Flange: Flange of same metal and finish as box overlaps surrounding wall finish and is concealed from view by an overlapping door.

E. Cabinet Trim Material: Steel sheet.

F. Door Material: Steel sheet.

G. Door Style: Vertical duo panel with frame.

H. Door Glazing: Transparent polycarbonate sheet.

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide recessed cabinet door pull, lockable.
   2. Provide manufacturer's standard hinge permitting door to open 180 degrees.

J. Accessories:
   1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
   2. Door Lock: Cylinder lock, keyed alike to other cabinets. Provide three keys per door lock.
   3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
      a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
         1) Location: Applied to cabinet door.
         2) Application Process: Decals or Pressure-sensitive vinyl letters.
         3) Lettering Color: Red.
         4) Orientation: Vertical.

K. Finishes: Manufacturer's standard baked-enamel or powder-coat finish.

2.5 ACCESSORIES

A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish.
   1. Provide brackets for extinguishers not located in cabinets.

B. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as indicated by Architect.
   1. Identify bracket-mounted extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to wall surface.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets are to be installed.

B. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing fire-protection specialties.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
   1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
   2. Fasten mounting brackets to structure and cabinets, square and plumb.
   3. Fasten cabinets to structure, square and plumb.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

D. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 1044004400
SECTION 105126 – SOLID-PHENOLIC LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Solid phenolic lockers. Wardrobe lockers as indicated on Finish Legend.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for phenolic lockers.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.
   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 items installed in phenolic lockers.
   4. Show phenolic locker fillers, trim, base and accessories.
   5. Show phenolic locker numbering sequence.

C. Samples for Verification: For the following:
   1. Solid phenolic panels, not less than 8 by 10 inches, for each type, color, pattern, and surface finish.
   2. Exposed cabinet hardware and accessories, one unit for each type.

D. Qualification Data: For Installer.

E. Maintenance Data: For adjusting, repairing, and replacing phenolic locker doors and latching mechanisms to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain phenolic lockers through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of phenolic lockers and are based on the specific system indicated. Refer to Division 01 Section "Product 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.

D. Accessibility Requirements: Comply with applicable Accessibility Code.

E. Fire-Test-Response Characteristics: Provide materials with fire-test-response characteristics as follows:

1. Surface-Burning Characteristics: Provide Class A materials as determined by testing identical products per ASTM E 84.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver phenolic lockers until painting and similar operations that could damage phenolic lockers have been completed in installation areas. If phenolic lockers must be stored in other-than-installation areas, store only in areas where environmental conditions are same as that in final installation location and comply with requirements specified in "Project Conditions" Article.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install phenolic lockers 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: Verify concealed framing, blocking, and reinforcements that support phenolic lockers by field measurements before being enclosed and before phenolic locker fabrication, and indicate measurements on Shop Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of phenolic lockers that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures.
2. Faulty operation of locks or hardware.
3. Deterioration of phenolic, phenolic finishes, and other materials beyond normal use.

B. Warranty Period: Ten years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 MANUFACTURERS (LOC-1, LOC-2)

A. Manufacturers: Subject to compliance with requirements, provide Architect approved products as indicated on Finish Legend by one of the following:
   1. ASI Storage Group (Basis of Design)
   2. Hollman Inc.
   3. List Industries Inc.
   5. Partition Systems, Inc. of South Carolina.
   6. Spectrum Phenolic Lockers
   7. The Young Group; Fabricated Products Div.

2.2 MATERIALS

A. Solid Phenolic: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. Provide minimum 1/2-inch-thick panels.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.
   1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts for corrosion resistance.
   2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.3 LOCKER HARDWARE

A. General: Provide manufacturer's standard phenolic locker hardware and accessories complying with the following:

B. Hinges: 304-grade stainless steel.
   1. Provide 2 hinges for doors 36 inches tall and less.
   2. Provide 3 hinges for doors more than 36 inches tall.

2.4 DOOR LOCKS

A. General: Fabricate phenolic lockers to receive locking devices. Provide one locking device for each phenolic locker door, unless otherwise indicated.

B. Digital Keypad Lock (Unless otherwise indicated): Battery-powered electronic keypad with reprogrammable manager and owner codes that override access. Three consecutive incorrect code entries shall disable lock for three minutes.
   1. Designed for shared or temporary access by multiple users, with user-defined code to lock and unlock. Provide LED indicator to show when lock is in use.

C. Cam Padlock Hasp (at Single Tier Lockers): Heavy duty, surface mounted, through-bolted to receive user-supplied padlock.
2.5 PHENOLIC LOCKERS

A. Locker Body: Fabricated from phenolic panels.
   1. Basis of Design: Phenolic Lockers by Spectrum
   2. Tiers and configurations: As indicated on Drawings.
   3. Interior Shoe Shelves: At single tier lockers.
   4. Exposed edges: Straight profile; eased edges to remove sharpness; machine polished and free from tooling imperfections.
   5. Tops, bottoms, and intermediate shelves: 1/2” thick solid phenolic composite material with ventilation holes.
   6. Locker backs: ¼” thick solid phenolic composite material.
   7. Locker Sides: 3/8” thick solid phenolic composite mat.

B. Doors: 1/2-inch- thick solid phenolic.
   2. Edges: Chamfered profile; machine polished and free from tooling imperfections.
   3. Limit Arm: Provide stainless steel limit arm to allow maximum opening to 90 degrees.

C. Tops, Bottoms and Shelves: Fabricated from ½-inch thick solid phenolic panels, dual ventilation slots.

D. End, Corner and Filler Panels: Fabricated from ½-inch thick solid phenolic panels.

E. Finish/Color: Rock/ A22.3.1 Ocean Grey.

2.6 LOCKER ACCESSORIES

A. Hooks: Manufacturer's standard nylon.

B. Number Plates: Etched, embossed, or stamped, plastic plates with black background and white numbers and letters at least 1/2 inch high. Identify phenolic lockers in sequence indicated on Drawings.

C. Base (At all Lockers): Phenolic panel furnished with locker. Provide adjustable leg mounted type or frame mounted type as recommended by manufacturer; fabricated in lengths as long as practicable to enclose base and base ends of phenolic lockers.

D. Continuously Sloping Tops (At Single Tier Lockers): 1/4-inch- thick panel that matches door faces for installation over phenolic lockers. Fabricate tops in lengths as long as practicable, without visible fasteners at splice locations.

2.7 PHENOLIC LOCKER FABRICATION

A. Unit Principle: Fabricate each phenolic locker with an individual door and frame, individual top, bottom, back, and shelves, and common intermediate uprights separating compartments.
   1. Fabricate phenolic lockers to dimensions, profiles, and details indicated.
B. Fabricate components square, rigid, without warp, and with finished faces flat and free of scratches and chips. Accurately machine components for attachments in factory, with no chips. Make joints tight and true.

C. Number Plates: Attach number plates flush in each phenolic locker door, near top, centered.

D. Complete fabrication, including assembly and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

2.8 BENCHES

A. Pedestal-Leg Locker Benches: Bench top supported by pedestal legs, minimum of two pedestals for each bench, with overall height of 18 inches measured from top of bench to floor, as follows:
   1. Metal Pedestal Legs: 1-1/2-inch diameter, stainless-steel round tube or pipe.
   2. Bench Tops: 1-1/4 inches deep; fabricated as follows:
      a. High-Pressure Decorative Laminate Top: Post formed over particleboard core, with color as selected by Architect from manufacturer's full range.
      b. Length and Width: As indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and phenolic bases for suitable conditions where phenolic lockers will be installed.

B. Verify that furring is attached to concrete and masonry walls that are to receive phenolic lockers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before installing phenolic lockers, examine factory-fabricated work for completeness and complete work as required, including removal of packing.

3.3 INSTALLATION

A. Install level, plumb, and true; shim as required, using concealed shims.

B. Connect groups of phenolic lockers together with manufacturer's standard fasteners, through predrilled holes, with no exposed fasteners on face frames. Fit phenolic lockers accurately together to form flush, tight, hairline joints.
C. Install phenolic lockers 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. Installation Tolerance: No more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line. Shim as required with concealed shims.

D. Scribe and cut corner and filler panels to fit adjoining work using fasteners concealed where practical. Repair damaged finish at cuts.

E. Fixed Locker Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

3.4 ADJUSTING AND CLEANING

A. Clean, lubricate, and adjust hardware. Adjust doors to operate easily without binding. Verify that integral locking devices operate properly.

B. Protect phenolic lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit phenolic locker use during construction.

END OF SECTION 105126
SECTION 109000 - MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section includes the following:
   1. Universal TV Mounting Brackets

1.3 ACTION SUBMITTALS

A. Product data for each type of accessory specified, with installation instructions for each unit built-in or connected to other construction. Include methods of installation for each type of substrate.

B. Shop drawings showing installation details of accessories permanently affixed to construction, including full-scale installation details of special conditions.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 3 years of production experience, whose published literature clearly indicates general compliance of products with requirements of this section.

B. Single Source Responsibility: Provide material produced by a single manufacturer for each accessory type.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original factory wrappings and containers, clearly labeled with identification of manufacturer, brand name, and lot number. Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

B. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements.

1.6 SEQUENCE AND SCHEDULING

A. Sequence accessory installation with other work to minimize possibility of damage and soiling during remainder of construction period.
PART 2 - PRODUCTS

2.1 UNIVERSAL TV MOUNTING BRACKET

A. Provide a complete wall mount TV bracket for LCD screens and pivot wall arm assembly with a mounting bracket fabricated to swivel at least 180 degrees with manufacturer's standard locking feature. The mounting bracket shall be adjustable for up to 20 degrees of tilt. Provide metal stud wall plate kit as appropriate.

1. Provide back plate for through-wall mounting, type as recommended by the manufacturer for the substrate indicated in the drawings.

2. Basis of Design: Subject to compliance with requirements, provide basis of design indicated or comparable product by one of the following:

   a. Peerless Sales Co.; SA740P (Basis of Design)
   b. Bretford Manufacturing
   c. Luxor
   d. Lucasey Mounting Systems

2.2 FABRICATION, GENERAL

A. Provide accessory items, both free standing and permanently installed, equipped with functions as specified. Fabricate units with tight seams and joints, exposed metal edges rolled. Provide products with smooth welds, consistent finish with no evidence of wrinkling, chipping, uneven coloration, dents, or other imperfections.

2.3 FINISHES

A. Provide materials in colors and finishes as selected by Architect from manufacturer's standard colors and finishes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify that materials are those specified before installing.

B. Install accessories after other finishing operations, including painting, have been completed.

C. Wall-Mounted Accessory Units: Install accessories complying with manufacturer's printed instruction, using fasteners as recommended by manufacturer as appropriate to substrate.

3.2 PROTECTION

A. Protect accessories against damage during remainder of construction period, complying with manufacturer's directions.

END OF SECTION 109000
SECTION 116800 - PLAY FIELD EQUIPMENT AND STRUCTURES

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 playground equipment as follows:
   1. Contractor furnished and installed playground equipment.

1.3 DEFINITIONS

A. Definitions in ASTM F1487 apply to Work of this Section.


1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of playground equipment.
   1. Include plans, elevations, sections, and attachment details.
   2. Include fall heights and use zones for playground equipment, coordinated with the
      critical-height values of protective surfacing specified in Section 321816.13 "Playground
      Protective Surfacing."

C. Samples for Initial Selection: For each type of exposed finish.
   1. Manufacturer's color charts.
   2. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following products:
   1. Include Samples of accessories to verify color and finish selection.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer manufacturer and testing agency.
B. Product Certificates: For each type of playground equipment.
C. Material Certificates: For the following items:
   1. Shop finishes.
D. Field quality-control reports.
E. Sample Warranty: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground equipment and finishes to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm whose playground equipment components have been certified by IPEMA's third-party product certification service.
B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of playground equipment that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
   2. Warranty Period: Five years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Source Limitations: Obtain playground equipment from single source from single manufacturer.
   B. Playground equipment and components shall have the IPEMA Certification Seal.

2.2 PERFORMANCE REQUIREMENTS
   A. Safety Standard: Provide playground equipment according to ASTM F1487.

2.3 FREESTANDING PLAYGROUND EQUIPMENT
   A. Spinner
      1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
         a. Kompan, Inc.; Spica 1, 5’7” height, Product code: GXY8014; or approved equal
   B. Adjustable Basketball Set
      1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
         a. Sportsplay Inc.; Adjustable Basketball Set with perforated metal backboard and break-away hoop, Item number 532-933; or approved equal

2.4 FABRICATION
   A. Provide sizes, strengths, thicknesses, wall thickness, and weights of components as required to comply with requirements in ASTM F1487. Factory drill components for field assembly. Unnecessary holes in components, not required for field assembly, are not permitted. Provide complete play structures, including supporting members and connections, means of access and egress, designated play surfaces, barriers, guardrails, handrails, handholds, and other components indicated or required for equipment indicated.
   B. Metal Frame: Fabricate main-frame upright support posts from metal pipe or tubing with cross-section profile and dimensions as required. Unless otherwise indicated, provide each pipe or tubing main-frame member with manufacturer's standard drainable bottom plate or support flange. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.
2.5 MATERIALS

A. Aluminum: Material, alloy, and temper recommended by manufacturer for type of use and finish indicated.

B. Steel: Material types, alloys, and forms recommended by manufacturer for type of use and finish indicated.

C. Opaque Plastics: Color impregnated, UV stabilized, and mold resistant.

D. Hardware: Manufacturer's standard; commercial-quality; corrosion-resistant; hot-dip galvanized steel and iron, stainless steel, or aluminum; of a vandal-resistant design.

E. Fasteners: Manufacturer's standard; corrosion-resistant; hot-dip galvanized or zinc-plated steel and iron, or stainless steel; permanently capped; and theft resistant.

2.6 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils, medium gloss. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.7 IRON AND STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions for pretreatment, applying, and baking.

B. PVC Finish: UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on PVC finish, with flame retardant added, and with minimum dry film thickness of 80 mils. Comply with coating manufacturer's written instructions for pretreatment and application.

C. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

D. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for earthwork, subgrade elevations, surface and subgrade drainage, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading required for placing playground equipment and protective surfacing is completed.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions for each equipment type unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.

1. Maximum Equipment Height: Coordinate installed fall heights of equipment with finished elevations and critical-height values of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.

B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.

C. Post Set with Concrete Footing: Comply with Section 033000 "Cast-in-Place Concrete" ACI 301 for measuring, batching, mixing, transporting, forming, and placing concrete.

1. Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.

   a. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

2. Embedded Items: Follow equipment manufacturer's written instructions and drawings to ensure correct installation of anchorages for equipment.

3. Finishing Footings: Smooth top, and shape to shed water.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Perform inspection and testing for each type of installed playground equipment according to ASTM F1487.

C. Playground equipment items will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.
E. Notify Landscape Architect 48 hours in advance of date(s) and time(s) of testing and inspection.

END OF SECTION 116800
SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

Section Includes:
Motor-operated roller shades with single rollers.

Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.3 ACTION SUBMITTALS

Product Data: For each type of product.

1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

2. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

Samples for Verification: For each type of roller shade.

3. Shadeband Material: Not less than 10 inches square. Mark inside face of material if applicable.

Roller-Shade Schedule: Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

Maintenance Data: For roller shades to include in maintenance manuals.

1.5 QUALITY ASSURANCE

Installer Qualifications: Fabricator of products.
1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products indicated on Finish Legend or Architect approved comparable products by one of the following:

1. Draper Inc.
   Hunter Douglas Contract.
   Lutron Electronics Co., Inc.
   MechoShade Systems, Inc. (Basis of Design)
   Silent Gliss USA, Inc.

B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MOTOR-OPERATED, SINGLE-ROLLER SHADES (SHD-1)

Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   Electric Motor: Manufacturer's standard tubular, enclosed in roller.
   Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:

   Individual Switch Control Station: Momentary-contact, three-position, toggle-style, wall-switch-operated control station with open, close, and center off functions.
a. Color: As selected by Architect from manufacturer's full range.

Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
2. Roller Drive-End Location: Right side of inside face of shade.
   Direction of Shadeband Roll: Regular, from back of roller.
   Shadeband-to-Roller Attachment: Manufacturer's standard method.

Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

B. Shadebands:
      Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
      Type: Enclosed in sealed pocket of shadeband material.
      a. Color and Finish: As indicated on Finish Legend.

Installation Accessories:
   Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
   Height: As indicated on Drawings.

2.3 SHADEBAND MATERIALS

Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.4 ROLLER-SHADE FABRICATION

Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

A. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
   1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
2. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

Electrical Connections: Connect motor-operated roller shades to building electrical system.

3.3 ADJUSTING

Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

B. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413
SECTION 124813 - ENTRANCE WALK-OFF MATS

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. Carpet-tile entrance mats.

1.3 COORDINATION
   A. Coordinate size and location of recesses in concrete to receive floor mats.

1.4 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 floor mats.
   
      B. Shop Drawings:
         1. Items penetrating floor mats, including door control devices.
         2. Divisions between mat sections.
         3. Perimeter floor moldings.
   
      C. Samples: Floor mat, in manufacturer’s standard sizes.

1.5 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For floor mats to include in maintenance manuals.

1.6 EXTRA MATERIALS
   A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
      1. Carpet Tile Entrance Mats: Full-size tile units equal to 2 percent of amount installed, but no fewer than 10 units.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR MATS, GENERAL

2.2 CARPET-TILE ENTRANCE MATS (CPT-2)

A. Carpet-Type Tiles: Subject to compliance with requirements provide Basis of Design products indicated on Finish Legend or an Architect approved comparable. Carpet tiles of manufacturer's standard thickness with nonraveling edges.

   1. Basis of Design: As indicated on Finish Legend; Modular.
   2. Tile and Mat Size: As Scheduled.
   3. Mat Size: As indicated on Drawings.
   4. Color: As indicated by manufacturers designations.

PART 3 - EXECUTION

3.1 EXAMINATION

   A. Examine substrates and floor conditions for compliance with requirements for location, sizes, and other conditions affecting installation of floor mats.

   B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

   A. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.

   B. Install units to comply with manufacturer's written instructions at locations indicated; coordinate with entrance locations and traffic patterns.

3.3 PROTECTION

   A. Protect mats until construction traffic has ended and Project is at Substantial Completion.

END OF SECTION 124813
SECTION 211313 - WET-PIPE AND DRY-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 SUMMARY

A. This section specifies: automatic sprinkler systems for buildings and structures. Materials and equipment specified in this section include:
   1. Pipe, fittings, valves, and specialties.
   2. Sprinklers and accessories.
   3. Dry-pipe air compressor and accessories.

B. Definitions:
   1. Pipe sizes: used in this specification are Nominal Pipe Size (NPS).
   2. Other definitions: for fire protection systems are listed in NFPA Standard 13.
   3. Working plans: as used in this section means those documents (including drawings and hydraulic calculations) prepared pursuant to the requirements contained in NFPA 13 and 24 for obtaining approval of the authority having jurisdiction.

C. System Description:
   1. The fire protection system: shall be an automatic sprinkler system. The system shall be complete with all necessary accessories and equipment, and be ready for operation.
   2. Wet-pipe Sprinkler System: The system: shall employ automatic sprinklers attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers opened by fire.
   3. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from opened sprinklers.
   4. Provide necessary water flow test to design the system.

D. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer or sprinkler design professional.

1.3 ACTION SUBMITTAL

A. Product data: shall be submitted in one package and shall include the following:
   1. Piping (including fittings, pipe hangers, and supports).
   2. Provide copies of water flow test.
   3. Provide necessary details of the riser and control valves.
   4. Provide necessary information for coordination with other trades to interface with system.
   5. Provide all necessary equipment.
   6. Automatic sprinklers (including escutcheons).
7. Provide calculations.

B. Shop drawings: shall be prepared in accordance with NFPA 13 and 24 identified as "Working Plans", including hydraulic calculations. When requested by the authority with jurisdiction, shop drawings shall be submitted for AWJ approval. The contractor is responsible for all shop drawing and field coordination with all other trades. All shop drawing coordination with other trades shall be incorporated into the sprinkler shop drawings. All field variances occurring during construction shall be included on the record drawings.

C. Record Drawings: The Contractor shall provide one set of reproducible plans that shall be "Record Drawings" which include all field variances. These plans shall be the same scale and size as the approved plans submitted by the engineer. In the event of significant changes in the field, a record set of hydraulic calculations that include any modifications shall be included with the record drawings.

D. Maintenance data: For each type sprinkler head, piping specialty shall be included in the operating and maintenance manual.

E. Test reports and certificate: including "Contractor's Material & Test Certificate for Aboveground Piping.”

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: The design and installation of the fire protection system shall comply with the requirements of the following codes:

2. NFPA Standards: 13, 24, 72 and 101.

B. Approvals: The system design and installation shall be approved by the local authority having jurisdiction.

C. UL Compliance: Fire protection system materials, components, and fire stops shall be Underwriters' Laboratories listed and labeled.

D. Applicable Publications: The standards listed below form a part of this specification to the extent referenced. The standards are referenced in the text by the basic designation.

E. National Fire Protection Association (NFPA):


PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTIONS

A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from opened sprinklers.
2.2 MANUFACTURERS

A. Grooved Mechanical Couplings:
   1. Sprink, Inc.
   2. Stockham.
   3. Victaulic Company of America.

B. Sprinkler Heads:
   1. Tyco Fire Products LP.

2.3 PIPE AND FITTINGS

A. General: Refer to the Execution section, Article "Pipe Applications" for identification of systems where the below specified pipe and fitting materials are used. Pipe shall be new, designed to withstand the working pressures involved, but not less that 175 psi. Pipe shall have the manufacturer's name or brands, along with the applicable ASTM standard, marked on each length of pipe.

B. Black steel pipe shall be Schedule 40, Sch 10, or other material UL listed for fire protection use and as called for on the plans.

C. Cast-iron threaded fittings shall be ANSI B16.4, Class 150, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1.

D. Malleable-iron threaded fittings shall be ANSI B16.3, Class 150, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1.

E. Grooved mechanical fittings shall be ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47 Grade 32510 malleable iron; or ASTM A53, Type F or Types E or S, Grade B fabricated steel fittings with grooves or shoulders designed to accept grooved end couplings.

F. Grooved mechanical couplings shall consist of ductile or malleable iron; housing, a synthetic rubber gasket or a central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or logs to secure roll-grooved pipe and fittings. Grooved mechanical couplings including gaskets used on dry-pipe systems shall be listed for dry-pipe service.

G. Gasket materials: Thickness, material, and type suitable for fluid or gas to be handled, and design temperatures and pressures.

H. Pipe hangers shall be as specified in Section 6-1 and 6-2 of NFPA 13.

2.4 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:
   1. Standard-Pressure Piping Specialty Valves: 175-psig (1200-kPa) minimum.

C. Body Material: Cast or ductile iron.
D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Alarm Valves:
   2. Design: For vertical installation.
   3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, and fill-line attachment with strainer.
   4. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
   5. 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.

2.5 AUTOMATIC SPRINKLERS
   A. Sprinkler heads shall be equal in construction, performance and listing to those shown on the plans.
   B. Sprinkler escutcheons shall be all metal type with finish to match sprinkler.
   C. Sprinkler heads shall be Tyco Fire Products model Raven.

2.6 ALARM DEVICES
   A. General: Types and sizes shall mate and match piping and equipment connections.

2.7 PRESSURE GAGES
   A. Standard: UL 393.
   B. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.
   C. Pressure Gage Range: 0- to 250-psig (0- to 1725-kPa) minimum.
   D. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PIPE APPLICATIONS
   A. Wet-Pipe System: Install schedule 40 black steel (or other material as specified on the plans) pipe with threaded joints and fittings for 2 inch and smaller. Schedule 10 steel pipe with roll-grooved ends and grooved mechanical couplings shall be used for 2 1/2 inch and larger.
3.2 PIPING INSTALLATIONS

A. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. So far as practical, install piping as indicated.

B. Other than minor deviations from approved "Working Plans" for sprinkler piping require written approval of the engineer. Written approval shall be on file with the Architect prior to deviating from the approved "Working Plans."

C. Install sprinkler piping to provide for system drainage in accordance with NFPA 13.

D. Use approved fittings to make all changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Hangers and Supports: Comply with the requirements of NFPA 13 and NFPA 16A. Hanger and support spacing and locations for piping joined with grooved mechanical couplings shall be in accordance with the grooved mechanical coupling manufacturer's written instructions, for rigid systems.

3.3 PIPE JOINT CONSTRUCTION

A. Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Join pipe, fittings, and valves as follows:
   1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   2. Align threads at point of assembly.
   3. Apply appropriate tape or thread compound to the external pipe threads.
   4. Assemble joint to appropriate thread depth. When using a wrench on valves place the wrench on the valve end into which the pipe is being threaded.

B. Damaged Threads: Do not use a pipe with threads which are corroded or damaged. If a weld pens during cutting or threading operations, that portion of pipe shall not be used.

C. Mechanical Grooved Joints: Cut or roll grooves on pipe ends dimensionally compatible with the couplings.

D. End Treatment: After cutting pipe lengths, remove burrs and fins from pipe ends.

3.4 SPRINKLER HEAD INSTALLATIONS

A. Install sprinklers in center of lay-in ceiling tile by means of "return bends." Use proper tools to prevent damage during installation.

3.5 FIELD QUALITY CONTROL

A. Flush, test, and inspect sprinkler piping systems in accordance with NFPA 13 and 24.

B. Replace piping system components which do not pass the test procedures specified, and retest repaired portion of the system.
WET-PIPE AND DRY-PIPE SPRINKLER SYSTEMS

END OF SECTION 211313
SECTION 220500 - BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 SUMMARY

A. This Section includes the following:
   1. Piping materials and installation instructions common to most piping systems.
   2. Dielectric fittings.
   3. Sleeves.
   4. Escutcheons.
   5. Equipment installation requirements common to equipment sections.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
2.2 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.3 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

2.4 SLEEVES

A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.5 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.
   1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   1. Finish: Polished chrome-plated.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

N. Verify final equipment locations for roughing-in.

O. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

3.4 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

END OF SECTION 220500
SECTION 220523 - PLUMBING VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawing and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 SUMMARY
   A. This Section includes the following general-duty valves:
      1. Copper-alloy ball valves.

1.3 SUBMITTALS
   A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; furnished specialties; and accessories.

1.4 QUALITY ASSURANCE
   A. ASME Compliance: ASME B31.9 for building services piping valves.
      1. Exceptions: Domestic hot- and cold-water piping valves unless referenced.
   B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection.
      1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 VALVES, GENERAL
   A. Refer to Part 3 "Valve Applications" Article for applications of valves.
   B. Bronze Valves: NPS 2 (DN 50) and smaller: Threaded ends, unless otherwise indicated.
   C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
   D. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
E. Valve Actuators:
   1. Handwheel: For valves other than quarter-turn types.
   2. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.

F. Extended Valve Stems: On insulated valves.

2.3 BALL VALVES

A. Available Manufacturers:
   1. Ball Valves:
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Crane Co.; Crane Valve Group; Stockham Div.
      d. Grinnell Corporation.
      e. NIBCO INC.

B. Copper-Alloy Ball Valves, General: MSS SP-110.

C. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball; PTFE seats; and 400-psig minimum CWP rating and blowout-proof stem.

2.4 CHECK VALVES

A. Available Manufacturers:
   1. Check Valves:
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Crane Co.; Crane Valve Group; Stockham Div.
      d. Grinnell Corporation.

B. Bronze Swing Check Valves with Bronze Disc, Class 125:
   a. Standard: MSS SP-80, Type 3.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Design: Horizontal flow.
   e. Ends: Threaded or soldered. See valve schedule articles.
   f. Disc: Bronze.

2.5 BRONZE GATE VALVES

A. Available Manufacturers:
   1. Gate Valves:
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Crane Co.; Crane Valve Group; Stockham Div.
      d. Grinnell Corporation.
B. Bronze Gate Valves, RS, Class 125:
   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 200 psig (1380 kPa).
   d. Ends: Threaded or solder joint.
   e. Stem: Bronze.
   f. Disc: Solid wedge; bronze.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron or aluminum.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
   1. Shutoff Service: Ball or Gates valves.
   2. Throttling Service: Ball valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Domestic Water Piping: Use the following types of valves:
   1. Ball Valves: Two-piece, 400-psig (2760-kPa) CWP rating, copper alloy.

D. Select valves, except wafer and flangeless types, with the following end connections:
   1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Solder-joint or threaded ends, except provide valves with threaded ends for heating hot water services.

3.2 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

3.3 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Basic Plumbing Materials and Methods" for basic piping joint construction.
3.4 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 220523
SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawing and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 SUMMARY
A. This Section includes hangers and supports for plumbing system piping and equipment.

1.3 PERFORMANCE REQUIREMENTS
A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.4 SUBMITTALS
A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 MANUFACTURED UNITS
A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components.
1. Available Manufacturers:
   a. B-Line Systems, Inc.
   b. Carpenter & Patterson, Inc.
   c. Grinnell Corp.
   d. GS Metals Corp.
   e. National Pipe Hanger Corp.
   f. Piping Technology & Products, Inc.
2. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
3. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
   1. Available Manufacturers:
      a. B-Line Systems, Inc.
      b. Grinnell Corp.
      c. GS Metals Corp.
      d. National Pipe Hanger Corp.
      e. Thomas & Betts Corp.
      f. Unistrut Corp.
   2. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
   3. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.
   1. Available Manufacturers:
      a. Carpenter & Patterson, Inc.
      b. Pipe Shields, Inc.
      c. Rilco Manufacturing Co., Inc.
      d. Value Engineered Products, Inc.
   2. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
   3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
   4. For Clevis or Band Hanger: Insert and shield cover lower 180 deg rees of pipe.
   5. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS
   A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
   B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
   C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

PART 3 - EXECUTION

3.1 APPLICATIONS
   A. Specific hanger requirements are specified in Sections specifying equipment and systems.
B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
   1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).

D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
   2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
   1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
   2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
   1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
   2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
   3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
   4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
   5. C-Clamps (MSS Type 23): For structural shapes.
   6. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
      a. Light (MSS Type 31): 750 lb (340 kg).
      b. Medium (MSS Type 32): 1500 lb (675 kg).
      c. Heavy (MSS Type 33): 3000 lb (1350 kg).
   7. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
   8. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
   1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

3.2 INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems. Field assemble and install according to manufacturer's written instructions.

C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes. Support pipes of various sizes together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

D. Install building attachments to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping.

E. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

K. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

c. Do not exceed pipe stress limits according to ASME B31.9.

2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.

   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.

5. Insert Material: Length at least as long as protective shield.

6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations. Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.5 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 220529
SECTION 220553 – IDENTIFICATION FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawing and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 SUMMARY
   A. This Section includes the following mechanical identification materials and their installation.

1.3 SUBMITTALS
   A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 PIPING IDENTIFICATION DEVICES
   A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
      1. Colors: Comply with ASME A13.1, unless otherwise indicated.
      2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
      3. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers extending 360 degrees around pipe at each location.
      4. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
      5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
   B. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
   C. Plastic Tape: Continuously printed, vinyl tape at least 3 mils (0.08 mm) thick with pressure-sensitive, permanent-type, self-adhesive back.
      1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): 3/4 inch (19 mm) minimum.
      2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches (150 mm) or Larger: 1-1/2 inches (38 mm) minimum.
2.2 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers, with numbering scheme. Provide 5/32-inch (4-mm) hole for fastener.

1. Material: 0.032-inch- (0.8-mm-) thick brass.
2. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 22 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 PIPING IDENTIFICATION

A. All exposed pipe will be painted. Colors will be selected by Engineer.

B. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 3/4 inch (19 mm) wide, lapped at least 1-1/2 inches (38 mm) at both ends of pipe marker, and covering full circumference of pipe.

2. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches (38 mm) wide, lapped at least 3 inches (75 mm) at both ends of pipe marker, and covering full circumference of pipe.

C. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.

3.3 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems.
B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:

1. Valve-Tag Size and Shape:
   a. Cold Water: 2 inches (50 mm), round.
   b. Hot Water: 2 inches (50 mm), round.
   c. Tempered Water: 2 inches (50 mm), round.
   d. Hot Water Return: 2 inches (50 mm), round.

2. Valve-Tag Color:
   b. Hot Water: Red.
   c. Tempered Water: Orange
   d. Hot Water Return: White

3. Letter Color:
   d. Hot Water Return: Red.

3.4 ADJUSTING AND CLEANING

A. Relocate identification materials and devices that have become visually blocked by other work.

B. Clean faces of identification devices.

END OF SECTION 220553
SECTION 220700 – PLUMBING PIPE INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawing and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 SUMMARY
   A. This Section includes semirigid and flexible piping insulation, insulating cements, field-applied jackets, accessories and attachments, and sealing compounds.

1.3 SUBMITTALS
   A. Product Data: Thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
   B. Shop Drawings: Shop fabrication and installation details for the following:
      1. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
      2. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
      3. Removable insulation at piping specialties and equipment connections.

1.4 QUALITY ASSURANCE
   A. Fire-Test-Response Characteristics: Provide products with flame-spread and smoke-developed indices of 25 and 50, respectively, according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      1. Mineral-Fiber Insulation:
         a. CertainTeed Manson.
         b. Knauf FiberGlass GmbH.
         c. Owens-Corning Fiberglas Corp.
         d. Schuller International, Inc.
2.2 PIPE INSULATION MATERIALS

A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:
   1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
   2. Fire-Resistant Adhesive: Comply with MIL-A-3316C Class I, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
   3. Vapor-Retarder Mantics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
   5. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.

B. Field-Applied Jackets: ASTM C 921, Type 1, unless otherwise indicated.
   1. Canvas jacket with vapor-retarder mastics.
   2. Pre-formed aluminum.

C. Accessories and Attachments:
   1. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).
   2. Bands: 3/4 inch (19 mm) wide aluminum.
   3. Wire: 0.080-inch (2.0-mm), nickel-copper alloy; 0.062-inch (1.6-mm), soft-annealed stainless steel; or 0.062-inch (1.6-mm), soft-annealed, galvanized steel.

PART 3 - EXECUTION

3.1 GENERAL APPLICATION REQUIREMENTS

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

E. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
F. Apply insulation with the least number of joints practical.

G. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

H. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.

I. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

J. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

K. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.

3.2 PIPE INSULATION APPLICATION SCHEDULE

A. Service: Domestic cold water.
   1. Operating Temperature: 35 to 60 deg F (2 to 15 deg C).
   2. Insulation Material: Mineral-fiber preformed pipe.
   3. Insulation Thickness: 1”.
   4. Vapor Retarder Required: Yes.
   5. Canvas jacket on exposed piping.

B. Service: Domestic hot water.
   1. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
   2. Insulation Material: Mineral fiber pre-formed pipe.
   3. Insulation Thickness: 1”.

C. Service: Above grand roof leaders and roof drain sumps.
   1. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
   2. Insulation Material: Mineral fiber pre-formed pipe.
   3. Insulation Thickness: 1”.
   4. Field-Applied Jacket: Canvas jacket on exposed piping

END OF SECTION 220700
SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 SUMMARY

A. This Section includes domestic water piping from locations indicated to fixtures and equipment inside the building.

1.3 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS


2.2 VALVES

A. Refer to Division 22 Section "Plumbing Valves" for valves.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Interior Domestic Water Piping: Use the following piping materials for each size range:

1. NPS 2 (DN 50) and Smaller: Hard copper tube, Type L (Type B); soldered joints.
3.2 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Shutoff Duty: Use bronze ball valves for piping NPS 2 (DN 50) and smaller.
   2. Throttling Duty: Use bronze ball valves for piping NPS 2 (DN 50) and smaller.

3.3 PIPING INSTALLATION

A. Refer to Division 22 Section "Basic Plumbing Materials and Methods" for basic piping installation.

B. Install domestic water piping level and plumb.

C. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

D. Perform the following steps before operation:
   1. Close drain valves, hydrants, and hose bibb.
   2. Open shutoff valves to fully open position.
   3. Open throttling valves to proper setting.
   4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
   5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
   6. Remove filter cartridges from housings, and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.

E. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

F. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.4 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Basic Plumbing Materials and Methods" for basic piping joint construction.

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 VALVE INSTALLATION

A. Install sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball valves for piping NPS 2 (DN 50) and smaller.

B. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball valves for piping NPS 2 (DN 50) and smaller.
C. Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
   1. Install hose-end drain valves at low points in water mains, risers, and branches.
   2. Install stop-and-waste drain valves where indicated.

3.6 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 22 Section "Hangers and Supports for Plumbing Pipe" for pipe hanger and support devices. Install the following:
   1. Vertical Piping: MSS Type 8 or Type 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs: According to the following:
      a. MSS Type 1, adjustable, steel clevis hangers.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Pipe."

C. Support vertical piping and tubing.

D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

E. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
   3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.

F. Install supports for vertical steel piping every 15 feet (4.5 m).

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 3/4 (DN 20) and smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
   3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.

H. Install supports for vertical copper tubing every 10 feet (3 m).

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.
3.8 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
   a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Fill and isolate system according to either of the following:
      1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
      2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116
SECTION 221119 - PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawing and general provisions of the contract, including General and Supplementary
      Conditions and Division 01 Specification Sections, apply to this section.

1.2 SUMMARY
   A. This Section includes plumbing specialties for water distribution systems; and soil, waste, and
      vent systems.

1.3 SUBMITTALS
   A. General: Submit the following in accordance with Conditions of Contract and Division 01
      Specification Sections.
   B. Submit product data including rated capacities of selected models and weights (shipping,
      installation, and operation). Indicate materials, finishes, dimensions, required clearances, and
      methods of assembly of components; and piping and wiring connections:

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Coordinate subparagraphs retained below with subparagraph titles retained in other Part 2
      articles.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers
      offering products that may be incorporated into the Work include, but are not limited to,
      the manufacturers specified.
      a. Josam Co.
      c. Watts Regulator Co.
      d. Woodford Manufacturing Co. Div., WCM Industries, Inc.
      e. Zurn by Hydromechanics Div., Zurn Industries, Inc.

2.2 HOSE BIBBS/HYDRANTS – LOCKABLE BOX (HB-1)
   A. HB: ANSI/ASSE 1019; Concealed, non-freeze, all bronze interior parts, replaceable bronze seat
      and seat washer, self-draining type with polished bronze box face, lockable box with “T” handle
      key, thread hose spout, removable key, and vacuum breaker.
2.3 FLOOR DRAINS
   A. FD-1: ANSI A112.21.1; lacquered cast iron two piece body with double drainage flange; weep holes; round adjustable, 304 stainless steel, anti-ligature strainer, and a 1/2” primer tap. Strainer shall be Galvin, model 303070X or Engineer approved equal.
   B. FD-2: ANSI A112.21.1; lacquered cast iron two piece body with double drainage flange, weep holes, and square adjustable nickel-bronze strainer.

2.4 CLEANOUTS
   A. Exterior Surfaced Areas: Round cast nickel bronze access frame and non-skid heavy duty scoriated cover.
   B. Exterior Unsurfaced Areas: Line type with lacquered cast iron body and round epoxy coated gasketed cover.
   C. Interior Finished Floor Areas: Lacquered cast iron, two piece body, round with scoriated cover in service areas and round with depressed cover to accept floor finish in finished floor areas.
   D. Interior Finished Floor Traffic Areas: Lacquered cast iron, two piece body, round with heavy duty scoriated cover.

2.5 WATER HAMMER ARRESTORS
   A. ANSI A112.26.1; sized in accordance with PDI WH-201, precharged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psig working pressure.

2.6 IN-LINE CIRCULATOR PUMPS
   A. Casing: Bronze, rated for 125 psig working pressure.
   B. Impeller: Bronze.
   C. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
   D. Seal: Carbon rotating against a stationary ceramic seat.
   E. Drive: Flexible coupling

2.7 VALVE CABINETS
   A. Guardian, model 1920-F-SL, recessed, solid metal lockable door, no label.

2.8 BALANCING VALVE
   A. Bronze, Calibrated-Orifice, Balancing Valves:
      1. Body: Bronze, ball or plug type with calibrated orifice or venturi.
      2. Ball: Brass or stainless steel.
      3. Plug: Resin.
4. Seat: PTFE.
5. End Connections: Threaded or socket.
7. Handle Style: Lever, with memory stop to retain set position.
8. CWP Rating: Minimum 125 psig (860 kPa).

2.9 THERMOSTATIC MIXING VALVE

A. Thermostatic water mixing valve, Copper encapsulated thermostatic assembly with Teflon coated shuttle Lead free (ECO-MIX™) Combination checkstops, unions on inlets, wall support Locking temperature regulating handle. Tempered outlet ball valves, Color coded dial thermometer (0 to140°F, -10° to 60°C). Recessed Stainless Steel cabinet, with door, left hand hinge and flange, cylinder lock, Rough Bronze finish. Bottom inlets, top outlet Factory assembled and tested Bronze, Calibrated-Orifice, Balancing Valves:

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Basic Plumbing Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated.
   1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at base of each vertical soil and waste stack.

C. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

D. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

E. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

F. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

G. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

H. Fasten recessed-type plumbing specialties to reinforcement built into walls.

I. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.
J. Install individual shutoff valve in each water supply to plumbing specialties. Use ball valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 22 Section "Plumbing Valves" for general-duty ball valves.

K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

L. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Install piping adjacent to equipment to allow service and maintenance.

B. Connect plumbing specialties and devices that require power according to Division 26 Sections.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each piece of equipment.

   1. Text: Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221119
SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawing and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 SUMMARY
A. This Section includes soil and waste, sanitary drainage and vent piping inside the building.

1.3 QUALITY ASSURANCE
A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS
B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.  
      a. Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel shield; stainless-steel bands; and sleeve.  
         1) NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 3-inch- (76-mm-) wide shield with 4 bands.  
         2) NPS 5 to NPS 10 (DN 125 to DN 250): 4-inch- (102-mm-) wide shield with 6 bands.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS
A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
B. Aboveground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:  
   1. NPS 1-1/4 and NPS 1-1/2 (DN 32 and DN 40): Use NPS 1-1/2 (DN 40) hubless, cast-iron soil piping and one of the following:  
      a. Couplings: Heavy-duty, Type 304, stainless steel.
2. NPS 2 to NPS 4 (DN 50 to DN 100): Hubless, cast-iron soil piping and one of the following:
   a. Couplings: Heavy-duty, Type 304, stainless steel.

C. Underground, Soil, Waste, and Vent Piping: Use any of the following piping materials for each size range.
   1. NPS 1-1/2 (DN 40): Hubless, cast-iron soil piping and one of the following:
      a. Couplings: Heavy-duty, Type 304, stainless steel.
   2. NPS 2 to NPS 4 (DN 50 to DN 100): Service class, cast-iron soil piping; gaskets; and gasketed joints.
   3. NPS 2 to NPS 4 (DN 50 to DN 100): Hubless, cast-iron soil piping and one of the following:
      a. Couplings: Heavy-duty, Type 304, stainless steel.

3.2 PIPING INSTALLATION

A. Refer to Division 22 Section "Basic Plumbing Materials and Methods" for basic piping installation.

B. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

C. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

D. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

E. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Basic Plumbing Materials and Methods" for basic piping joint construction.

   1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
3. Install supports for vertical steel piping every 15 feet (4.5 m) Vertical Piping: MSS Type 8 or Type 42, clamps.
4. Individual, Straight, Horizontal Piping Runs: According to the following:
5. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
7. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
8. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).
   a. MSS Type 1, adjustable, steel clevis hangers.
C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Pipe."
D. Support vertical piping and tubing at base and at each floor.
E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).
H. Install supports for vertical steel piping every 15 feet (4.5 m).

3.4 CONNECTIONS
A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

3.5 FIELD QUALITY CONTROL
A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.
   1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   2. Prepare reports for tests and required corrective action.

3.6 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316
SECTION 221413 – STORM DRAINAGE PIPING

PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes storm drainage piping inside the building.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS
B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.
      a. Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel shield; stainless-steel bands; and sleeve.
         1) NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 3-inch- (76-mm-) wide shield with 4 bands.
         2) NPS 5 to NPS 10 (DN 125 to DN 250): 4-inch- (102-mm-) wide shield with 6 bands.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS
A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.
C. Aboveground Storm Drainage Piping: Use any of the following piping materials for each size range:
   1. NPS 2 to NPS 4 (DN 50 to DN 100): Service class, cast-iron soil piping; gaskets; and gasketed joints.
   2. NPS 2 to NPS 4 (DN 50 to DN 100): Hubless, cast-iron soil piping and one of the following:
      a. Couplings: Heavy-duty, Type 304, stainless steel.
3. NPS 5 and NPS 6 (DN 125 and DN 150): Service class, cast-iron soil piping; gaskets; and gasketed joints.
4. NPS 5 and NPS 6 (DN 125 and DN 150): Hubless, cast-iron soil piping and one of the following:
   a. Couplings: Heavy-duty, Type 304, stainless steel.

D. Underground Storm Drainage Piping: Use any of the following piping materials for each size range:
   1. NPS 3 and NPS 4 (DN 80 and DN 100): Service class, cast-iron soil piping; gaskets; and gasketed joints.
   2. NPS 3 and NPS 4 (DN 80 and DN 100): Hubless, cast-iron soil piping and one of the following:
      a. Couplings: Heavy-duty, Type 304, stainless steel.
   3. NPS 5 and NPS 6 (DN 125 and DN 150): Service class, cast-iron soil piping; gaskets; and gasketed joints.
   4. NPS 5 and NPS 6 (DN 125 and DN 150): Hubless, cast-iron soil piping and one of the following:
      a. Couplings: Heavy-duty, Type 304, stainless steel.

3.2 PIPING INSTALLATION

A. Refer to Division 22 Section "Basic Plumbing Materials and Methods" for basic piping installation.

B. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers.

C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.

D. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

E. Make changes in direction for storm piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

F. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

G. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
H. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Basic Plumbing Materials and Methods" for basic piping joint construction.

   1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
   2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

3.4 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 22 Section "Hangers and Supports for Plumbing Pipe" for pipe hanger and support devices. Install the following:
   1. Vertical Piping: MSS Type 8 or Type 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs: According to the following:
      a. MSS Type 1, adjustable, steel clevis hangers.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Pipe."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
   2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
   3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
   4. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
   5. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/4 (DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
   3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
   4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
   5. NPS 3 (DN 80): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.

H. Install supports for vertical steel piping every 15 feet (4.5 m).

3.5 CONNECTIONS

A. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

B. Connect storm drainage piping to roof drains and storm drainage specialties.

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspections.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction.

3.7 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221413
SECTION 224000 – PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes plumbing fixtures and trim, fittings, and accessories, appliances, appurtenances, equipment, and supports associated with plumbing fixtures.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.

B. Product data for each type of plumbing fixture specified, including fixture and trim, fittings, accessories, appliances, appurtenances, equipment, supports, construction details, dimensions of components, and finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers.

1. Fixtures:
   a. Behavioral Safety Products
   b. American Standard, Inc.
   c. Kohler Co.
   d. Zurn Industries, Inc.

2. Sinks:
   a. American Standard, Inc.
   b. Elkay Manufacturing Co.
   c. Just Manufacturing Co.
   d. Kohler Co.

3. Mop Basins:
   a. Crane Plumbing/Fiat Products.
   b. Florestone Products Co., Inc.
   c. Swan Corp.

4. Water Coolers:
   a. Elkay Manufacturing Co.
   b. Halsey Taylor; A Household International Co.
c. Haws Drinking Faucet Co.

5. Toilet Seats:
   b. Kohler Co.
   c. Zurn Industries, Inc.

6. Flushometers:
   a. Coyne & Delany Co.
   b. Sloan Valve Co.

7. Commercial/Industrial Cast-Brass Faucets:
   a. Armstrong Hot Water Group
   c. Crane Plumbing/Fiat Products.
   d. Elkay Manufacturing Co.
   e. Jay R. Smith Manufacturing Co.
   f. T & S Brass and Bronze Works, Inc.

2.2 WATER CLOSET – LIGATURE RESISTANT (P-1)

A. Bowl: ANSI A112.19.2; floor mounted, back outlet, back spud, with seat holes, siphon jet, vitreous china closet bowl, with elongated rim, 17-1/8 inches high, ADA, 1-1/2 inch spud, low consumption 1.6 gpf, and china bolt caps. Behavioral Safety Products model TN691 or Engineer approved equal.

B. Flush Valve: ANSI A112.19.1; concealed, diaphragm type with push button, chloramine resistant, dual seal diaphragm, with a clog resistant, triple filtered by-pass, non-hold open and no leak push button feature, one piece hex coupling nut, adjustable tail piece, and spud coupling for back spud connection, integral screwdriver stop and vacuum breaker. Sloan model Royal 143, ESS, hardwired-1.6-CP-OR-2-10-3/4-LDIM-HW or Engineer approved equal.

C. Seat: Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

2.3 WATER CLOSET – LIGATURE RESISTANT (P-1A)

A. Bowl: ANSI A112.19.2; floor mounted, back outlet, back spud, with seat holes, siphon jet, vitreous china closet bowl, with elongated rim, 15 inches high, 1-1/2 inch spud, low consumption 1.6 gpf, and china bolt caps. Kohler Model Anglesey, model K-4396 or Engineer approved equal.

B. Flush Valve: ANSI A112.19.1; concealed, diaphragm type with push button, chloramine resistant, dual seal diaphragm, with a clog resistant, triple filtered by-pass, non-hold open and no leak push button feature, one piece hex coupling nut, adjustable tail piece, and spud coupling for back spud connection, integral screwdriver stop and vacuum breaker. Sloan model Royal 143, ESS, hardwired-1.6-CP-OR-2-10-3/4-LDIM-HW or Engineer approved equal.

C. Seat: Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.
2.4 LAVATORY – LIGATURE RESISTANT FAUCET – I/R SENSOR – (P-2)

A. Bowl: Solid surface counter with integral molded bowl provided by General Contractors.

B. Trim: ANSI A112.18.1; Ligature resistant, sensor-operated electronic faucet, battery powered, chrome plated brass with waterproof circuit control module, vandal resistant recessed aerator, loose key supply stops, thermostatic mixing valve, ligature resistant grid waste, offset drain, cast brass P-trap and arm with escutcheon. Behavioral safety products model SF370/SAL-5011 or Engineer approved equal.

2.5 SHOWER – CERAMIC TILE – ROLL-IN TYPE (P-3)

A. Trim: ANSI A112.18.1; Ligature resistant, concealed in-wall, single knob pressure balanced mixing valves, non-rising stem, polished chrome plated finish, integral stops, and checks, 2-3/4 inch vandal resistant metal knob handle, ligature resistant shower head, and escutcheons. Mixing valve: Odd Ball Industries model SP-10B. Diverting valve: Odd Ball Industries SP-12B. Shower head: Wallgate model SNC-01 ceiling mounted shower nozzle. Ligature Resistant Connector and Quick Disconnect Adapter with Hand Held Shower: Intersan Manufacturing Company, Model 40707. Or engineer approved equal.

B. Drain: 304 Stainless steel, ligature resistant, linear drain with flashing flange. Whitehall, model “WHLD” or engineer approved equal.

2.6 SHOWER – CERAMIC TILE – ROLL-IN TYPE (P-3A)

A. Trim: ANSI A112.18.1; Ligature resistant, concealed in-wall, single knob pressure balanced mixing valves, non-rising stem, polished chrome plated finish, integral stops, and checks, 2-3/4 inch vandal resistant metal knob handle, ligature resistant shower head, and escutcheons. Mixing valve: Odd Ball Industries model SP-10B. Diverting valve: Odd Ball Industries SP-12B. Shower head: Wallgate model SNC-01 ceiling mounted shower nozzle. Ligature Resistant Connector and Quick Disconnect Adapter with Hand Held Shower: Intersan Manufacturing Company, Model 40707. Or engineer approved equal.

B. Drain: 304 Stainless steel anti-ligature, round drain with flashing flange roll resistant shower drain. Whitehall, model “WHFD” or Engineer approved equal.

2.7 SINK – DOUBLE BOWL UNDERCOUNTER (P-4)

A. Bowl: ANSI A112.19.3; single compartment 33 x 22 x 8 inch outside dimensions, 14 x 15-3/4 inch inside dimension bowl, 20 gage thick, Type 304 stainless steel, under-mount with undercoating, 3-1/2 inch crumb cup and chromed brass drain, ledge back drilled for trim. Elkay model LWFDB332284 or Engineer approved equal.

B. Trim: ANSI ANSI A112.18.1; single lever cast brass deck-mount faucet, polished chrome plated finish, swivel 8” spout, metal trim, water economy aerator, loose key supply stops, color indexed vandal resistant handle, cast brass P-trap and arm with escutcheon. Elkay model LK1001CR or Engineer approved equal.
2.8 **SINK – DOUBLE BOWL UNDERCOUNTER (P-4A)**

A. Bowl: ANSI A112.19.3; single compartment 33 x 22 x 8 inch outside dimensions, 14 x 15-3/4 inch inside dimension bowl, 20 gage thick, Type 304 stainless steel, under-mount with undercoating, 3-1/2 inch crumb cup and chromed brass drain, ledge back drilled for trim. Elkay model LWFDB332284 or Engineer approved equal.

B. Trim: ANSI ANSI A112.18.1; single leaver cast brass deck-mount faucet, polished chrome plated finish, swivel 8” spout, metal trim, water economy aerator, loose key supply stops, color indexed vandal resistant handle, cast brass P-trap and arm with escutcheon. Elkay model LK1001CR or Engineer approved equal.

C. Accessories: Guardian model G1101 Faucet mounted eyewash or Engineer approved equal.

2.9 **LAVATORY – WALL MOUNTED (P-5)**

A. Basin: ANSI A112.19.2; enameled cast-iron wall-hung lavatory 19 x 17 inch minimum, drillings to match faucet requirements, overflow and wall mounting bracket. American Standard model 4867.004.

B. Trim: ANSI A112.18.1; two handle cast brass deckmount faucet, polished chrome plated finish, swivel gooseneck spout, metal trim, water economy aerator, color indexed vandal resistant handle, 6 inch blade handles, cast brass P-trap and arm with escutcheon. American Standard model 7500.160 with swivel gooseneck spout or Engineer approved equal.

C. Accessories: Guardian model G1101 Faucet mounted eyewash or Engineer approved equal.

2.10 **SINK – SINGLE BOWL UNDERCOUNTER (P-6)**

A. Bowl: ANSI A112.19.3; single compartment 21-1/2 x 18-1/2 x 4-7/8 inch outside dimensions, 19 x 16 inch inside dimension bowl, 18 gage thick, Type 304 stainless steel, under-mount with undercoating, 3-1/2 inch crumb cup and chromed brass drain. Elkay model ELUHAD191650 or Engineer approved equal.

B. Trim: ANSI A112.18.1; single lever cast brass deck-mount faucet, polished chrome plated finish, swivel 8” spout, metal trim, water economy aerator, loose key supply stops, color indexed vandal resistant handle, cast brass P-trap and arm with escutcheon. Elkay model LK1001CR or Engineer approved equal.

2.11 **SINK – SINGLE BOWL UNDERCOUNTER (P-6A)**

A. Bowl: ANSI A112.19.3; single compartment 21-1/2 x 18-1/2 x 4-7/8 inch outside dimensions, 19 x 16 inch inside dimension bowl, 18 gage thick, Type 304 stainless steel, under-mount with undercoating, 3-1/2 inch crumb cup and chromed brass drain. Elkay model ELUHAD191650 or Engineer approved equal.

B. Trim: ANSI A112.18.1; single lever cast brass deck-mount faucet, polished chrome plated finish, swivel 8” spout, metal trim, water economy aerator, loose key supply stops, color indexed vandal resistant handle, cast brass P-trap and arm with escutcheon. Elkay model LK1001CR or Engineer approved equal.
C. Accessories: Guardian model G1101 Faucet mounted eyewash or Engineer approved equal.

2.12 MOP SINK – MOLDED STONE (P-7)

A. Bowl: 24 x 36 x 10 inch high molded stone floor mounted, corner type, with one inch wide shoulders, vinyl bumper guards, 3 inch drain and stainless steel strainer. Fiat model MSB-3624.

B. Trim: ANSI A112.18.1 exposed wall type supply with lever handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges; 5 feet of 1/2 inch diameter plain end reinforced rubber hose, hose clamp, mop hanger.

2.13 WASHER BOX (P-8)

A. Recessed wall box fabricated of reinforced plastic, brass fittings for connecting the supply pipe to valve, valve shall have water hammer arrestor, and ½ inch inlet x ¼ inch OD outlet compression angle valve.

2.14 REFRIGERATOR BOX (P-9)

A. Recessed wall box fabricated of reinforced plastic, brass fittings for connecting the supply pipe to valve, valve shall have water hammer arrestor, and ½ inch inlet x ¼ inch OD outlet compression angle valve.

2.15 ICE MAKER BOX (P-10)

A. Recessed wall box fabricated of reinforced plastic, brass fittings for connecting the supply pipe to valve, valve shall have water hammer arrestor, and ½ inch inlet x ¼ inch OD outlet compression angle valve.

2.16 SERVICE SINK – FLUSH VALVE – BED PAN WASHER (P-12)


2.17 ELECTRIC WATER COOLER – INTERIOR – DUAL LEVEL (EWC-1)

A. Fountain: ARI 1010; dual level electric water cooler with stainless steel top, stainless steel body, elevated mount with stream guard, automatic stream regulator, vandal resistant bubbler, mounting bracket, wall carrier, refrigerated with integral air cooled remote condenser; capacity of 5 gal/min of 50 degree F water with inlet at 80 degree F and room temperature of 90 degree F. Elkay model EMABFTLR8C or engineer approved equal.
PART 3 - EXECUTION

3.1 INSPECTION
A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
B. Verify adjacent construction is ready to receive rough-in work of this Section.

3.2 INSTALLATION
A. Install each fixture with trap, easily removable for servicing and cleaning.
B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
C. Install components level and plumb.
D. Install and secure fixtures in place with wall carriers and bolts.
E. Seal fixtures to wall and floor surfaces with sealant.
F. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
G. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
   1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
   2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
   3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
H. Install wall-hanging fixtures with tubular waste piping attached to supports.
I. Install counter-mounting fixtures in and attached to casework.
J. Install fixtures level and plumb according to manufacturers’ written instructions and rough-in drawings.
K. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
   1. Exception: Use ball valve if stops are not specified with fixture. Refer to Division 22 Section “Plumbing Valves” for general-duty valves.
L. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
M. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
N. Install toilet seats on water closets.
O. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.

P. Install shower, flow-control fittings with specified maximum flow rates in shower arms.

Q. Install traps on fixture outlets.
   1. Exception: Omit trap on fixtures with integral traps.

R. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 22 Section “Basic Plumbing Materials and Methods” for escutcheons.

S. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

A. Connect water supplies from water distribution piping to fixtures.

B. Connect drain piping from fixtures to drainage piping.

C. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

3.4 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

3.5 ADJUSTING AND CLEANING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

B. At completion clean plumbing fixtures and equipment.

C. Solidly attach water closets to floor with lag screws.

END OF SECTION 224000
SECTION 230500 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 SUMMARY

A. This Section includes the following:
1. Piping materials and installation instructions common to most piping systems.
2. Sleeves.
3. Escutcheons.
4. Mechanical demolition.
5. Equipment installation requirements common to equipment sections.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 QUALITY ASSURANCE

A. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 PRODUCTS
2.1 PIPE, TUBE, AND FITTINGS
   A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

2.2 JOINING MATERIALS
   A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

2.3 ESCUTCHEONS
   A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
   B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
   C. One-Piece, Cast-Brass Type: With set screw.
      1. Finish: Polished chrome-plated.
   D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
      1. Finish: Polished chrome-plated.

PART 3 EXECUTION

3.1 DEMOLITION
   A. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
      1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
      2. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS
   A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
   B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
C. Install piping in concealed locations, unless otherwise indicated.
D. Diagonal runs are prohibited unless specifically indicated otherwise.
E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
F. Install piping to permit valve servicing.
G. Install piping free of sags and bends.
H. Install fittings for changes in direction and branch connections.
I. Install piping to allow application of insulation.
J. Select system components with pressure rating equal to or greater than system operating pressure.
K. Install escutcheons for penetrations of walls, ceilings, and floors.
L. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floors.
M. Refer to manufacturer installation requirements for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION
A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
B. Ream ends of pipes and tubes and remove burrs.
C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

3.4 PIPING CONNECTIONS
A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to each valve and at final connection to each piece of equipment.

END OF SECTION 230500
SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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 general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION
   A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
      1. Motor controllers.
      2. Torque, speed, and horsepower requirements of the load.
      3. Ratings and characteristics of supply circuit and required control sequence.
      4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS
   A. Comply with NEMA MG 1 unless otherwise indicated.
   B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS
   A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.
   B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS
   A. Description: NEMA MG 1, Design B, medium induction motor.
   B. Efficiency: Energy efficient, as defined in NEMA MG 1.
   C. Service Factor: 1.15.
D. Multispeed Motors: Variable torque.
   1. For motors with 2:1 speed ratio, consequent pole, single winding.
   2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:
   1. Motors HP and Larger: NEMA starting Code F or Code G.
   2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
   1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
   2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
   3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
   4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
   1. Permanent-split capacitor.
   2. Split phase.
   3. Capacitor start, inductor run.
   4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513
SECTION 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following mechanical identification materials and their installation:
   1. Equipment nameplates.
   2. Equipment markers.
   3. Equipment signs.
   4. Pipe markers.

1.3 QUALITY ASSURANCE


PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
   1. Data:
      a. Manufacturer, product name, model number, and serial number.
      b. Capacity, operating and power characteristics, and essential data.
      c. Labels of tested compliances.
   2. Location: Accessible and visible.
   3. Fasteners: As required to mount on equipment.

B. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
   1. Data: Instructions for operation of equipment and for safety procedures.
   2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
   3. Thickness: 1/16 inch (1.6 mm), unless otherwise indicated.
   4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
C. Access Panel and Door Markers: 1/16-inch- (1.6-mm-) thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch (3.2-mm) center hole for attachment.
   1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
   1. Colors: Comply with ASME A13.1, unless otherwise indicated.
   2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
   3. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers extending 360 degrees around pipe at each location.
   4. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
   5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

C. Plastic Tape: Continuously printed, vinyl tape at least 3 mils (0.08 mm) thick with pressure-sensitive, permanent-type, self-adhesive back.
   1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): 3/4 inch (19 mm) minimum.
   2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches (150 mm) or Larger: 1-1/2 inches (38 mm) minimum.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
   1. Packaged HVAC central-station and zone-type units.

B. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible:
1. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.

3. Include signs for the following general categories of equipment:
   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   b. Fuel-burning units, including boilers, furnaces, heaters, etc.
   c. Fans, blowers, primary balancing dampers, and mixing boxes.
   d. Packaged HVAC central-station and zone-type units.

C. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 3/4 inch (19 mm) wide, lapped at least 1-1/2 inches (38 mm) at both ends of pipe marker, and covering full circumference of pipe.

2. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches (38 mm) wide, lapped at least 3 inches (75 mm) at both ends of pipe marker, and covering full circumference of pipe.

3.4 ADJUSTING AND CLEANING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

END OF SECTION 230553
SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

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. Balancing Air Systems:
      a. Variable-air-volume systems.
   2. Balancing Hydronic Piping Systems:
      a. Constant-flow hydronic systems.

1.3 DEFINITIONS

C. TAB: Testing, adjusting, and balancing.
D. TABB: Testing, Adjusting, and Balancing Bureau.
E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
D. Certified TAB reports.
E. Sample report forms.
F. Instrument calibration reports, to include the following:
   1. Instrument type and make.
   2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.

B. TAB Conference: Meet with Architect, Owner, and Engineer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:
   b. The TAB plan.
   c. Coordination and cooperation of trades and subcontractors.
   d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:
   1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
   2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.
PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves.
   1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
   2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

J. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

K. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

M. Examine system pumps to ensure absence of entrained air in the suction piping.

N. Examine operating safety interlocks and controls on HVAC equipment.
O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:
   1. Permanent electrical-power wiring is complete.
   2. Hydronic systems are filled, clean, and free of air.
   3. Automatic temperature-control systems are operational.
   4. Equipment and duct access doors are securely closed.
   5. Balance, smoke, and fire dampers are open.
   6. Isolating and balancing valves are open and control valves are operational.
   7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
   8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
   1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
   2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.
D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified.

3.5 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.

2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.

3. Measure total system airflow. Adjust to within indicated airflow.

4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.

5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

   a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.

8. Record final fan-performance data.

3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' “as-built” piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check liquid level in expansion tank.
3. Check makeup water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.7 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

   a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Engineer and comply with requirements in "Hydronic Pumps."

2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.

   a. Monitor motor performance during procedures and do not operate motors in overload conditions.

3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake
horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 10 percent of design.

B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.

D. Set calibrated balancing valves, if installed, at calculated presettings.

E. Measure flow at all stations and adjust, where necessary, to obtain first balance.
   1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
   1. Determine the balancing station with the highest percentage over indicated flow.
   2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
   3. Record settings and mark balancing devices.

H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems’ pressures and temperatures including outdoor-air temperature.

I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.

J. Check settings and operation of each safety valve. Record settings.

3.8 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS
A. Balance the primary circuit flow first and then balance the secondary circuits.

3.9 PROCEDURES FOR MOTORS
A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
   1. Manufacturer’s name, model number, and serial number.
   4. Efficiency rating.
   5. Nameplate and measured voltage, each phase.
   6. Nameplate and measured amperage, each phase.
   7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper
operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.10 PROCEDURES FOR CHILLERS

A. Balance water flow through each evaporator to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:

1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
2. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
3. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.
4. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.
5. Capacity: Calculate in tons of cooling.
6. For air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.11 PROCEDURES FOR BOILERS

A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.

3.12 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

3.13 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlet and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.14 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to
HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.15 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
   2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:
   1. Pump curves.
   2. Fan curves.
   3. Manufacturers' test data.
   4. Field test reports prepared by system and equipment installers.
   5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:
   1. Title page.
   2. Name and address of the TAB contractor.
   3. Project name.
   4. Project location.
   5. Architect's name and address.
   6. Engineer's name and address.
   7. Contractor's name and address.
   9. Signature of TAB supervisor who certifies the report.
   10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
   11. Summary of contents including the following:
       a. Indicated versus final performance.
       b. Notable characteristics of systems.
       c. Description of system operation sequence if it varies from the Contract Documents.
   12. Nomenclature sheets for each item of equipment.
   13. Data for terminal units, including manufacturer's name, type, size, and fittings.
   14. Notes to explain why certain final data in the body of reports vary from indicated values.
   15. Test conditions for fans and pump performance forms including the following:
       a. Settings for outdoor-, return-, and exhaust-air dampers.
       b. Conditions of filters.
c. Cooling coil, wet- and dry-bulb conditions.

d. Face and bypass damper settings at coils.

e. Fan drive settings including settings and percentage of maximum pitch diameter.

f. Inlet vane settings for variable-air-volume systems.

g. Settings for supply-air, static-pressure controller.

h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.

2. Water and steam flow rates.

3. Duct, outlet, and inlet sizes.

4. Pipe and valve sizes and locations.

5. Terminal units.


E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

   a. Unit identification.

   b. Location.

   c. Make and type.

   d. Model number and unit size.

   e. Manufacturer's serial number.

   f. Unit arrangement and class.

   g. Discharge arrangement.

   h. Sheave make, size in inches (mm), and bore.

   i. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

   j. Number, make, and size of belts.

   k. Number, type, and size of filters.

2. Motor Data:

   a. Motor make, and frame type and size.

   b. Horsepower and rpm.

   c. Volts, phase, and hertz.

   d. Full-load amperage and service factor.

   e. Sheave make, size in inches (mm), and bore.

   f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

3. Test Data (Indicated and Actual Values):

   a. Total air flow rate in cfm (L/s).

   b. Total system static pressure in inches wg (Pa).

   c. Fan rpm.

   d. Discharge static pressure in inches wg (Pa).

   e. Filter static-pressure differential in inches wg (Pa).

   f. Preheat-coil static-pressure differential in inches wg (Pa).

   g. Cooling-coil static-pressure differential in inches wg (Pa).

   h. Heating-coil static-pressure differential in inches wg (Pa).

   i. Outdoor airflow in cfm (L/s).
j. Return airflow in cfm (L/s).
k. Outdoor-air damper position.
l. Return-air damper position.
m. VFD reading.

F. Apparatus-Coil Test Reports:
1. Coil Data:
   a. System identification.
   b. Location.
   c. Coil type.
   d. Number of rows.
   e. Fin spacing in fins per inch (mm) o.c.
   f. Make and model number.
   g. Face area in sq. ft. (sq. m).
   h. Tube size in NPS (DN).
   i. Tube and fin materials.
   j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):
   a. Air flow rate in cfm (L/s).
   b. Average face velocity in fpm (m/s).
   c. Air pressure drop in inches wg (Pa).
   d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
   e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
   f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
   g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
   h. Water flow rate in gpm (L/s).
   i. Water pressure differential in feet of head or psig (kPa).
   j. Entering-water temperature in deg F (deg C).
   k. Leaving-water temperature in deg F (deg C).

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:
   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer's serial number.
   f. Fuel type in input data.
   g. Output capacity in Btu/h (kW).
   h. Ignition type.
   i. Burner-control types.
   j. Motor horsepower and rpm.
   k. Motor volts, phase, and hertz.
   l. Motor full-load amperage and service factor.

2. Test Data (Indicated and Actual Values):
a. Low-fire fuel input in Btu/h (kW).
b. High-fire fuel input in Btu/h (kW).
c. Manifold pressure in psig (kPa).
d. High-temperature-limit setting in deg F (deg C).
e. Operating set point in Btu/h (kW).
f. Heating value of fuel in Btu/h (kW).

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:
   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and size.
   e. Manufacturer's serial number.
   f. Arrangement and class.
   g. Sheave make, size in inches (mm), and bore.
   h. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

2. Motor Data:
   a. Motor make, and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
   e. Sheave make, size in inches (mm), and bore.
   f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
   g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm (L/s).
   b. Total system static pressure in inches wg (Pa).
   c. Fan rpm.
   d. Discharge static pressure in inches wg (Pa).
   e. Suction static pressure in inches wg (Pa).

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:
   a. System and air-handling-unit number.
   b. Location and zone.
   c. Traverse air temperature in deg F (deg C).
   d. Duct static pressure in inches wg (Pa).
   e. Duct size in inches (mm).
   f. Duct area in sq. ft. (sq. m).
   g. Indicated air flow rate in cfm (L/s).
   h. Indicated velocity in fpm (m/s).
   i. Actual air flow rate in cfm (L/s).
   j. Actual average velocity in fpm (m/s).
   k. Barometric pressure in psig (Pa).
J. Air-Terminal-Device Reports:
   1. Unit Data:
      a. System and air-handling unit identification.
      b. Location and zone.
      c. Apparatus used for test.
      d. Area served.
      e. Make.
      f. Number from system diagram.
      g. Type and model number.
      h. Size.
      i. Effective area in sq. ft. (sq. m).

   2. Test Data (Indicated and Actual Values):
      a. Air flow rate in cfm (L/s).
      b. Air velocity in fpm (m/s).
      c. Preliminary air flow rate as needed in cfm (L/s).
      d. Preliminary velocity as needed in fpm (m/s).
      e. Final air flow rate in cfm (L/s).
      f. Final velocity in fpm (m/s).
      g. Space temperature in deg F (deg C).

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
   1. Unit Data:
      a. System and air-handling-unit identification.
      b. Location and zone.
      c. Room or riser served.
      d. Coil make and size.
      e. Flowmeter type.

   2. Test Data (Indicated and Actual Values):
      a. Air flow rate in cfm (L/s).
      b. Entering-water temperature in deg F (deg C).
      c. Leaving-water temperature in deg F (deg C).
      d. Water pressure drop in feet of head or psig (kPa).
      e. Entering-air temperature in deg F (deg C).
      f. Leaving-air temperature in deg F (deg C).

L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
   1. Unit Data:
      a. Unit identification.
      b. Location.
      c. Service.
      d. Make and size.
      e. Model number and serial number.
      f. Water flow rate in gpm (L/s).
      g. Water pressure differential in feet of head or psig (kPa).
h. Required net positive suction head in feet of head or psig (kPa).

i. Pump rpm.

j. Impeller diameter in inches (mm).

k. Motor make and frame size.

l. Motor horsepower and rpm.

m. Voltage at each connection.

n. Amperage for each phase.

o. Full-load amperage and service factor.

p. Seal type.

2. Test Data (Indicated and Actual Values):
   a. Static head in feet of head or psig (kPa).
   b. Pump shutoff pressure in feet of head or psig (kPa).
   c. Actual impeller size in inches (mm).
   d. Full-open flow rate in gpm (L/s).
   e. Full-open pressure in feet of head or psig (kPa).
   f. Final discharge pressure in feet of head or psig (kPa).
   g. Final suction pressure in feet of head or psig (kPa).
   h. Final total pressure in feet of head or psig (kPa).
   i. Final water flow rate in gpm (L/s).
   j. Voltage at each connection.
   k. Amperage for each phase.

M. Instrument Calibration Reports:
   1. Report Data:
      a. Instrument type and make.
      b. Serial number.
      c. Application.
      d. Dates of use.
      e. Dates of calibration.

3.16 INSPECTIONS

A. Initial Inspection:
   1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
   2. Check the following for each system:
      a. Measure airflow of at least 10 percent of air outlets.
      b. Measure water flow of at least 5 percent of terminals.
      c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
      d. Verify that balancing devices are marked with final balance position.
      e. Note deviations from the Contract Documents in the final report.
B. Final Inspection:
   1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Engineer.
   2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Engineer.
   3. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
   4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
   5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
   1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
   2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

END OF SECTION 230593
SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following duct services:
   1. Indoor, concealed supply, return, and outdoor air.
   2. Indoor, exposed supply, return, and outdoor air.
   3. Indoor, concealed exhaust air.
   4. Indoor, exposed exhaust air.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

D. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
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. CertainTeed Corp.; SoftTouch Duct Wrap.
   b. Johns Manville; Microlite.
   c. Knauf Insulation; Friendly Feel Duct Wrap.
   d. Owens Corning; SOFTR All-Service Duct Wrap.
   
E. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

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. CertainTeed Corp.; Commercial Board.
   b. Fibrex Insulations Inc.; FBX.
   c. Johns Manville; 800 Series Spin-Glas.
   d. Knauf Insulation; Insulation Board.
   e. Owens Corning; Fiberglas 700 Series.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.


D. For indoor applications, adhesives shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 300 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
2.4 SEALANTS

A. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Fire- and water-resistant, flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
   5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.6 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Width: 3 inches (75 mm).
   2. Thickness: 11.5 mils (0.29 mm).
   3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
   6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.7 SECUREMENTS

A. Insulation Pins and Hangers:
   1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
      a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
      b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
      c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
   2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm) thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm) wide, stainless steel or Monel.

C. Wire: 0.080-inch (2.0-mm) nickel-copper alloy 0.062-inch (1.6-mm) soft-annealed, stainless steel 0.062-inch (1.6-mm) soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.8 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Keep insulation materials dry during application and finishing.

F. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

G. Install insulation with least number of joints practical.

H. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

I. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

J. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch- (75-mm) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) 4 inches (100 mm) o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

C. Insulation Installation at Floor Penetrations:
   1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).
   2. Seal penetrations through fire-rated assemblies.
3.4 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer’s recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
   b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not over compress insulation during installation.
   e. Impale insulation over pins and attach speed washers.
   f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.
B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
   b. On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not over compress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.
B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.6 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:
   1. Indoor, concealed supply and outdoor air.
   2. Indoor, exposed supply and outdoor air.
   3. Indoor, concealed return located in unconditioned space.
   4. Indoor, exposed return located in unconditioned space.
   5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
   6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.

B. Items Not Insulated:
   1. Fibrous-glass ducts.
   2. Factory-insulated flexible ducts.
   3. Factory-insulated plenums and casings.
   4. Flexible connectors.
   5. Vibration-control devices.
   6. Factory-insulated access panels and doors.

3.7 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket 2 inches (50 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket 2 inches (50 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

C. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket 2 inches (50 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

D. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket 2 inches (50 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

E. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber board, 2 inches (50 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

F. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber board, 2 inches (50 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

G. Exposed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber board, 2 inches (50 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

H. Exposed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber board, 2 inches (50 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
3.8 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Ductwork, Exposed:
   1. Canvas Jacket on all exposed ductwork.

END OF SECTION 230713
SECTION 231123 – FUEL GAS PIPING

PART 1 - GENERAL

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

1.2 SUMMARY
   A. This Section includes fuel gas piping, specialties, and accessories within the building.

1.3 PROJECT CONDITIONS
   A. Gas System Pressures: Two pressure ranges. Primary pressure is more than 0.5 psig (3.45 kPa) but not more than 5.0 psig (13.8 kPa), and is reduced to secondary pressure of 0.5 psig (3.45 kPa) or less.

1.4 QUALITY ASSURANCE
   A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   C. FMG Standard: Provide components listed in FMG's "Fire Protection Approval Guide" if specified to be FMG approved.
   E. UL Standard: Provide components listed in UL's "Gas and Oil Equipment Directory" if specified to be UL listed.

1.5 COORDINATION
   A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
      1. Notify Architect not less than two days in advance of proposed utility interruptions.
      2. Do not proceed with utility interruptions without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS
   A. Steel Pipe: ASTM A 53; Type E or S; Grade B; Schedule 40; black.
2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
5. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
7. Steel Flanges and Flanged Fittings: ASME B16.5.
8. Gasket Material: Thickness, material, and type suitable for natural gas.

B. Common Joining Materials: Refer to Division 23 Section "Basic Mechanical Materials and Methods" for joining materials not in this Section.

2.2 VALVES

A. Valves, NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

B. Valves, NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.


D. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig (13.8-kPa) minimum pressure rating.

E. Gas Valves, NPS 2 (DN 50) and Smaller: ASME B16.33 and IAS-listed bronze body and 125-psig (860-kPa) pressure rating.

2.3 PRESSURE REGULATORS

A. General Requirements:
   1. Single stage and suitable for natural gas.
   2. Steel jacket and corrosion-resistant components.
   3. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller.

   1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
   2. Springs: Zinc-plated steel; interchangeable.
   4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
   5. Orifice: Aluminum; interchangeable.
   7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
11. Maximum Inlet Pressure: 5 psig (13.8 kPa).

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Use flanges, unions, transition, and special fittings in applications below, unless otherwise indicated.
   1. NPS 1/2 (DN 15) and Smaller: NPS 3/4 (DN 20) steel pipe, malleable-iron threaded fittings, and threaded joints.
   3. NPS 1-1/4 to NPS 4 (DN 32 to DN 100): Steel pipe, malleable-iron threaded fittings, and threaded joints.
   4. NPS 1-1/4 to NPS 4 (DN 32 to DN 100): Steel pipe, steel welding fittings, and welded joints.

3.2 VALVE APPLICATIONS

A. Appliance Shutoff Valves for Pressure 0.5 psig (3.45 kPa) or Less: Appliance connector valve or gas stop.
B. Piping Line Valves, NPS 2 (DN 50) and Smaller: Gas valve.

3.3 INSTALLATION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements and piping joint construction.
B. Coordinate installation of service-meter assemblies with the local utilities.
C. Drips and Sediment Traps: Install drips at points where condensate may collect. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.
   1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches (75 mm) long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.
D. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
E. Connect branch piping from top or side of horizontal piping.
F. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

G. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.

3.4 HANGERS AND SUPPORTS

A. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (16 mm).

3.5 CONNECTIONS

A. Install piping adjacent to appliances to allow service and maintenance. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches (1800 mm) of each appliance. Install union downstream from valve.

3.6 FIELD QUALITY CONTROL

A. Inspect, test, and purge piping according to ANSI Z223.1, Part 4 "Inspection, Testing, and Purging," and requirements of authorities having jurisdiction. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

END OF SECTION 231123
SECTION 233113 - METAL DUCTS

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. Single-wall rectangular ducts and fittings.
   2. Sheet metal materials.
   3. Sealants and gaskets.
   4. Hangers and supports.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

D. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
5. Mold and mildew resistant.
6. VOC: Maximum 420 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.
   2. Type: S.
   3. Grade: NS.
   5. Use: O.
   6. For indoor applications, use sealant that has a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports:

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

J. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

C. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Duct System Cleanliness Tests:
   1. Visually inspect duct system to ensure that no visible contaminants are present.
C. Duct system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Clean the following components by removing surface contaminants and deposits:
   1. Air outlets and inlets (registers, grilles, and diffusers).
   2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
   3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
   5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
   7. Dedicated exhaust and ventilation components and makeup air systems.

3.7 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

A. Supply Ducts:
   1. Ducts Connected to Terminal Units:
      a. Pressure Class: Positive 1-inch wg (250 Pa).
      b. Minimum SMACNA Seal Class: A.
      c. SMACNA Leakage Class for Rectangular: 6.
      d. SMACNA Leakage Class for Round: 3.
   2. Ducts Connected to Constant-Volume Air-Handling Units:
      a. Pressure Class: Positive 3-inch wg (750 Pa).
      b. Minimum SMACNA Seal Class: A.
      c. SMACNA Leakage Class for Rectangular: 6.
      d. SMACNA Leakage Class for Round: 3.

B. Exhaust Ducts:
   1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
      a. Pressure Class: Negative 1-inch wg (250 Pa).
      b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
      c. SMACNA Leakage Class for Rectangular: 6.
      d. SMACNA Leakage Class for Round: 3.
C. Outdoor-Air Ducts:
   1. Ducts Connected to Supply air fans:
      a. Pressure Class: Positive or negative 2-inch wg (500 Pa).
      b. Minimum SMACNA Seal Class: A.
      c. SMACNA Leakage Class for Rectangular: 3.

D. Elbow Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
   2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

E. Branch Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
      a. Rectangular Main to Rectangular Branch: 45-degree entry.
      b. Rectangular Main to Round Branch: Spin in.
   2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

END OF SECTION 233113
SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Backdraft and pressure relief dampers.
   3. Turning vanes.
   4. Duct-mounted access doors.
   5. Flexible connectors.
   6. Flexible ducts.
   7. Duct accessory hardware.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   2. Exposed-Surface Finish: Mill phosphatized.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Description: Gravity balanced.

B. Maximum Air Velocity: 2000 fpm (10 m/s).
C. Maximum System Pressure: 1-inch wg (0.25 kPa).

D. Frame: 0.052-inch- (1.3-mm-) thick, galvanized sheet steel.

E. Blades: Multiple single-piece blades, center-pivoted, maximum 6-inch (150-mm) width, 0.025-inch- (0.6-mm-) thick, roll-formed aluminum with sealed edges.

F. Blade Action: Parallel.

G. Blade Seals: Vinyl foam.

H. Blade Axles:
   1. Material: Galvanized steel.
   2. Diameter: 0.20 inch (5 mm).

I. Tie Bars and Brackets: Galvanized steel.

J. Return Spring: Adjustable tension.

K. Bearings: Synthetic pivot bushings.

L. Accessories:
   1. Adjustment device to permit setting for varying differential static pressure.
   2. Counterweights and spring-assist kits for vertical airflow installations.
      a. Sleeve Thickness: 20-gage (1.0-mm) minimum.
      b. Sleeve Length: 6 inches (152 mm) minimum.
   4. Screen Mounting: Rear mounted.
   5. Screen Material: Aluminum.
   6. Screen Type: Bird.
   7. 90-degree stops.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
   1. Standard leakage rating.
   2. Suitable for horizontal or vertical applications.
   3. Frames:
      a. Hat-shaped, galvanized-steel channels, 0.064-inch (1.62-mm) minimum thickness.
      b. Mitered and welded corners.
      c. Flanges for attaching to walls and flangeless frames for installing in ducts.
   4. Blades:
      a. Multiple or single blade.
      b. Parallel- or opposed-blade design.
      c. Stiffen damper blades for stability.
      d. Galvanized-steel, 0.064 inch (1.62 mm) thick.
6. Bearings:
   a. Oil-impregnated bronze.
   b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

7. Tie Bars and Brackets: Galvanized steel.

8. Remotely Operated Hardware: Provide all necessary components to connect to a Bowden cable control system.

9. Cable Control System: Young Regulator or engineer approved equal. All cables and controls system components shall be concealed above ceiling. The Bowden cable shall be .054” stainless steel control wire with a tensile strength of 260,000 lbs. control wire shall be encapsulated in 1/16” flexible galvanized spiral wire sheath. Controls shall be rack and pinion gear drive system. control shall be manually operated using special wrench.

2.4 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

C. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

2.5 FLEXIBLE DUCTS

A. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
   1. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
   2. Maximum Air Velocity: 4000 fpm (20 m/s).
   3. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).
   4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.

B. Flexible Duct Connectors:
   1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.

2.6 DUCT ACCESSORY HARDWARE

A. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.
   1. For indoor applications, adhesives shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

B. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
   1. Install steel volume dampers in steel ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install manual volume damper cable control system complete and test prior to ceiling installation.

F. Install controllers flush in high finish ceiling. Do not install in low soffits. Label ceiling with room number and damper type. Coordinate with engineer in field.

G. Install access doors with swing against duct static pressure.

H. Install flexible connectors to connect ducts to equipment.

I. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

J. Connect diffusers or light troffer boots to ducts with maximum 8-feet lengths of flexible duct clamped or strapped in place.

K. Connect flexible ducts to metal ducts with sealant, draw bands and tape.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Operate dampers to verify full range of movement.
   2. Inspect locations of access doors and verify that purpose of access door can be performed.
   3. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300
SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Centrifugal roof ventilators.
   2. Ceiling-mounting ventilators.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual Project site elevations.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material thickness and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
   6. Roof curbs.
   7. Fan speed controllers.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Carnes Company HVAC.
2. Central Blower Co.
4. Loren Cook Company.
5. Penn Ventilation.

B. Description: Belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

C. Housing: Removable, spun-aluminum, mushroom-domed top; square, one-piece, aluminum base with venturi inlet cone.

D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

E. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
4. Fan and motor isolated from exhaust airstream.
F. Accessories:
   1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
   2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
   3. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
   4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

G. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch (40-mm) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.
   1. Configuration: Self-flashing without a cant strip, with mounting flange.
   2. Overall Height: 16 inches (400 mm).
   5. Metal Liner: Galvanized steel.

2.2 CEILING-MOUNTING VENTILATORS

A. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:
   2. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
   4. Manufacturer's standard roof jack or wall cap, and transition fittings.
2.3 MOTORS
   A. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.
   B. Enclosure Type: Open dripproof.

2.4 SOURCE QUALITY CONTROL
   A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound
      Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant
      Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
   B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation,
      and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of
      Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION
   A. Install power ventilators level and plumb.
   B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware.
   C. Install units with clearances for service and maintenance.
   D. Label units according to requirements specified in Division 23 Section "Identification for
      HVAC Piping and Equipment."

3.2 CONNECTIONS
   A. Duct installation and connection requirements are specified in other Division 23 Sections.
      Drawings indicate general arrangement of ducts and duct accessories. Make final duct
      connections with flexible connectors. Flexible connectors are specified in Division 23 Section
      "Air Duct Accessories."
   B. Install ducts adjacent to power ventilators to allow service and maintenance.
   C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical
      Systems."
   D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors
      and Cables."

3.3 FIELD QUALITY CONTROL
   A. Perform the following field tests and inspections and prepare test reports:
      1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Division 23 Section “Testing, Adjusting, and Balancing for HVAC” for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 233423
SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing 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. Square Ceiling Diffuser.
2. Ceiling Return Grilles.
4. Exhaust Grilles.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 SUPPLY DIFFUSERS

A. Square Ceiling Diffuser:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carnes.
   b. METALAIRE, Inc.
   c. Nailor Industries Inc.
   d. Price Industries.
   e. Titus.
3. Finish: Baked enamel, white.

2.2 REGISTERS AND GRILLES

A. Ceiling Return Grille:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Carnes.
      b. METALAIRE, Inc.
      c. Nailor Industries Inc.
      d. Price Industries.
      e. Titus.
   3. Finish: Baked enamel, white.
   6. Mounting: Lay-in

B. Exhaust Grille:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Carnes.
      b. METALAIRE, Inc.
      c. Nailor Industries Inc.
      d. Price Industries.
      e. Titus.
   3. Finish: Baked enamel, white.

2.3 SIDEWALL GRILLES

A. Sidewall Grilles:
   1. Material: Aluminum.
   2. Finish: Baked enamel, off-white.
   5. Frame: 1-1/4” wide with screw holes.
2.4 SECURITY SUPPLY, RETURN, AND EXHAUST GRILLES

A. Security Supply and Return Grilles:
   1. Type: Maximum security, suicide deterrent type.
   2. Face Plate: 3/16” stainless steel with 3/16” diameter holes on 9/32” staggered centers
       with 1” border.
   3. Sleeve: 3/16” steel by 12” long.
   5. Angle Frame: 1-1/2” x 1-1/2” x 3/16” steel angle shipped loose for field welding. Frame
       shall be mill finish. Rear mounting for security and concealed fastening.
   7. Titus: SG-SD or engineer approved equal.

B. Security Exhaust Grilles:
   1. Type: Maximum security, suicide deterrent type for corrosive environments.
   2. Face Plate: 3/16” steel with 3/16” diameter holes on 9/32” staggered centers with 1”
       border.
   3. Sleeve: 3/16” steel by 12” long.
   5. Angle Frame: 1-1/2” x 1-1/2” x 3/16” steel angle shipped loose for field welding. Frame
       shall be mill finish. Rear mounting for security and concealed fastening.
   7. Titus: SG-SD or engineer approved equal.

2.5 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70,
   "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings,
   and accessories. Air outlet and inlet locations have been indicated to achieve design
   requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make
   final locations where indicated, as much as practical. For units installed in lay-in ceiling panels,
   locate units in the center of panel. Where architectural features or other items conflict with
   installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and
   maintenance of dampers, air extractors, and fire dampers.
3.2 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713
SECTION 233723 - HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section Includes:
      1. Roof hoods.

1.3 SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Shop Drawings: For gravity ventilators. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.
      1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.

1.4 COORDINATION
   A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 MATERIALS
   A. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) zinc coating, mill phosphatized.
   B. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.
      1. Use types and sizes to suit unit installation conditions.
      2. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.

2.2 FABRICATION, GENERAL
   A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.
B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

D. Fabricate supports, anchorages, and accessories required for complete assembly.

E. Perform shop welding by AWS-certified procedures and personnel.

2.3 ROOF HOODS

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:

2. Carnes.
4. Loren Cook Company.

B. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 6-6 and 6-7.

C. Materials: Galvanized-steel sheet, minimum 0.064-inch- (1.62-mm-) thick base and 0.040-inch- (1.0-mm-) thick hood; suitably reinforced.

D. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 16 inches (400 mm).

E. Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) wire.

F. Galvanized-Steel Sheet Finish:

1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
2. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat and an overall minimum dry film thickness of 2 mils (0.05 mm).
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.

B. Install goosenecks on curb base where throat size exceeds 9 by 9 inches (230 by 230 mm).

C. Install gravity ventilators with clearances for service and maintenance.

D. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses.

E. Label gravity ventilators according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in Division 23 Section "Metal Ducts". Drawings indicate general arrangement of ducts and duct accessories.

3.3 ADJUSTING

A. Adjust damper linkages for proper damper operation.

END OF SECTION 233723
SECTION 237413 - ROOFTOP AIR CONDITIONERS

PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes the following rooftop air conditioners:
   1. Cooling and heating units 6 tons (21 kW) and smaller.

1.3 SUBMITTALS
A. Product Data: For each model indicated.
B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Prepare the following by or under the supervision of a qualified professional engineer:
   1. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
   2. Wiring Diagrams: Power, signal, and control wiring.
C. Field quality-control test reports.
D. Operation and maintenance data.
E. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
D. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
E. Comply with NFPA 54 for gas-fired furnace section.
F. Units shall be designed to operate with HCFC-free refrigerants.

1.5 WARRANTY

A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to replace components of rooftop air conditioners that fails in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 ROOFTOP AIR CONDITIONERS 6 TONS (21 kW) AND SMALLER

A. Available Manufacturers:

1. Carrier Corp.
2. Lennox Industries Inc.
3. Trane Company (The); North American Commercial Group.
4. YORK International Corporation.

B. Description: Factory assembled and tested; designed for exterior installation; consisting of compressor, indoor and outside refrigerant coils, indoor fan and outside coil fan, refrigeration and temperature controls, filters, and dampers.

C. Performance: 16 SEER with 2 stages of cooling and 80.4% AFUE with 2 stages of natural gas heat.

D. Casing: Galvanized-steel construction with enamel paint finish, removable panels or access doors with neoprene gaskets for inspection and access to internal parts, minimum 1/2-inch- (13-mm-) thick thermal insulation, knockouts for electrical and piping connections, exterior condensate drain connection, and lifting lugs.

E. Indoor Fan: Forward curved, centrifugal, belt driven by multi-speed ECM motor.

F. Outside Coil Fan: Propeller type, directly driven by motor.

G. Refrigerant Coils: Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
H. Compressor: Hermetic scroll compressor with integral vibration isolators, internal overcurrent and overtemperature protection, internal pressure relief, and crankcase heater.

I. Refrigeration System:
   1. Compressor.
   2. Outside coil and fan.
   3. Indoor coil and fan.
   4. Expansion valve with replaceable thermostatic element.
   5. Refrigerant dryer.
   6. High-pressure switch.
   7. Low-pressure switch.
   8. Refrigerant Charge.

J. Filters: 2-inch- (50-mm-) thick, fiberglass throwaway filters in filter rack.

K. Heat Exchanger: Aluminized-steel construction for natural-gas-fired burners with the following controls:
   1. Redundant single or dual gas valve with manual shutoff.
   2. Direct spark ignition.
   3. Electronic flame sensor.
   4. Induced-draft blower.

L. Power Connection: Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in circuit breaker.

M. Unit Controls: Solid-state control board and components contain at least the following features:
   1. Indoor fan on/off delay.
   2. Default control to ensure proper operation after power interruption.
   3. Service relay output.
   4. Unit diagnostics and diagnostic code storage.
   5. Field-adjustable control parameters.
   6. Economizer control
   7. Minimum run time.
   8. Night setback mode.

N. Thermostat: programmable wall type with sub-base. Thermostat shall be capability to control up to 2 heating and 2 cooling stages. Thermostat shall have minimum 2 year clock backup. Provide 2 occupied and 2 unoccupied periods per day, automatic heat/cool changeover with 2 degree F. dead-band, cumulative override periods for a 1 to 4 hour adjustable period. Thermostat shall display room temperature in F. Provide with remote sensor. Provide with minimum 4 levels of keypad lockout.

O. Accessories:
   1. Condensate drain trap.

P. Structural Roof Curb: Coated 14 gauge steel sheet curb sections, corners mitered or enclosed fully welded; 2” by 4” pressure treated continuous wood nailer mechanically fastened with
corrosion resistant fasteners at 12 inches on center to exterior face of curb. Shop prime welded connections with zinc-rich paint complying with SSPC-paint 20. Minimum height of 14 inches (350 mm). Curb shall require no steel framing and be Professional Engineered certified test data. Model ASRC by AES Industries, Inc. or engineer approved equal.

Q. Economizer: Return- and outside-air dampers with neoprene seals, outside-air filter, and hood.
   1. Damper Motor: Fully modulating spring return with adjustable minimum position.
   2. Control: Electronic-control system uses outside-air enthalpy to adjust mixing dampers.
   3. Relief Damper: Gravity actuated with bird screen and hood.
   4. Leakage: Maximum leakage 2.5 percent at nominal airflow of 400 cfm per ton (54 L/s per kW) with 1-inch wg (250-Pa) pressure differential.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, maintaining manufacturer's recommended clearances. Install according to ARI Guideline B.

B. Install structural roof curb in accordance with the manufacturers written instructions and requirements. Install and secure rooftop air conditioners on curbs and coordinate roof penetrations and flashing with roof construction. Secure units to curb in accordance with unit manufacturer.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.
   1. Gas Piping: Comply with applicable requirements in Division 23 Section "Fuel Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
   1. Install ducts to termination in roof curb.
   2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
   3. Terminate return-air duct through roof structure and insulate space between roof and bottom of unit with 2-inch- (50-mm-) thick, acoustic duct liner.

D. Electrical System Connections: Comply with applicable requirements in Division 26 Sections for power wiring, switches, and motor controls.

E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field quality-control tests and inspections and prepare test reports:
   1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
   2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove malfunctioning units, replace with new units, and retest as specified above.

3.4 ADJUSTING

A. Adjust initial temperature set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 237413
SECTION 260100 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 SUMMARY

A. This Section includes the following:
   1. Connectors.
   2. Supporting devices for electrical components.
   3. Cutting and patching for electrical construction.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.4 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings for electrical supports, raceways, and cable with general construction work.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the work.

C. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces

D. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating:

B. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

C. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
D. Expansion Anchors: Carbon-steel wedge or sleeve type.
E. Toggle Bolts: All-steel springhead type.

2.2 ELECTRICAL IDENTIFICATION
A. See Division 26 Section, “Identification for Electrical Systems.”

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION
A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom.
B. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
C. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION
A. Dry Locations: Steel materials.
B. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four with, 200-lb (90-kg) minimum design load for each support element.

3.3 SUPPORTING INSTALLATION
A. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
B. Size supports for multiple raceway or cable runs so capacity can be increased by a 25 percent minimum in the future.
C. Support individual horizontal single raceways with separate, malleable-iron pipe hangers or clamps except use spring-steel fasteners for 1-1/2-inch (38-mm) and smaller single raceways above suspended ceilings and for fastening raceways to slotted channel and angle supports.
D. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
E. Secure electrical items and their supports to building structure, using the following methods unless other fastening methods are indicated.
   1. Gypsum Board: Toggle bolts. Seal around sleeves with joint compound, both sides of wall.
2. Masonry: Toggle bolts on hollow block and expansion bolts on solid block. Seal around sleeves with mortar, both sides of wall.

3. Structural Steel: Welded threaded studs, Spring-tension clamps, Threaded studs driven by powder charge and provided with lock washers.
   a. Comply with AWS D1.1 for field welding.

4. Light Steel Framing: Sheet metal screws.

5. Light Steel: Sheet-metal screws.

6. Fasteners: Select so load applied to each fastener does not exceed 25 percent of its proof-test load.

F. Metallic conduit shall not be used for hanger support material.

3.4 IDENTIFICATION MATERIALS AND DEVICES

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

3.5 FIRESTOPPING

A. Apply firestopping to cable and raceway sleeves and other penetrations of fire-rated floor and wall assemblies to restore original undisturbed fire-resistance ratings of assemblies.

3.6 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair, refinish and touch up disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. All work to be executed by skilled mechanics.

END OF SECTION 260100
SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawing and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 SUMMARY
A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS
A. Field quality-control test reports.

1.4 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 CONDUCTORS AND CABLES
A. Manufacturers:
   2. General Cable Corporation.
B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
C. Conductor Material: Copper, solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.

D. Conductor Insulation Types: Type THHN-THWN.

2.3 CONDUCTORS AND SPLICES

A. Manufacturers:
   1. AFC Cable Systems, Inc.
   2. AMP Incorporated/Tyco International.
   3. Hubbell/Anderson.
   4. O-Z/Gedney; EGS Electrical Group LLC.
   5. 3M Company; Electrical Products Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

A. Exposed Branch Circuits: Type THHN-THWN, single conductors in raceway.

B. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

C. Fire Alarm Circuits: As recommended by manufacturer.

D. No “common” neutral conductors are to be used for multiple circuits.

3.2 CONDUCTOR AND INSULATION APPLICATIONS

A. 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.

B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

C. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

D. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

E. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

F. Wiring to devices shall not exceed the UL rating for the device.
3.3 FIELD QUALITY CONTROL

A. Testing: Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Test Reports: When requested, prepare a written report to record the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519
SECTION 260526 - GROUNDING AND BONDING 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 grounding and bonding systems and equipment.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS
   A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.
   B. Qualification Data: For testing agency and testing agency's field supervisor.
   C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS
   A. Operation and maintenance data.
      1. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
         a. Ground rods.
         b. Grounding arrangements and connections for separately derived systems.

1.6 QUALITY ASSURANCE
   A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 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 UL 467 for grounding and bonding materials and equipment.
2.2 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
   3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
   4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.3 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Conduit Hubs: Mechanical type, terminal with threaded hub.

G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with socket set screw.

H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

I. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

J. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

K. Water Pipe Clamps:
   1. Mechanical type, two pieces with stainless-steel bolts.
      b. Listed for direct burial.
   2. U-bolt type with malleable-iron clamp and copper ground connector.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel 3/4 inch by 10 feet (19 mm by 3 m).
PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
   3. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   5. Three-phase motor and appliance branch circuits.
   6. Flexible raceway runs.
   7. Armored and metal-clad cable runs.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.
3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
   3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:
   1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
   2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
   3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
   a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:
   1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
   2. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526
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 and fittings.
   2. Nonmetallic conduits and fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
   1. Structural members in paths of conduit groups with common supports.
   2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:
   1. 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.
   2. GRC: Comply with ANSI C80.1 and UL 6.
   3. ARC: Comply with ANSI C80.5 and UL 6A.
   4. IMC: Comply with ANSI C80.6 and UL 1242.
   5. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
      a. Comply with NEMA RN 1.
      b. Coating Thickness: 0.040 inch (1 mm), minimum.
   6. EMT: Comply with ANSI C80.3 and UL 797.
7. FMC: Comply with UL 1; aluminum.
8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.
   1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Fittings, General: Listed and labeled for type of conduit, location, and use.
   3. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
   4. Fittings for EMT:
      a. Material: Steel.
      b. Type: compression.
   5. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
   6. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

C. Joint Compound for IMC, GRC, or ARC: 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 NONMETALLIC CONDUITS AND FITTINGS
A. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   1. ENT: Comply with NEMA TC 13 and UL 1653.
   2. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
   3. LFNC: Comply with UL 1660.

B. Nonmetallic Fittings:
   1. Fittings, General: Listed and labeled for type of conduit, location, and use.
   2. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
   3. Fittings for LFNC: Comply with UL 514B.
   4. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 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. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Metal Floor Boxes:
   1. Material: Cast metal.
   2. Type: Semi-adjustable.
   3. Shape: Rectangular.
   4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. 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.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

K. 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.
   3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

L. Cabinets:
   1. NEMA 250, Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.
   6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
   1. Exposed Conduit: GRC.
   2. Underground Conduit: RNC, Type EPC-40-PVC.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated.
1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250.

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 and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

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. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

C. Do not fasten conduits onto the bottom side of a metal deck roof.

D. 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.
E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. 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.

G. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

H. Concel conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

I. Support conduit within 12 inches (300 mm) of enclosures to which attached.

J. Stub-ups to Above Recessed Ceilings:
   1. Use EMT for raceways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. 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.

L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. 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 (35-mm) 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.

O. 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.

P. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

Q. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where an underground service raceway enters a building or structure.
   3. Conduit extending from interior to exterior of building.
4. Conduit extending into pressurized duct and equipment.
5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
6. Where otherwise required by NFPA 70.

R. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F (0.06 mm per meter of length of straight run per degree C) of temperature change for PVC conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, 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.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

T. 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.

U. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

W. Locate boxes so that cover or plate will not span different building finishes.

X. 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.
Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

Z. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:
   1. Excavate trench bottom to provide firm and uniform support for conduit.
   2. Install backfill.
   3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.
   4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
   5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
      a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
      b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
   6. Underground Warning Tape: Comply with requirements in Division 26 Section "Identification for Electrical Systems."

3.4 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533
SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

1.3 SUBMITTALS
   A. Product Data: For each electrical identification product indicated.
   B. Schedule of Nomenclature: An index of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE
   A. Comply with ANSI C2.
   B. Comply with NFPA 70.
   C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 RACEWAY AND CABLE LABELS
   A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
      1. Color: Black letters on orange field.
      2. Legend: Indicates voltage and service.
      3. Other colors excepted when required.
   B. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl with legend overlaminated with a clear, weather- and chemical-resistant coating.
   C. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide (0.08 mm thick by 25 to 51 mm wide).
   D. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
2.2 NAMEPLATES AND SIGNS


B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
   1. Engraved legend with black letters on white face.
   2. Punched or drilled for mechanical fasteners.

C. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
   1. Minimum Width: 3/16 inch (5 mm).
   2. Tensile Strength: 50 lb (22.3 kg) minimum.
   3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).

B. Paint: Formulated for the type of surface and intended use.
   1. Primer for Galvanized Metal: Single-component acrylic vehicle formulated for galvanized surfaces.
   2. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.
   3. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.
   4. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.

C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before applying.

E. Install painted identification according to manufacturer's written instructions and as follows:
   1. Clean surfaces of dust, loose material, and oily films before painting.
   2. Prime surfaces using type of primer specified for surface.
   3. Apply one intermediate and one finish coat of enamel.
F. All conduit shall be painted. Color shall match Wake County standard.

G. Circuit Identification Labels on Boxes: Install labels externally.
   1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
   2. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

H. Color-Coding of Secondary Phase Conductors: Use the following colors for service, feeder and branch-circuit phase conductors:
   1. 208/120-V Conductors:
      a. Phase A: Black.
      b. Phase B: Red.
      c. Phase C: Blue.
   2. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:
      a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch- (25-mm-) wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
      b. Colored cable ties applied in groups of three ties of specified color to each wire at each terminal or splice point starting 3 inches (76 mm) from the terminal and spaced 3 inches (76 mm) apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.

END OF SECTION 260553
SECTION 262416 - PANELBOARDS

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. Distribution panelboards.
   2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.
   B. Shop Drawings: For each panelboard and related equipment.
      1. Include dimensioned plans, elevations, sections, and details.
      2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
      3. Detail bus configuration, current, and voltage ratings.
      4. Short-circuit current rating of panelboards and overcurrent protective devices.
      5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
      6. Include wiring diagrams for power, signal, and control wiring.
      7. Key interlock scheme drawing and sequence of operations.
      8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.5 INFORMATIONAL SUBMITTALS

A. Panelboard schedules for installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.7 FIELD CONDITIONS

A. Service Conditions: NEMA PB 1, usual service conditions, as follows:
1. Ambient temperatures within limits specified.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
   1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

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 NEMA PB 1.

C. Comply with NFPA 70.

D. Enclosures: Surface-mounted, dead-front cabinets.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
   2. Height: 84 inches (2.13 m) maximum.
   3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
   4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.

E. Incoming Mains Location: Convertible between top and bottom.

F. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

G. Conductor Connectors: Suitable for use with conductor material and sizes.
   2. Main and Neutral Lugs: Compression type, with a lug on the neutral bar for each pole in the panelboard.
   3. Ground Lugs and Bus-Configured Terminators: Compression type, with a lug on the bar for each pole in the panelboard.

H. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

I. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.2 POWER PANELBOARDS

A. Panelboards: NEMA PB 1, distribution type.

B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
   1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

C. Mains: Circuit breaker or Lugs only as indicated.


E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: Circuit breaker or lugs only.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers:
      a. Inverse time-current element for low-level overloads.
      b. Instantaneous magnetic trip element for short circuits.
      c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
   5. MCCB Features and Accessories:
      a. Standard frame sizes, trip ratings, and number of poles.
      b. Breaker handle indicates tripped status.
      c. UL listed for reverse connection without restrictive line or load ratings.
      d. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
2.5 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install panelboards and accessories according to NECA 407 and NEMA PB 1.1.

C. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box.

E. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

F. Install overcurrent protective devices and controllers not already factory installed.
   1. Set field-adjustable, circuit-breaker trip ranges.

G. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

H. Install filler plates in unused spaces.

I. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Division 26 Section "Identification for Electrical Systems."
B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Division 26 Section "Identification for Electrical Systems" identifying source of remote circuit.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

C. Tests and Inspections:
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262416
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard-grade receptacles, 125 V, 20 A.
2. GFCI receptacles, 125 V, 20 A.
3. Toggle switches, 120/277 V, 20 A.
4. Occupancy sensors.
5. Wall-box dimmers.
6. Wall plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 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 use.

B. Comply with NFPA 70.

C. RoHS compliant.

D. Comply with NEMA WD 1.

E. 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.
2. Wiring Devices Connected to Essential Electrical System: Red.
F. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

A. Duplex Receptacles, 125 V, 20 A:
1. Description: Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.

B. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:
1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.

C. Weather-Resistant Duplex Receptacle, 125 V, 20 A:
1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

D. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 20 A:
1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.3 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A:
1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: Non-feed through.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

B. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A:
1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: Non-feed through.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A:
   1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
   2. Configuration: NEMA WD 6, Configuration 5-15R.
   3. Type: Non-feed through.
   4. Standards: Comply with UL 498 and UL 943 Class A.
   5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.4 TOGGLE SWITCHES, 120/277 V, 20 A
   A. Single-Pole Switches, 120/277 V, 20 A:
   B. Two-Pole Switches, 120/277 V, 20 A:
      1. Comply with UL 20 and FS W-S-896.
   C. Three-Way Switches, 120/277 V, 20 A:
      1. Comply with UL 20 and FS W-S-896.
   D. Four-Way Switches, 120/277 V, 20 A:

2.5 OCCUPANCY SENSORS
   A. Wall Switch Sensor Light Switch, Dual Technology:
      1. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology.
      3. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
      4. Adjustable time delay of five minutes.
      5. Able to be locked to Manual-On mode.

2.6 DIMMERS
   A. Wall-Box Dimmers:
      1. Description: Modular, full-wave, solid-state dimmer switch with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
      2. Control: Continuously adjustable toggle switch; with single-pole or three-way switching.
4. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.7 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. 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: 0.035-inch- (1-mm-) thick, satin-finished, Type 302 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.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

D. Security Wall Plates: series of security wall plates shall be used where there is the potential for severe use or unauthorized access to the wiring device or box cavity behind the plate. Plates shall be UL Listed to UL 514A and allows installation compliance with NEC 410-56(e) and CEC 26-700(11)(a) which require the receptacle face to protrude .015” beyond the surface of the cover. A “Safety Ground-Tab” to insure the grounding integrity of the entire installation

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. 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.
   2. 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.
   3. Install wiring devices after all wall preparation, including painting, is complete.

C. Device Installation:
   1. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
   2. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

D. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.

2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

E. 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.

F. Dimmers:
   1. Install dimmers within terms of their listing.
   2. Verify that dimmers used for fan-speed control are listed for that application.
   3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers’ device, listing conditions in the written instructions.

G. 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.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. In healthcare facilities, prepare reports that comply with NFPA 99.
   2. Test Instruments: Use instruments that comply with UL 1436.
   3. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.

C. Test straight-blade convenience outlets in patient-care areas for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 262726
SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawing and general provisions of the contract, including General and Supplementary
      Conditions and Division 01 Specification Sections, apply to this section.

1.2 SUMMARY
   A. This Section includes fuses rated 600 V and less.

1.3 SUBMITTALS
   A. Product Data: For each fuse type indicated.

1.4 QUALITY ASSURANCE
   A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70,
      Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for
      intended use.
   B. Source Limitations: Obtain fuses from one source by a single manufacturer.
   C. Comply with NFPA 70 for components and installation.

1.5 EXTRA MATERIALS
   A. Furnish extra materials described below that match products installed and that are packaged
      with protective covering for storage and identified with labels describing contents.
      1. Spare Fuses: Furnish quantity equal to 10 percent of each fuse type and size installed,
         but not less than one set of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering
      products that may be incorporated into the Work include, but are not limited to, the following:
      2. Eagle Electric Mfg. Co., Inc.
2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

A. Motor Branch Circuits: Class RK5, time delay.

B. Other Branch Circuits: Class RK5, non-time delay.

3.2 INSTALLATION

A. Install fuses in fusible devices as indicated. Arrange fuses so fuse ratings are readable without removing fuse.

3.3 IDENTIFICATION

A. Install typewritten labels on inside door of each fused switch to indicate fuse replacement information.

B. Label as specified in Division 26 Section, Identification for Electrical Systems.

END OF SECTION 262813
SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawing and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 SUMMARY
A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
   1. Fusible switches.
   2. Nonfusible switches.
   3. Enclosures.

1.3 SUBMITTALS
A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
B. Shop Drawings: Diagram power, signal, and control wiring.
C. Field quality-control test reports.
D. Operation and maintenance data.

1.4 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2.2 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:
   1. Eaton Corporation; Cutler-Hammer Products.
   2. General Electric Co.; Electrical Distribution & Control Division.
   4. Square D/Group Schneider.

B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Nonfusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
   3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.3 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
   1. Outdoor Locations: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches.

B. Mount individual wall-mounting switches with tops at uniform height, unless otherwise indicated.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods" and "Electrical Identification."
3.2 FIELD QUALITY CONTROL

A. Prepare for acceptance testing as follows:
   1. Inspect mechanical and electrical connections.
   2. Verify switch and relay type and labeling verification.
   3. Verify rating of installed fuses.

B. Perform the field tests and inspections and prepare test reports when requested to meet manufacturer’s requirements.

END OF SECTION 262816
SECTION 263213.13 - DIESEL EMERGENCY ENGINE GENERATORS

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 packaged diesel engine generators for emergency use with the following features:
   1. Diesel engine.
   2. Diesel fuel-oil system.
   3. Control and monitoring.
   4. Generator overcurrent and fault protection.
   5. Generator, exciter, and voltage regulator.

B. Related Requirements:
   1. Division 26 Section "Transfer Switches" for transfer switches, including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Include plans and elevations for engine generator and other components specified. Indicate access requirements affected by height of subbase fuel tank.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Identify fluid drain ports and clearance requirements for proper fluid drain.
   4. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and supported equipment. Include base weights.
   5. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for EPS equipment and functional relationship between all electrical components.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates for engine generator, accessories, and components, from manufacturer.

B. Source quality-control reports.
C. Certified test reports.
D. Field quality-control reports.
E. Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS
A. Operation and maintenance data.

1.6 QUALITY ASSURANCE
A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
B. Testing Agency Qualifications: Accredited by NETA.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 WARRANTY
A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Source Limitations: Obtain packaged engine generators and auxiliary components from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS
A. B11 Compliance: Comply with B11.19.
B. NFPA Compliance:
   2. Comply with NFPA 70.
   4. Comply with NFPA 110 requirements for Level 1 EPSS.
C. UL Compliance: Comply with UL 2200.
D. Engine Exhaust Emissions: Comply with EPA Tier 3 requirements and applicable state and local government requirements.
E. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by engine generator.
including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

F. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
   1. Ambient Temperature: 5 to 104 deg F (Minus 15 to plus 40 deg C).
   2. Relative Humidity: Zero to 95 percent.
   3. Altitude: Sea level to 1000 feet (300 m).

2.3 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

B. 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.

C. EPSS Class: Engine generator shall be classified as a Class 2 according to NFPA 110.

D. Service Load: 63 kVA.

E. Power Factor: 0.8, lagging.

F. Frequency: 60 Hz.

G. Voltage: 208 V ac.

H. Phase: Three-phase, four-wire wye.

I. Induction Method: Turbocharged.

J. Governor: Adjustable isochronous, with speed sensing.

K. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.
   1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and engine generator center of gravity.

L. Capacities and Characteristics:
   1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries.
   2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

M. Engine Generator Performance:
   1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage, from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.

3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency, from no load to full load.

4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.

5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.

6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.

7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.

8. Start Time: Comply with NFPA 110, Type 10 system requirements.

2.4 DIESEL ENGINE

A. Fuel: ASTM D 975 diesel fuel oil, Grade 2-D S15.

B. Rated Engine Speed: 1800 rpm.

C. Lubrication System: Engine or skid mounted.
   1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
   2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
   3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity and with UL 499.

E. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator mounting frame and integral engine-driven coolant pump.
   1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
   2. Size of Radiator: Adequate to contain expansion of total system coolant, from cold start to 110 percent load condition.
   3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant-system pressure for engine used. Equip with gage glass and petcock.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

   a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
   b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

F. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
   1. Minimum sound attenuation of 25 dB at 500 Hz.
   2. Sound level measured at a distance of 25 feet (8 m) from exhaust discharge after installation is complete shall be 78 dBA or less.

G. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

H. Starting System: 12 V electric, with negative ground.
   1. Components: Sized so they are not damaged during a full engine-cracking cycle, with ambient temperature at maximum specified in "Performance Requirements" Article.
   2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
   3. Cranking Cycle: As required by NFPA 110 for system level specified.
   4. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least twice without recharging.
   5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
   6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 50 deg F (10 deg C) regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
   7. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
   9. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:
      a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg F (minus 40 deg C) to 140 deg F (plus 60 deg C) to prevent overcharging at high temperatures and undercharging at low temperatures.

c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.


e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.

f. Enclosure and Mounting: NEMA 250, Type 1 wall-mounted cabinet.

2.5 DIESEL FUEL-OIL SYSTEM

A. Comply with NFPA 30.

B. Integral/Sub-base Fuel Tank: Dual wall, secondary containment fuel tank mounts directly below generator skid base. Integral fuel tank shall be incorporated into generator set base frame including linear vibration isolators between tank base, engine, and generator. Modular tank shall be compatible with factory unit and enclosure. Provide tank with emergency vent and normal vent extension kits, 5 gallon spill containment, overfill prevention valve and all options for a complete installation. Tank capacity shall be 250 gallons.

2.6 CONTROL AND MONITORING

A. Automatic-Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

B. Manual-Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts engine generator. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

C. Provide minimum run time control set for 15 minutes, with override only by operation of a remote emergency-stop switch.

D. Comply with UL 508A.

E. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from engine generator vibration. Panel shall be powered from the engine generator battery.
F. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common wall-mounted control and monitoring panel. Panel shall be powered from the engine generator battery.

G. Control and Monitoring Panel:

1. Digital controller with integrated LCD display, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
2. Analog control panel with dedicated gages and indicator lights for the instruments and alarms indicated below.
3. Instruments: Located on the control and monitoring panel and viewable during operation.
   a. Engine lubricating-oil pressure gage.
   b. Engine-coolant temperature gage.
   c. DC voltmeter (alternator battery charging).
   d. Running-time meter.
   e. AC voltmeter, for each phase.
   f. AC ammeter, for each phase.
   g. AC frequency meter.
   h. Generator-voltage-adjusting rheostat.
4. Controls and Protective Devices: Controls, shutdown devices, and common visual alarm indication as required by NFPA 110 for Level 1 system, including the following:
   a. Cranking control equipment.
   c. Control switch not in automatic position alarm.
   d. Overcrank alarm.
   e. Overcrank shutdown device.
   f. Low water temperature alarm.
   g. High engine temperature pre-alarm.
   h. High engine temperature.
   i. High engine temperature shutdown device.
   j. Overspeed alarm.
   k. Overspeed shutdown device.
   l. Low-fuel main tank.
      1) Low-fuel-level alarm shall be initiated when the level falls below that required for operation for the duration required for the indicated EPSS class.
   m. Coolant low-level alarm.
   n. Coolant low-level shutdown device.
   o. Coolant high-temperature prealarm.
   p. Coolant high-temperature alarm.
   q. Coolant low-temperature alarm.
   r. Coolant high-temperature shutdown device.
   s. EPS load indicator.
   t. Battery high-voltage alarm.
   u. Low-cranking voltage alarm.
   v. Battery-charger malfunction alarm.
   w. Battery low-voltage alarm.
   x. Lamp test.
   y. Contacts for local and remote common alarm.
z. Low-starting air pressure alarm.

aa. Low-starting hydraulic pressure alarm.


c. Air shutdown damper alarm when used.

dd. Air shutdown damper shutdown device when used.

e. Generator overcurrent-protective-device not-closed alarm.

H. Common Remote Panel with Common Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel. Remote panel shall be powered from the engine generator battery.

I. Remote Alarm Annunciator: Comply with NFPA 99. An LED indicator light labeled with proper alarm conditions shall identify each alarm event, and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

1. Overcrank alarm.

2. Coolant low-temperature alarm.

3. High engine temperature prealarm.

4. High engine temperature alarm.

5. Low lube oil pressure alarm.

6. Overspeed alarm.

7. Low-fuel main tank alarm.

8. Low coolant level alarm.

9. Low-cranking voltage alarm.

10. Contacts for local and remote common alarm.


12. Air shutdown damper when used.


14. Control switch not in automatic position alarm.

15. Fuel tank derangement alarm.

16. Fuel tank high-level shutdown of fuel-supply alarm.

17. Lamp test.

18. Low-cranking voltage alarm.

19. Generator overcurrent protective device not closed.

J. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator unless otherwise indicated.

K. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.
1. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.

B. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with UL 489.
   1. Tripping Characteristic: Designed specifically for generator protection.
   2. Trip Rating: Matched to generator output rating.
   3. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
   4. Mounting: Adjacent to or integrated with control and monitoring panel.

C. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other engine generator protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector performs the following functions:
   1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other engine generator malfunction alarms. Contacts shall be available for load shed functions.
   2. Under single- or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
   3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the engine generator.
   4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

D. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground fault.
   1. Indicate ground fault with other engine generator alarm indications.
   2. Trip generator protective device on ground fault.

2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide six-lead alternator.

E. Range: Provide broad range of output voltage by adjusting the excitation level.

F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
G. Enclosure: Dripproof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified and as required by NFPA 110.
   1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
   2. Maintain voltage within 15 percent on one step, full load.
   3. Provide anti-hunt provision to stabilize voltage.
   4. Maintain frequency within 10 percent and stabilize at rated frequency within two seconds.

J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

K. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

L. Subtransient Reactance: 12 percent, maximum.

2.9 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

B. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
   1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
   2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.

C. Interior Lights with Switch: Factory-wired, vaporproof-type fixtures within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.
   1. AC lighting system and connection point for operation when remote source is available.
   2. DC lighting system for operation when remote source and generator are both unavailable.

D. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.

2.10 VIBRATION ISOLATION DEVICES

A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
   1. Housing: Steel with resilient, vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment-mounting and -leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Minimum Deflection: 1 inch (25 mm).

B. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.11 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1 and NECA 404.

B. Comply with packaged engine generator manufacturers' written installation and alignment instructions and with NFPA 110.

C. Equipment Mounting:
   1. Install packaged engine generators on cast-in-place concrete equipment bases.
   2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
   3. Install packaged engine generator with restrained spring isolators having a minimum deflection of 1 inch (25 mm) on 4-inch- (100-mm-) high concrete base. Secure engine generator to anchor bolts installed in concrete bases.

D. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

E. Drain Piping: Install condensate drain piping to muffler drain outlet with a shutoff valve, stainless-steel flexible connector, and Schedule 40 black steel pipe with welded joints.

F. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.2 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.

3.3 IDENTIFICATION

A. Identify system components according to Division 23 Section "Identification for HVAC Piping and Equipment" and Division 26 Section "Identification for Electrical Systems."

B. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections with the assistance of a factory-authorized service representative.

D. Tests and Inspections:

1. Perform tests recommended by manufacturer and in "Visual and Mechanical Inspection" and "Electrical and Mechanical Tests" subparagraphs below, as specified in the NETA ATS. Certify compliance with test parameters.
   a. Visual and Mechanical Inspection:
      1) Compare equipment nameplate data with Drawings and the Specifications.
      2) Inspect physical and mechanical condition.
      3) Inspect anchorage, alignment, and grounding.
      4) Verify that the unit is clean.
   b. Electrical and Mechanical Tests:
      1) Perform insulation-resistance tests according to IEEE 43.
         a) Machines 200 hp (150 kW) or Less: Test duration shall be one minute. Calculate the dielectric-absorption ratio.
      2) Test protective relay devices.
      3) Verify phase rotation, phasing, and synchronized operation as required by the application.
      4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
      5) Perform vibration test for each main bearing cap.
      6) Conduct performance test according to NFPA 110.
      7) Verify correct functioning of the governor and regulator.

2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
   a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
   b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
   c. Verify acceptance of charge for each element of the battery after discharge.
   d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.

6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120 kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.

7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.

8. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 percent and 100 percent of rated linear load. Verify that harmonic content is within specified limits.

E. Coordinate tests with tests for transfer switches, and run them concurrently.

F. Test instruments shall have been calibrated within the past 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

G. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

H. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

I. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

J. Remove and replace malfunctioning units and retest as specified above.

K. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.

L. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component, indicating satisfactory completion of tests.
3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 263213.13
SECTION 263600 - TRANSFER SWITCHES

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 automatic transfer switches rated 600 V and less.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Shop Drawings:
      1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
      2. Single-Line Diagram: Show connections between transfer switch, power sources, and load.

1.4 INFORMATIONAL SUBMITTALS
   A. Source quality control reports.
   B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS
   A. Operation and maintenance data.

1.6 WARRANTY
   A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.
      1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   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 NEMA ICS 1.
C. Comply with NFPA 99.

D. Comply with NFPA 110.

E. Comply with UL 1008 unless requirements of these Specifications are stricter.

F. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

G. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

H. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

I. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

J. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.

K. Neutral Terminal: Solid and fully rated unless otherwise indicated.

L. Battery Charger: For generator starting batteries.
   1. Float type, rated 10 A.
   2. Ammeter to display charging current.
   3. Fused ac inputs and dc outputs.

M. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed markers at terminations. Color-coding and wire and cable markers are specified in Division 26 Section "Identification for Electrical Systems."
   1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
   2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
   3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
   4. Accessible via front access.

N. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.2 CONTACTOR-TYPE AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.
B. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
   1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are unacceptable.
   2. Switch Action: Double throw; mechanically held in both directions.
   3. Contacts: Silver composition or silver alloy for load-current switching. Contactor-style automatic transfer-switch units, rated 600 A and higher, shall have separate arcing contacts.
   4. Conductor Connectors: Suitable for use with conductor material and sizes.
   6. Main and Neutral Lugs: Compression type.
   7. Ground Lugs and Bus-Configured Terminators: Compression type.
   8. Ground bar.
   9. Connectors shall be marked for conductor size and type according to UL 1008.

C. Automatic Open-Transition Transfer Switches: Interlocked to prevent the load from being closed on both sources at the same time.
   1. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.

D. Automatic Delayed-Transition Transfer Switches: Pauses or stops in intermediate position to momentarily disconnect both sources, with transition controlled by programming in the automatic transfer-switch controller. Interlocked to prevent the load from being closed on both sources at the same time.
   1. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals for alternative source. Adjustable from zero to six seconds, and factory set for one second.
   2. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.
   3. Fully automatic break-before-make operation with center off position.
   4. Fully automatic break-before-make operation with transfer when two sources have near zero phase difference.

E. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval shall be adjustable from 1 to 30 seconds.

F. Automatic Transfer-Switch Controller Features:
   1. Controller operates through a period of loss of control power.
   2. Undervoltage Sensing for Each Phase of Normal and Alternate Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
   3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
   a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods shall be adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
   a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
   b. Push-button programming control with digital display of settings.
   c. Integral battery operation of time switch when normal control power is unavailable.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect components, assembled switches, and associated equipment according to UL 1008. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

B. Prepare test and inspection reports.
1. For each of the tests required by UL 1008, performed on representative devices, for emergency systems. Include results of test for the following conditions:
   a. Overvoltage.
   b. Undervoltage.
c. Loss of supply voltage.
d. Reduction of supply voltage.
e. Alternative supply voltage or frequency is at minimum acceptable values.
f. Temperature rise.
g. Dielectric voltage-withstand; before and after short-circuit test.
h. Overload.
i. Contact opening.
j. Endurance.
k. Short circuit.
l. Short-time current capability.
m. Receptacle withstand capability.
n. Insulating base and supports damage.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Annunciator and Control Panel Mounting: Flush in wall unless otherwise indicated.
B. Identify components according to Division 26 Section "Identification for Electrical Systems."
C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.
D. Comply with NECA 1.

3.2 CONNECTIONS
A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets, control, and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
   1. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceways and Boxes for Electrical Systems."
C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
E. Connect twisted pair cable according to Division 27 Section "Communications Copper Horizontal Cabling."
F. Route and brace conductors according to manufacturer's written instructions. Do not obscure manufacturer's markings and labels.
G. Final connections to equipment shall be made with liquidtight, flexible metallic conduit no more than 18 inches (457 mm) in length.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visual and Mechanical Inspection:
   a. Compare equipment nameplate data with Drawings and Specifications.
   b. Inspect physical and mechanical condition.
   c. Inspect anchorage, alignment, grounding, and required clearances.
   d. Verify that the unit is clean.
   e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
   f. Verify that manual transfer warnings are attached and visible.
   g. Verify tightness of all control connections.
   h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:
      1) Use of low-resistance ohmmeter.
      2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.
   i. Perform manual transfer operation.
   j. Verify positive mechanical interlocking between normal and alternate sources.
   k. Perform visual and mechanical inspection of surge arresters.
   l. Inspect control power transformers.
      1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
      2) Verify that primary and secondary fuse or circuit-breaker ratings match Drawings.
      3) Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.

2. Electrical Tests:
   a. Perform insulation-resistance tests on all control wiring with respect to ground.
   b. Perform a contact/pole-resistance test. Compare measured values with manufacturer's acceptable values.
   c. Verify settings and operation of control devices.
   d. Calibrate and set all relays and timers.
   e. Verify phase rotation, phasing, and synchronized operation.
   f. Perform automatic transfer tests.
   g. Verify correct operation and timing of the following functions:
      1) Normal source voltage-sensing and frequency-sensing relays.
      2) Engine start sequence.
      3) Time delay on transfer.
      4) Alternative source voltage-sensing and frequency-sensing relays.
      5) Automatic transfer operation.
      6) Interlocks and limit switch function.
7) Time delay and retransfer on normal power restoration.
8) Engine cool-down and shutdown feature.

   a. Check for electrical continuity of circuits and for short circuits.
   b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
   c. Verify that manual transfer warnings are properly placed.
   d. Perform manual transfer operation.

4. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.
   a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.
   b. Simulate loss of phase-to-ground voltage for each phase of normal source.
   c. Verify time-delay settings.
   d. Verify pickup and dropout voltages by data readout or inspection of control settings.
   e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for one pole deviating by more than 50 percent from other poles.
   f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
   a. Verify grounding connections and locations and ratings of sensors.

B. Coordinate tests with tests of generator and run them concurrently.

C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

D. Transfer switches will be considered defective if they do not pass tests and inspections.

E. Remove and replace malfunctioning units and retest as specified above.

F. Prepare test and inspection reports.

G. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
   1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.

B. Coordinate this training with that for generator equipment.

END OF SECTION 263600
SECTION 265119 - LED 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 the following types of LED luminaires:
   1. Downlight.
   2. Recessed, linear.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.
   1. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
   2. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.
   1. Include plans, elevations, sections, and mounting and attachment details.
   2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS
A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.

B. Product Certificates: For each type of luminaire.

C. Product test reports.

D. Sample warranty.

1.5 CLOSEOUT SUBMITTALS
A. Operation and maintenance data.
1.6 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.7 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Ambient Temperature: 41 to 104 deg F (5 to 40 deg C).
   1. Relative Humidity: Zero to 95 percent.

2.2 LUMINAIRE REQUIREMENTS

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. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
   1. Label shall include the following lamp characteristics:
      a. "USE ONLY" and include specific lamp type.
      b. Lamp diameter, shape, size, wattage, and coating.
      c. CCT and CRI.

C. Recessed luminaires shall comply with NEMA LE 4.

D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
2.3 DOWNLIGHT

A. Nominal Operating Voltage: 120 V ac.

B. Lamp:
1. Minimum 250 lm.
2. Minimum allowable efficacy of 80 lm/W.
3. CRI of minimum 80. CCT of 4100 K.
4. Rated lamp life of 50,000 hours to L70.
5. Dimmable from 100 percent to 0 percent of maximum light output.
6. Internal driver.
7. User-Replaceable Lamps:
   a. Bulb shape complying with ANSI C78.79.
   b. Lamp base complying with ANSI C81.61 or IEC 60061-1.
8. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

C. Housings:
1. Extruded-aluminum housing and heat sink.
2. Powder-coat painted finish.
4. Integral junction box with conduit fittings.

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. Fixed lens.
2. Medium light distribution.
3. Prismatic acrylic.
4. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
5. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

F. Standards:
1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.
4. Recessed luminaires shall comply with NEMA LE 4.

2.4 RECESSED, LINEAR

A. Nominal Operating Voltage: 120 V ac.

B. Lamp:
1. Minimum 3,000 lm.
2. Minimum allowable efficacy of 85 lm/W.
3. CRI of minimum 80. CCT of 4100 K.
4. Rated lamp life of 50,000 hours to L70.
5. Dimmable from 100 percent to 0 percent of maximum light output.
6. Internal driver.
7. User-Replaceable Lamps:
   a. Bulb shape complying with ANSI C78.79.
   b. Lamp base complying with ANSI C81.61 or IEC 60061-1.
8. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

C. Housings:
1. Extruded-aluminum housing and heat sink.
2. Powder-coat painted finish.
3. With integral mounting provisions.

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. Components are 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. Prismatic acrylic.
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

F. Standards:
1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.
4. NEMA LE 4.

2.5 SUSPENDED, LINEAR

A. Nominal Operating Voltage: 120 V ac.

B. Lamp:
1. Minimum 3,000 lm.
2. Minimum allowable efficacy of 85 lm/W.
3. CRI of minimum 80. CCT of 4100 K.
4. Rated lamp life of 50,000 hours to L70.
5. Dimmable from 100 percent to 0 percent of maximum light output.
6. Internal driver.
7. User-Replaceable Lamps:
   a. Bulb shape complying with ANSI C78.79.
   b. Lamp base complying with ANSI C81.61 or IEC 60061-1.
8. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.
C. Housings:
   1. Extruded-aluminum housing and heat sink.
   2. Powder-coat painted finish.
   3. With integral mounting provisions.

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. Components are 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. Prismatic acrylic.
   2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   3. Glass: Annealed crystal glass unless otherwise indicated.
   4. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

F. Standards:
   1. ENERGY STAR certified.
   2. RoHS compliant.
   3. UL Listing: Listed for damp location.

2.6 MATERIALS

A. Metal Parts:
   1. Free of burrs and sharp corners and edges.
   2. Sheet metal components shall be steel unless otherwise indicated.
   3. Form and support to prevent warping and sagging.

B. Steel:
   1. ASTM A 36/A 36M for carbon structural steel.
   2. ASTM A 568/A 568M for sheet steel.

C. Stainless Steel:
   1. 1. Manufacturer's standard grade.
   2. 2. Manufacturer's standard type, ASTM A 240/240 M.

D. Galvanized Steel: ASTM A 653/A 653M.

E. Aluminum: ASTM B 209.

2.7 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.
2.8 LUMINAIRE SUPPORT

A. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

B. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:
   1. Sized and rated for luminaire weight.
   2. Able to maintain luminaire position after cleaning and relamping.
   3. Provide support for luminaire without causing deflection of ceiling or wall.
   4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.2 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
   2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 265119
SECTION 265213 - EMERGENCY AND EXIT 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. Emergency lighting units.
   2. Exit signs.

1.3 DEFINITIONS
A. CCT: Correlated color temperature.
B. CRI: Color Rendering Index.
C. Emergency Lighting Unit: A lighting unit with integral or remote emergency battery powered supply and the means for controlling and charging the battery and unit operation.
D. Lumen: Measured output of lamp and luminaire, or both.
E. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support, arranged by designation.
B. Shop Drawings: For nonstandard or custom luminaires.
   1. Include plans, elevations, sections, and mounting and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS
A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, coordinated with each other, using input from installers of the items involved:
B. Product Certificates: For each type of luminaire.
C. Seismic Qualification Data: Certificates, for luminaires, accessories, and components, from manufacturer.
1.6      CLOSEOUT SUBMITTALS

A.       Operation and maintenance data.

1.7      WARRANTY

A.       Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1.      Warranty Period: Two year(s) from date of Substantial Completion.

B.       Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1      GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

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.       NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C.       Comply with NFPA 70 and NFPA 101.

D.       Comply with NEMA LE 4 for recessed luminaires.

E.       Comply with UL 1598 for recessed luminaires.

F.       Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast.

1.       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.

2.       Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

   a.       Ambient Temperature: Less than 0 deg F (minus 18 deg C) or exceeding 104 deg F (40 deg C), with an average value exceeding 95 deg F (35 deg C) over a 24-hour period.
   b.       Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C).
   c.       Humidity: More than 95 percent (condensing).
3. Test Push-Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
   a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

G. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more lamps, remote mounted from luminaire.
   1. Emergency Connection: Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire.
   2. 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.
   3. Nightlight Connection: Operate lamp in a remote fixture continuously.
   5. Charger: Fully automatic, solid-state, constant-current type.
   6. Housing: NEMA 250, Type 1 enclosure listed for installation inside, on top of, or remote from luminaire. Remote assembly shall be located no less than half the distance recommended by the emergency power unit manufacturer, whichever is less.
   7. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   8. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.2 EXIT SIGNS

A. Internally Lighted Signs:
   1. Operating at nominal voltage of 120 V ac.
   2. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
   3. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

2.3 MATERIALS

A. Metal Parts:
   1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:
   1. Smooth operating, free of light leakage under operating conditions.
   2. Designed to permit relamping without use of tools.
   3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:
   1. Prismatic acrylic.
   2. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

D. Housings:
   1. Extruded aluminum.
   2. Powder coat painted finish.

E. Conduit: Electrical metallic tubing, minimum 3/4 inch (21 mm) in diameter.

2.4 METAL FINISHES

A. 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 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:
   1. Sized and rated for luminaire and emergency power unit weight.
   2. Able to maintain luminaire position when testing emergency power unit.
   3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
   4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of fixture weight.

E. Wall-Mounted Luminaire Support:
   1. Attached to structural members in walls.
2. Do not attach fixtures directly to gypsum board.

F. Suspended Luminaire Support:
1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling Grid Mounted Luminaires:
1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.

H. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 265213
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. Voice and Data Cables.

B. Premises wiring and outlets.

1.3 RELATED SECTIONS

A. Division 26 Section – Raceways and Boxes for Electrical Systems

1.4 SYSTEM DESCRIPTION

A. A cable system consisting of copper cables, routed between various telecommunications outlets and their designated equipment room, as shown on the Drawings.

1.5 PRELIMINARY MEETING/CONTRACTOR DELIVERABLES

A. Prior to shop drawing submittals, an Initial Planning Meeting will be held for the Contractor and the Owner to clarify all requirements (systems, services, distribution methods, etc.), identify responsibilities, and schedule the events that will transpire during the implementation of the project.

B. At the subsequent Product and Design Meeting, the Contractor will bring product submittals for each component of the proposed system, and be prepared to ask any questions related to installation. No material shall be ordered or installed until reviewed and approved by the Owner and Designer.

C. The Contractor’s lead technician or project manager shall be BICSI certified, and shall be on-site whenever work is being performed. The Contractor shall utilize certified cable technicians with approved manufacturer-specific certification.

1.6 QUALITY ASSURANCE

A. The Contractor shall at a minimum possess the following qualifications:

1. Be a firm with at least 5 years of experience of successful installation experience with projects utilizing unshielded twisted pair cabling (UTP), Category 5e and Category 6 in compliance with EIA/TIA-568.

2. The firm must have an RCDD on staff. In addition, the lead technician MUST be BICSI certified at the Technician Level prior to leading the installation of cabling on the project.
The same technician must be the lead technician for the duration of the project or be replaced by a technician with the same credentials.

3. The Contractor shall utilize certified cable technicians with approved manufacturer-specific certification. The Contractor shall have a permanent service organization with an office located within thirty miles of project site.

4. Contractor shall demonstrate satisfaction of sound financial condition and can be adequately bonded and insured if the project deems necessary.

5. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.

6. Personnel knowledgeable in local, state, province and national codes and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.

7. Must possess current liability insurance certificates.

8. Must have personnel fluent in the use of Computer Aided Design and possess and operate CAD software using .DWG or .DXF format.

9. The Contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to data, voice and imaging network systems. The Contractor shall at a minimum possess the following qualifications:

10. Personnel trained and certified in the design of the Siemon Cabling System®.

11. Personnel trained and certified to install the Siemon Cabling System®.

12. The Designer and Installer shall show proof of current certification of the Siemon Cabling System® via an updated certificate given after attending the CI-301 training course or an on-line re-certification class given every two years.

13. Provide references of the type of installation provide in this specification.

14. Personnel trained and certified in fiber optic cabling, splicing, termination and testing techniques. Personnel must have experience using an optical light source and power meter plus OTDR. Personnel trained in the installation of pathways and support for housing horizontal and backbone cabling.

B. Manufacturer's Qualifications: Firm regularly engaged in the manufacture of unshielded twisted pair and coaxial cables, connectors and hardware and have products in satisfactory use for a minimum of five years.

C. The Contractor shall perform all installation work according to the principles outlined in:

1. ANSI/TIA/EIA-568B: "Commercial Building Telecommunications Cabling Standard."

2. ANSI/TIA/EIA-569: "Commercial Building Standard for Telecommunications Pathways and Spaces."


4. NFPA 70: "National Electrical Code."

5. BICSI Telecommunication Distribution Methods Manual.


7. And generally accepted industry practices.

D. The Contractor shall provide materials that are NRTL (Nationally Recognized Testing Laboratory) listed and labeled, as defined in the "National Electrical Code," Article 100 and FCC Regulations, “Title 47 of the Code of Federal Regulations”, Part 68, Chapter 1.
1.7 GENERAL REQUIREMENTS

A. The Contractor shall provide any necessary screws, anchors, clamps, tie wraps, distribution rings, miscellaneous grounding and support hardware, etc. necessary to facilitate the installation of the system in a neat and orderly fashion.

B. It shall be the responsibility of the Contractor to furnish any special installation equipment or tools necessary to properly complete the system. This may include, but is not limited to, tools for terminating, testing, and splicing copper cables, jack stands for cable reels, and/or cable winches.

1.8 WARRANTY/REPAIR SERVICE

A. The Contractor shall provide a two (2)-year warranty for both products and labor.

B. The Contractor must provide repair service within eight business hours of notification for outages deemed by the Owner to be an Emergency, which includes but is not limited to outages of more than five stations or a critical emergency service station, and within sixteen business hours for routine service.

PART 2 - PRODUCTS

2.1 GENERAL

A. All like items of products provided must be new and of the same manufacturer and meet the performance requirements for that item as shown in this specification or industry standards, whichever is more stringent.

B. All system components must be selected and installed as a complete systems-solution, providing a manufacturer’s certified warranty for a minimum of five years.

C. Section delineates the performance requirements and characteristics for cables and associated hardware which will be used as a copper transmission media.

D. All like items of products provided must be of the same manufacturer and meet the performance requirements for that item as shown in this specification or industry standards, whichever is more stringent.

E. All cables shall meet or exceed the appropriate flame retardant requirement for the area in which they are installed (NEC type-requirements).

F. Approved systems solutions manufacturers are:
   1. Siemon Siemons Station Outlets Siemons Patch Panels

2.2 VOICE/DATA STATION CABLE

A. All station cable shall be CAT 6, 4-pair, UTP, non-stranded, and colored blue. Cables that will be placed in conduit for installation in a slab on grade must also be outdoor rated, suitable for underground service. Gel Cleaner (Polywater) can be used to clean gel from the ends before termination. All cables shall be composed of 24 AWG solid copper conductors. All cables shall
be Underwriter's Laboratories (UL) listed type MPR, MPP, CMR, and CMP. Determination of plenum rating will be project-specific. Cable shall also support IEEE 802.3, 10BASE-T, and IEEE 802.5 standards.

B. Approved manufacturer is Siemons. All other manufacturers shall be approved by Engineer and Owner.

2.3 TELECOMMUNICATIONS STATION OUTLETS

A. Standard Wall Station Outlet: Standard wall faceplate shall be four (4) position, brushed stainless steel, UNLESS NOTED OTHERWISE mounted on single gang outlet box, to accommodate RJ45 jacks. Each standard wall faceplate shall contain two (2) CAT 6 compliant RJ45 modular jacks, two (2) color-coded blue, to accommodate two cables, plus two blank inserts.

B. Approved station outlet manufacturer is Siemons. All other manufacturers shall be approved by Engineer and Owner.

2.4 VOICE BACKBONE/RISER CABLE

A. The building system voice backbone cables are existing to remain. Protect during construction. Provide connections as required for complete operation.

2.5 DATA PATCH PANELS

A. Data station cables shall be terminated on 19” rack-mounted CAT 6 angled patch panels, with 110 crossconnect terminations, wired in the T568B configuration. Patch panels shall be 48-port, and mounted in the rack designated for Data. The first and second data jack (blue) of each outlet will be terminated on a patch panel, designated blue. The Contractor shall provide sufficient quantity of data patch panels in each telephone room to terminate all data station cables shown on plans, plus 20% spare capacity for future station jacks.

2.6 PATCH CORDS

A. The Contractor shall supply factory-prepared eight (8)-conductor modular CAT 6 molded boot patch cords with male RJ45 connector on each end. Patch cords shall have a T568B wiring/pin configuration. Provide the following patch cords for each data outlet: 1 five (5) feet, 1 seven (7) feet, 1 ten (10) feet, and colored blue.

B. The Contractor shall provide one data patch cord for each station outlet, plus an additional 30% for future growth.

2.7 EQUIPMENT RACKS

A. Two EIA standard (7’ x 19") black aluminum equipment racks are required for each telephone room. All equipment racks shall be capable of supporting 600 pounds, with type B universal mounting rail pattern.
B. Vertical wire management shall be provided on each side of racks, with units between racks. Vertical wire managers shall be black 7-foot, double-sided (front and rear) units, with finger openings, hinged front cover, and all brackets and connectors necessary for a complete system.

C. The basis of design product for equipment racks is Siemens RS-07. Substitutions may only be submitted for approval during the pre-bid process.

D. Each data rack shall be equipped with one rack-mounted horizontal power strip, providing at least six (6) 20 ampere, 120-volt receptacles, having a cord at least 10’ long.

E. Each rack shall be equipped with two 2RU sections of horizontal wire management, with hinged covers, which match the vertical wire manager.

2.8 CABLE SUPPORTS

A. The contractor will provide and install horizontal wire basket tray in each telephone room. The installation is intended to support cables across the longest wall of the closet, and to connect each equipment rack to the wall. For buildings with 1-2 stories, the ladder rack shall be 18” wire basket.

B. Acceptable product is Hoffman Model LSS12BLK, or equivalent.

2.9 HANGERS

A. The Contractor shall use approved J-hooks or other CAT 6-rated cable support hangers in ceiling void.

2.10 LABELS

A. All Labels used to mark cables, faceplates, patch panels and distribution hardware shall be of the self-laminating type, and shall be machine-printed with black ink on white background. Labels will have pressure sensitive, permanent acrylic-type adhesive. All labels will be uniform in size using the same font size on letters and numbers throughout. Label printing will be 1/8” minimum in block style.

PART 3 - EXECUTION

3.1 COMMUNICATIONS CLOSETS

A. Prior to working in the communications closets, the Contractor shall ensure that a #6 AWG minimum green insulated copper grounding conductor has been provided. In each closet, the equipment rack shall be bolted to the floor and properly bonded to an approved building ground. The ladder rack shall be placed according to the communications closet layout, and securely fastened to the wall and the ladder rack to support the weight of cables. The electrical outlet strips should be installed in the middle of each rack. The power cord will be securely connected to the electrical outlet provided for that purpose, routing the power cord over the top of the rack, or routed through the channel to the UPS. See Typical Communications Closet Layout detail on the drawings. D Rings are to be installed in communications closets to protect cables in transition.
3.2 COPPER CABLE INSTALLATION

A. Layouts for all communications closets will be provided by the Owner, and must be received by the Contractor before work can begin. The approved closet layout should be posted in each closet.

B. In all wiring closets, install cables parallel and at right angles to walls. Bundle, lace and train the conductors to terminal points with no excess. Use wire distribution spools at points where cables are fanned or conductors turned. In the communications closets, do not run station cables through the D rings.

C. Terminate conductors of cables on terminal block using tools recommended by terminal block manufacturer.

D. The Contractor will make every effort to install cables to maintain numerical order in a clockwise sequence around each floor, according to the numbering scheme provided by the Owner.

E. All cables shall be run concealed in accessible ceiling space, unless otherwise indicated by the owner, or on the plans. No exposed copper cable will be permitted, unless written authorization is secured from the engineer.

F. Cables shall be routed along the most direct path between the outlet and the wiring closet, however all paths shall be rectilinear, running parallel and perpendicular to corridors. Diagonal routing shall not be permitted. All cable shall be routed in a neat and orderly manner, using installed cable tray or ladder rack whenever possible.

G. All cables must be properly secured to the building structure at intervals as required to prevent sagging between supports, as per NEC 800. Only J-Hooks or approved CAT 6 hangers may be used. Cables must be supported every four to five feet, and may not rest on ceiling tiles or grid, and may not be secured to improper structures such as ceiling grid or conduits. Cable routing shall avoid contact or close proximity to power conduits, lighting fixtures and other potential sources of interference. Cables must not be spliced between the normal terminations of runs. The Engineer (the Owner) reserves the right to reject workmanship that does not meet this requirement.

H. Cable shall be installed without damaging conductors or jacket. The Contractor shall ensure that the manufacturer recommended maximum pulling tensions and cable bends of the specified distribution cables are not exceeded. Failure to follow the appropriate guidelines will require the Contractor to provide, in a timely fashion, the additional material and labor necessary to properly rectify the situation. This shall also apply to any and all damages sustained to existing cables by the Contractor during the implementation.

I. The Contractor shall pull cables simultaneously where more than one is being installed in the same raceway or at the same location. Use pulling compound or lubricant where necessary. Compound used must not damage conductor or insulation. Use pulling methods that will not damage cable or raceway, including fish tape, cable, rope, and wire-cable grips.

J. The Contractor shall not place or attach any communications cabling alongside power lines, or share the same conduit, channel or sleeve with electrical apparatus.
K. To facilitate future rearrangements, a three-foot (3’) service loop shall be allowed for cables in every wiring closet, with slack routed neatly on the ladder rack. Cables installed in raceways from ceiling space to outlet boxes, shall have a 12” repair loop above the ceiling, at transition from horizontal to vertical drop. Cables installed for cubicles shall be placed with a 5” slack loop in the raceway.

L. The amount of cable jacket removed from the end of cables shall be kept to a minimum. Never remove the jacket more than specified by the manufacturer to achieve manufacturer certification. The Contractor shall maintain the twist integrity of each cable pair up to the point of termination.

M. Install cables to maintain numerical order in a clockwise sequence around each floor, according to the numbering scheme provided by the Owner.

N. On the patch panels and punchdown blocks, sequential, numerical order shall be maintained. Numbering shall be from left to right and from top to bottom with consecutive numbers, skipping no spaces.

O. The Contractor shall properly fire stop all penetrations through fire-rated walls with an approved material to restore the original fire rating.

3.3 TELECOMMUNICATIONS STATION OUTLETS

A. Standard voice/data outlets terminated in a four-pair faceplate will contain three CAT 6 4-pair cables, terminated on RJ45 CAT 6 jacks, plus one blank insert. The top two jacks, color-coded blue, will support data service. The third and fourth positions shall be blank.

B. All cables for data support will be routed to the appropriate patch panel installed in a rack designated for data.

3.4 LABELLING

A. Station cables shall be labeled within four inches of each end, behind the faceplate, and in the wiring closet. Jack numbers shall match exactly at both ends of all copper cables. Printed labels on the outlet faceplate shall be mounted above the jack positions, so they can be easily read when patch cords are in place.

B. There will be a single label on each faceplate. Jack numbers will be comprised of: <Building> <Floor> <Room> <Panel> <Port>. Example: Label “WB111-100-A32” corresponds to station outlet Wakebrook 111, Room 100, Panel A, Port 32. In a standard faceplate, it is understood that the “red” data cable will be routed to a port on the “red” data patch panel, the “ivory” data cable to the “ivory” patch panel, and the “blue” voice cable will be routed to a voice patch panel.

C. All copper patch panels shall be labeled to identify the panel with: the panel designation.

D. Numbering on all panels shall be from left to right and from top to bottom, with consecutive numbers, skipping no spaces.
3.5 ACCEPTANCE TESTING

A. The Owner shall be given the opportunity to witness testing. The Contractor shall submit a testing schedule at least three (3) business days prior to initial testing.

B. All copper cables shall be tested. Sample testing shall not be permitted. All tests shall be performed on the completely installed system, through all terminations, in the system’s final state, as it will be turned over to Wake County.

C. The initial computer-generated test results, including failures, shall be submitted to the Owner, in both printed and electronic formats. All test data shall indicate the date of the test and the name of the persons that performed the test.

D. All cables shall be tested for:

1. Continuity [pass/fail].
2. Proper termination sequence [pass/fail].
3. Cable length (measured electronically) [feet].
4. Line attenuation, indicate frequency [dB @ MHz].
5. Signal-to-noise ratio (with active hubs) [dB].
6. Ambient line-noise level [dBm].
7. Shorts between any two or more conductors.
9. Bi-Directional near-end crosstalk (NEXT) shall be tested on all six pair combinations in each four pair cable. Tests for NEXT shall be performed from both the work area outlet location and link origination point.

E. Bi-Directional near-end crosstalk (NEXT) shall be tested on all six pair combinations in each four pair cable. Tests for NEXT shall be performed from both the work area outlet location and link origination point.
SECTION 271513 - COMMUNICATIONS COPPER 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. Category 6 twisted pair cable.
   2. Twisted pair cable hardware, including plugs and jacks.
   3. Cable management system.

1.3 COPPER HORIZONTAL CABLE DESCRIPTION

A. Horizontal cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
   1. TIA-568-C.1 requires that a minimum of two equipment outlets 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 equipment outlet.
   3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the equipment outlets to the station equipment.

C. 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.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Reviewed and stamped by RCDD.
   1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
   2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
   3. Cabling administration Drawings and printouts.
4. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment.

C. Twisted pair cable testing plan.

D. Samples: For telecommunications jacks and plugs.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, installation supervisor, and field inspector.

B. Product Certificates: For each type of product.

C. Source quality-control reports.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Software and Firmware Operational Documentation:
   1. Software operating and upgrade manuals.
   3. Device address list.
   4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
   1. Layout Responsibility: Preparation of Shop Drawings, cabling administration Drawings, and field testing program development by an RCDD.
   2. Installation Supervision: Installation shall be under the direct supervision of 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.

B. Testing Agency Qualifications: Testing agency must have personnel certified by BICSI on staff.
   1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD.

1.8 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

1.9 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, provide software support for two years.
B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

C. Grounding: Comply with TIA-607-B.

2.2 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:

1. Communications, Plenum Rated: Type CM, Type CMG, Type CMP, Type CMR, or Type CMX in metallic conduit installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

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. RoHS compliant.

2.3 CATEGORY 6 TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250MHz.


C. Conductors: 100-ohm, 23 AWG solid copper.

D. Shielding/Screening: Unshielded twisted pairs (UTP).

E. Cable Rating: Plenum.

F. Jacket: Blue thermoplastic.
2.4 TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

B. General Requirements for Twisted Pair Cable Hardware:
   1. Comply with the performance requirements of Category 6.
   2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
   3. Cables shall be terminated with connecting hardware of same category or higher.

C. Source Limitations: Obtain twisted pair cable hardware from same manufacturer as twisted pair cable, from single source.

D. Connecting Blocks:
   1. 110-style IDC for Category 6.
   2. 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.

E. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
   1. Number of Terminals per Field: One for each conductor in assigned cables.

F. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.
   1. Features:
      a. Universal T568A and T568B wiring labels.
      b. Labeling areas adjacent to conductors.
      c. Replaceable connectors.
      d. 24 or 48 ports.
   2. Construction: 16-gauge steel and mountable on 19-inch (483 mm) equipment racks.

G. Plugs and Plug Assemblies:
   1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
   3. Marked to indicate transmission performance.

H. Jacks and Jack Assemblies:
   1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
   2. Designed to snap-in to a patch panel or faceplate.
   4. Marked to indicate transmission performance.

I. Faceplate:
   1. Two port, vertical single gang faceplates designed to mount to single gang wall boxes.
2. Metal Faceplate: Stainless steel, complying with requirements in Division 26 Section "Wiring Devices."
   a. Flush mounting jacks, positioning the cord at a 45-degree angle.

J. Legend:
   1. Machine printed, in the field, using adhesive-tape label.
   2. Snap-in, clear-label covers and machine-printed paper inserts.

2.5 CABLE MANAGEMENT SYSTEM
A. Description: Computer-based cable management system, with integrated database capabilities.
B. Document physical characteristics by recording the network, TIA details, and connections between equipment and cable.
C. Information shall be presented in database view, schematic plans, or technical drawings.
   1. Microsoft Visio Professional or AutoCAD drawing software shall be used as drawing and schematic plans software.
D. System shall interface with the following testing and recording devices:
   1. Direct upload tests from circuit testing instrument into the personal computer.
   2. Direct download circuit labeling into labeling printer.

2.6 GROUNDING
A. Comply with TIA-607-B.

PART 3 - EXECUTION

3.1 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES
A. Comply with NECA 1 and NECA/BICSI 568.
   1. Install plenum cable in environmental air spaces, including plenum ceilings.
C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.
D. General Requirements for Cabling:
   3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Do not untwist twisted pair cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. 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.
7. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
9. 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.
10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
11. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:
   1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.

3.2 FIRESTOPPING
   A. Comply with TIA-569-D, Annex A, "Firestopping."

3.3 GROUNDING
   A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."
   B. Comply with TIA-607-B and NECA/BICSI-607.
   C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.
   D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.
3.4 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B.

B. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 3 level of administration, including optional identification requirements of this standard.

C. Equipment grounding conductors.

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 the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
   3. Exposed Cables: 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, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
      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 a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:
   1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Visually inspect 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-568-C.1.
   2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
   3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.
D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 271513
SECTION 284621.11 - ADDRESSABLE FIRE-ALARM 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. Fire-alarm control unit.
   3. System smoke detectors.
   7. Addressable interface device.
   8. Digital alarm communicator transmitter.

B. Related Requirements:
   1. Division 27 Section "Communications Copper Horizontal Cabling" for cables and conductors for fire-alarm systems.

1.3 ACTION SUBMITTALS

A. 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.
      c. Licensed or certified by authorities having jurisdiction.

B. Product Data: For each type of product, including furnished options and accessories.

C. Shop Drawings: For fire-alarm system.
   1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
   2. Include plans, elevations, sections, details, and attachments to other work.
   3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
   4. Detail assembly and support requirements.
   5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
   a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
   b. Show field wiring required for HVAC unit shutdown on alarm.
   c. Locate detectors according to manufacturer's written recommendations.
12. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

1.4 INFORMATIONAL SUBMITTALS
A. Qualification Data: For Installer.
B. Seismic Qualification Data: Certificates, for fire-alarm control unit, accessories, and components, from manufacturer.
C. Field quality-control reports.
D. Sample warranty.

1.5 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:
   a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
   b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
   c. Complete wiring diagrams showing connections between all devices and equipment.
   d. Riser diagram.
   e. Record copy of site-specific software.
   f. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
       1) Equipment tested.
       2) Frequency of testing of installed components.
       3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.
   g. Manufacturer's required maintenance related to system warranty requirements.
   h. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:
   1. Software operating and upgrade manuals.
   2. Program Software Backup: On magnetic media or compact disk, complete with data files.
   3. Device address list.
   4. Printout of software application and graphic screens.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
   1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

E. 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.
2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
   2. Heat detectors.
   3. Smoke detectors.
   4. Automatic sprinkler system water flow.
   5. Dry system pressure flow switch.

B. Fire-alarm signal shall initiate the following actions:
   1. Continuously operate alarm notification appliances.
   2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
   3. Transmit an alarm signal to the remote alarm receiving station.
   4. Release fire and smoke doors held open by magnetic door holders.
   5. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
   6. Activate preaction system.
   7. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:
   1. Valve supervisory switch.
   2. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
   3. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:
   1. Open circuits, shorts, and grounds in designated circuits.
   2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
   3. Loss of communication with any addressable sensor, input module, relay, control module, or remote annunciator.
   4. Loss of primary power at fire-alarm control unit.
   5. Ground or a single break in internal circuits of fire-alarm control unit.
   6. Abnormal ac voltage at fire-alarm control unit.
   7. Break in standby battery circuitry.
   8. Failure of battery charging.
   9. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Supervisory Signal Actions:
   1. Initiate notification appliances.
   2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
   3. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.

2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.

3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, Class B.
2. Pathway Survivability: Level 0.

D. Notification-Appliance Circuit:

1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

E. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls be connected to fire-alarm system.

F. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.

G. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

H. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

I. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38.

1. Single-action mechanism, 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.

2.5 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.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

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.).

2.6 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature or a rate of rise.

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.
2.7 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.

C. Visible Notification Appliances: Xenon strobe lights complying 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. Mounting: Wall mounted unless otherwise indicated.
   2. Flashing shall be in a temporal pattern, synchronized with other units.

2.8 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
   1. Electromagnets: Require no more than 3 W to develop 25-lbf (111-N) holding force.
   2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
   3. Rating: 24-V ac or dc.

B. Material and Finish: Match door hardware.

2.9 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
   1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

A. General:
   1. Include address-setting means on the module.
   2. Store an internal identifying code for control panel use to identify the module type.
B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Control Module:
   1. Operate notification devices.
   2. Operate solenoids for use in sprinkler service.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:
   1. Verification that both telephone lines are available.
   2. Programming device.
   3. LED display.
   5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:
   1. Address of the alarm-initiating device.
   2. Address of the supervisory signal.
   3. Address of the trouble-initiating device.
   4. Loss of ac supply.
   5. Loss of power.
   6. Low battery.
   7. Abnormal test signal.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.
PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above the finished floor.

C. Manual Fire-Alarm Boxes:
   1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.
   3. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.

D. Smoke- or Heat-Detector Spacing: Comply with NFPA 72.

E. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

F. 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. Install all devices at the same height unless otherwise indicated.

G. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.

H. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.2 PATHWAYS

A. Pathways shall be installed in EMT.

B. Exposed EMT shall be painted red enamel.

3.3 CONNECTIONS

A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
   1. Electronically locked doors and access gates.
   2. Supervisory connections at valve supervisory switches.
   3. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
4. Magnetically held-open doors.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Install framed instructions in a location visible from fire-alarm control unit.

3.5 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.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.6 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by Architect and authorities having jurisdiction.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visual Inspection: Conduct visual inspection prior to testing.

   a. Inspection shall be based on completed record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter.

   b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.


3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.

4. Test audible appliances for the private operating mode according to manufacturer's written instructions.

5. Test visible appliances for the public operating mode according to manufacturer's written instructions.

6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

D. Fire-alarm system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.
F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.7 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
   1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 284621.11
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. Protecting existing vegetation to remain.
   2. Removing existing vegetation.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Stripping and stockpiling rock.
   6. Removing above- and below-grade site improvements.
   7. Disconnecting, capping or sealing, and removing site utilities, abandoning site utilities in place.
   8. Temporary erosion and sedimentation control.

B. Related Requirements:
   1. Section 015000 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

C. Related Requirements:
   1. Section 015000 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.
D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.

G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.6 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.

2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and stockpiling program.

C. Rock stockpiling program.

D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.7 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.
B. Rock Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.8 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
   1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify utility locator service, Call Before You Dig, One Call for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and tree-protection measures are in place.

F. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."

G. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
   1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.
PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 "Temporary Tree and Plant Protection."

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.4 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
   1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
   1. Arrange with utility companies to shut off indicated utilities.
   2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities intended to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition."

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Grind down stumps and remove roots larger than 2 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
   3. Use only hand methods or air spade for grubbing within protection zones.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

   1. Limit height of topsoil stockpiles to 72 inches.
   2. Do not stockpile topsoil within protection zones.
   3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
   4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Burning tree, shrub, and other vegetation waste is permitted according to burning requirements and permitting of authorities having jurisdiction. Control such burning to produce the least smoke or air pollutants and minimum annoyance to surrounding properties. Burning of other waste and debris is prohibited.

C. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000
SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY
   A. Section includes soil treatment for termite control.

1.2 ACTION SUBMITTALS
   A. Product Data: Treatments and application instructions, including EPA-Registered Label.

1.3 INFORMATIONAL SUBMITTALS
   A. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements of the N.C. Dept. of Agriculture, Structural Pest Control Division.

   B. Bill of materials (proof of quantity of material purchased), estimate of square footage of coverage (area of treated ground) and certification that mix and rates of application comply with governing restrictions and manufacturers recommendations. Quantities will be verified.

   C. Qualification Data: For applicator.

   D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner’s record information, including the following as applicable:
      1. Date and time of application.
      2. Moisture content of soil before application.
      3. Brand name and manufacturer of termiticide.
      4. Quantity of undiluted termiticide used.
      5. Dilutions, methods, volumes, and rates of application used.
      6. Areas of application.
      7. Water source for application.

   E. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE
   A. Applicator Qualifications: A Pest Control Operator who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.

   B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

D. Source Limitations: Obtain termite control products from single manufacturer for each product.

E. Testing: If required by the Architects Construction Administrator or Owner, the Contractor shall contact the NC Department of Agriculture to have treated soil tested to verify application compliance. Allow a minimum of 2 days notice to schedule inspection.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

1.6 COORDINATION

A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.7 WARRANTY

A. Special Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

   1. Warranty Period: Five years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

A. Continuing Service: Provide a proposal for continuing service, including monitoring, inspection, and retreatment for occurrences of termite activity, from applicator to Owner, in the form of a standard yearly (or other period) continuing service agreement, starting on the date of Substantial Completion. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Manufacturers: Subject to compliance with requirements of the N.C. Dept. of Agriculture, Structural Pest Control Division, provide products by one of the following:

   1. AgrEvo Environmental Health, Inc.
   2. Bayer Corp.
   3. Dow AgroSciences.
4. FMC Corp.
5. Zeneca Ag Products.

B. Termiticide: Provide an EPA-registered termiticide, complying with requirements of state and local authorities having jurisdiction, in a soluble or emulsible concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

1. Use only soil treatment solutions that are not harmful to plants.
2. Use compatible dye in termiticide to provide visible evidence of treatment.
3. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.

C. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a
continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.

1. Slabs-on-Grade: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.
4. Penetrations: At expansion joints, control joints, and areas where slabs and below-grade walls will be penetrated.

B. Post warning signs in areas of application.

C. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified independent testing agency to perform field quality-control testing and provide report to Architect.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer receiving termiticide treatment. Proceed with subsequent work only after inspections for previously completed work comply with requirements.

C. When testing agency reports that subgrades, fills, or backfills have not been adequately treated with termiticide, reapply treatment and retest until specified treatment has been achieved.

3.6 PROTECTION

A. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

B. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

END OF SECTION 313116
SECTION 321216 - ASPHALT PAVING

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. Cold milling of existing asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt overlay.
5. Asphalt curbs.
6. Asphalt traffic-calming devices.
7. Asphalt surface treatments.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for demolition and removal of existing asphalt pavement.
2. Section 312000 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
3. Section 321313 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.
4. Section 321373 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.
5. Section 321400 "Unit Paving" for bituminous setting bed for pavers and for stone and precast concrete curbs.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

   a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.4 SUBMITTALS
A. Product Data: For each type of product.
   1. Include technical data and tested physical and performance properties.
   2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
B. Material Certificates: For each paving material, from manufacturer.
C. Material Test Reports: For each paving material.
D. Field quality-control reports.

1.5 QUALITY ASSURANCE
A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by NCDOT.
B. Testing Agency Qualifications: Qualified according to ASTM D3666 for testing indicated.
C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of NCDOT and the Town of Fuquay-Varina for asphalt paving work.
   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.6 FIELD CONDITIONS
A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
   1. Prime Coat: Minimum surface temperature of 60 deg F.
   2. Tack Coat: Minimum surface temperature of 60 deg F.
   4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
   5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
   1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D242, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a, PG 64-22.

B. Cutback Prime Coat: ASTM D2027, medium-curing cutback asphalt, MC-30 or MC-70.

C. Emulsified Asphalt Prime Coat: ASTM D977 emulsified asphalt, or ASTM D2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

D. Tack Coat: ASTM D977 emulsified asphalt, or ASTM D2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

E. Fog Seal: ASTM D977 emulsified asphalt, or ASTM D2397 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

F. Water: Potable.

G. Undersealing Asphalt: ASTM D3141/D3141M; pumping consistency.

2.3 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

B. Sand: ASTM D1073, Grade No. 2 or No. 3.

C. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

2.4 MIXES

A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by NCDOT; designed according to procedures in AIM-2, "Asphalt Mix Design Methods for Asphalt Concrete and other Hot-Mix Types"

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excessive yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

3.3 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

1. Mill to a depth of 1-1/2 inches to 3 inches or the full pavement depth.
2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
3. Control rate of milling to prevent tearing of existing asphalt course.
4. Repair or replace curbs, driveway aprons, manholes, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Patch surface depressions deeper than 1 inch after milling, before wearing course is laid.
7. Handle milled asphalt material according to approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."
8. Keep milled pavement surface free of loose material and dust.
9. Do not allow milled materials to accumulate on-site.

3.4 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Undersealing: Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

E. Placing Patch Material: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.5 SURFACE PREPARATION

A. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
   1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
   1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
   2. Protect primed substrate from damage until ready to receive paving.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.6 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. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
   2. Place hot-mix asphalt surface course in number of lifts and thicknesses indicated.
   3. Spread mix at a minimum temperature of 250 deg F.
   4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
   5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
   1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
   2. Complete a section of asphalt base course before placing asphalt surface course.

C. 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.
3.7 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. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. 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."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.8 COMPACTION

A. General: 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.

1. Complete compaction before mix temperature cools to 185 deg F

B. 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.

C. 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: 96 percent of reference laboratory density according to ASTM D6927, but not less than 94 percent or greater than 100 percent.
2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D2041/D2041M, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. 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.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
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.

3.9 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.
2. Surface Course: Plus 1/4 inch, 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 straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D3549/D3549M.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D979/D979M.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041/D2041M, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D1188 or ASTM D2726/D2726M.

   a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
   b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D1188 or ASTM D2726/D2726M.

E. Replace and compact hot-mix asphalt where core tests were taken.
F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.11 DISPOSAL

A. Remove excavated materials from Project Site and legally dispose of them in an EPA approved landfill.
   1. Do not allow milled materials to accumulate on site.

END OF SECTION 321216
This page intentionally left blank.
SECTION 321313 - CONCRETE PAVING

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. Walks.
   2. Curbs

B. Related Sections:
   1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
   2. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

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

B. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. Design Mixtures for Credit ID 1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements. For each design mixture submitted, include an equivalent concrete mixture that does not contain portland cement replacements, to determine amount of portland cement replaced.

C. Other Action Submittals:
   1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer.

B. Material Certificates: For the following, from manufacturer:
   1. Cementitious materials.
   2. Steel reinforcement and reinforcement accessories.
   3. Fiber reinforcement.
   4. Admixtures.
   5. Curing compounds.

C. Material Test Reports: For each of the following:
   1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

D. Field quality-control reports.

E. Product Submittals: Submit cut sheets of detectable warning paver selection. Include paver choice and color.

1.6 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.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

C. Slip Resistance: The project shall conform to the Occupational Safety and Health Administration recommendations for walking surfaces have a static coefficient of friction of 0.5. A static coefficient of friction of 0.6 is required for accessible routes and 0.8 for ramps.

D. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

E. ACI Publications: Comply with ACI 301 unless otherwise indicated.

F. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to concrete paving, including but not limited to, the following:
      a. Concrete mixture design.
b. Quality control of concrete materials and concrete paving construction practices.
c. Sub base and base preparation
d. Form work layout
e. Finish, finish tools and finishing process

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Concrete paving subcontractor.

1.7 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces. Use material appropriate to obtain the correct quality and alignments.

1. Use 2” thick wood forms or formed steel forms for straight lines and rectangular applications

2. Use flexible forms capable of delivering smoothly curved formwork free of kinks, bulges, or flats. Forms can be steel, plastic or wood, but must have adequate joining methods to allow the smooth flow of curved lines through the union of form sections.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from steel wire into flat sheets.

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

D. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars galvanized after fabrication according to ASTM A 767/A 767M, Class I coating. Cut bars true to length with ends square and free of burrs.
2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C 150, gray Portland cement Type I. The following are allowed supplements:
   a. Fly Ash: ASTM C 618, Class F.
   b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 4S, uniformly graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 1 inches nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: Potable and complying with ASTM C 94/C 94M.


E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

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.

2.4 CURING MATERIALS

A. Water: Potable.

B. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B, dissipating.

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. Anti-Hydro International, Inc.; A-H Curing Compound #2 DR WB.
   b. ChemMasters; Safe-Cure Clear.
   c. Conspec by Dayton Superior;
   d. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
   e. Edoco by Dayton Superior;
   f. Euclid Chemical Company (The), an RPM company; Kurez W VOX.
   g. Kaufman Products, Inc.; Thinfilm 420.
   h. Lambert Corporation; AQUA KURE - CLEAR.
   i. L&M Construction Chemicals, Inc.; L&M CURE R.
   j. Meadows, W. R., Inc.; 1100-CLEAR SERIES.
   k. Nox-Crete Products Group; Resin Cure E.
   l. SpecChem, LLC; PaveCure Rez.
   m. Symons by Dayton Superior; Resi-Chem Clear.
2.5 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic curb and gutter machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
3. Slump Limit: 5 inches, plus or minus 1 inch.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 5-1/2 percent plus or minus 1.5 percent.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture or plasticizing and retarding admixture in concrete as required for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:

1. Fly Ash or Pozzolan: 25 percent.
2. Ground Granulated Blast-Furnace Slag: 50 percent.
3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

2.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances. Grades should be compacted, smooth and free of dips, ridges or other potential snags that could cause less predictable cracking.

B. Proof-roll prepared base surface below concrete paving to identify soft pockets and areas of excess yielding.
   1. Completely proof-roll base in one direction [for pedestrian applications] and repeat in perpendicular direction [for vehicular applications]. Limit vehicle speed to 3 mph.
   2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
   3. Correct base with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Division 31 Section "Earth Moving." Do not fill with concrete.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted base surface immediately before placing concrete.

B. Place and compact base materials according to “Hot Mixed Asphalt Paving” specifications for ABC gravel.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI’s "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS
A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.

C. Expansion Joints: Form isolation joints of preformed joint-filler strips abutting buildings, columns, footings, concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals shown in the drawings but not more than 40’.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in. Provide notification to Landscape Architect no less than 48 hours prior to installation to arrange for on-site inspection of formwork.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into.

G. Consolidate concrete according to ACI 301 by hand spading, rodding, or tamping.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
   1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
   1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
   2. Do not use frozen materials or materials containing ice or snow.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

M. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
   3. Fog-spray forms and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface by hand floating. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
   1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
   2. Acrylic Color Seal Coat Graphics: Finish concrete per manufacturer’s recommendations for proper adherence of seal coat to concrete paving and to produce a medium textured finished surface.
3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. 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 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.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by curing compound as follows:
   1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.9 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:
   1. Elevation: 3/4 inch.
   4. Lateral Alignment and Spacing of Dowels: 1 inch.
   8. Joint Spacing: as shown on the drawing
   9. Joint alignment: when aligned with plan identified site element, ¼”.
   10. Edge alignment – no more than ½” out of alignment over 20’
   11. Joint straightness – no more than ½” out of alignment over 20’

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain at least one composite sample for the first 20 yards and one each 100 cu. yd. thereafter or fraction thereof of each concrete mixture placed each day.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.

   a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

H. Prepare test and inspection reports.

3.11 CONCRETE REJECTION AND REPLACEMENT

A. Concrete paving will be considered defective if it:

1. Does not pass tests and inspections.
2. Does not meet layout and alignments,
3. Does not have a consistent color and texture
4. Shows spalling, alligator cracking or cracking due to base failures.
5. Jointing is installed after contraction cracking has occurred,
6. Jointing and edges are not smooth curves or in straight lines as indicated by the drawings,
7. Exceeds the gradients indicated on the plans,
8. Does not adequately drain water away as shown on the drawings.

B. Defective concrete shall be removed immediately and replaced with acceptable concrete work at the Contractor's expense.

3.12 REPAIRS AND PROTECTION
A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313
This page intentionally left blank.
SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Cold-applied joint sealants.
   2. Joint-sealant backer materials.
   3. Primers.

B. Related Requirements:
   1. Section 079200 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

1.3 PREINSTALLATION MEETINGS
A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. 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.
C. Paving-Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.

1.5 INFORMATIONAL SUBMITTALS
A. Qualification Data: For testing agency.
B. Product Certificates: For each type of joint sealant and accessory.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1.7 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.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.2 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D5893/D5893M, Type NS.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Crafco Inc.
   b. Dow Corning Corporation.
   c. Pecora Corporation.

B. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D5893/D5893M, Type SL.
1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. **Crafco Inc.**
   b. **Dow Corning Corporation.**
   c. **Pecora Corporation.**

C. **Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant:** ASTM C920, Type M, Grade NS, Class 25, for Use T.

   1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. **W.R. Meadows, Inc.**

D. **Single Component, Pourable, Urethane, Elastomeric Joint Sealant:** ASTM C920, Type S, Grade P, Class 25, for Use T.

   1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. **W.R. Meadows, Inc.**

E. **Multicomponent, Pourable, Urethane, Elastomeric Joint Sealant:** ASTM C920, Type M, Grade P, Class 25, for Use T.

   1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. **Pecora Corporation.**

2.3 **JOINT-SEALANT BACKER MATERIALS**

A. **No rigid plastic joint materials for expansion joint and no rigid plastic cap over other expansion joint material.**

B. **Joint-Sealant Backer Materials:** Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

C. **Round Backer Rods for Cold- and Hot-Applied Joint Sealants:** ASTM D5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
D. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

E. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.4 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on 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.

3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions.
C. Install joint-sealant backings to support joint 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 joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact 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.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements 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 joint sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.5 PAVING-JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Joints within concrete paving.

1. Joint Location:
   a. Expansion and isolation joints in concrete paving.

3. Joint-Sealant Color: to match adjacent concrete paving within manufacturer’s standard range of colors.

END OF SECTION 321373
SECTION 321723 - PAVEMENT MARKINGS

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 painted markings applied to asphalt pavement.

1.3 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at [Project site] <Insert location>.
      1. Review methods and procedures related to marking pavement including, but not limited
         to, the following:
         a. Pavement aging period before application of pavement markings.
         b. Review requirements for protecting pavement markings, including restriction of
            traffic during installation period.

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of product.
      1. Include technical data and tested physical and performance properties.

1.5 QUALITY ASSURANCE
   A. Regulatory Requirements: Comply with materials, workmanship, and other applicable
      requirements of NCDOT and Town of Fuquay-Varina for pavement-marking work.
      1. Measurement and payment provisions and safety program submittals included in standard
         specifications do not apply to this Section.

1.6 FIELD CONDITIONS
   A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at
      a minimum ambient or surface temperature of 40 deg F for alkyd materials, 55 deg F for water-
      based materials, and not exceeding 95 deg F.
PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design".

2.2 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, colors complying with FS TT-P-1952.

B. Pavement-Marking Paint: MPI #32, solvent-borne traffic-marking paint.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
   1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
3.3 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723
This page intentionally left blank.
SECTION 321813 - SYNTHETIC GRASS SURFACING

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 synthetic grass surfacing.

B. Related Requirements:

1. Section 312000 "Earth Moving" for preparation, compaction, and grading of granular base.

2. Section 334600 "Subdrainage" for subsurface drainage system.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For synthetic grass surfacing.

1. Include sections and details.

2. Show locations of seams and method of seaming.

3. Show layout of game lines, numbers, and letters. Indicate application method of each line and marking.

4. Show location and layout of team logo/graphics.

C. Samples: For each type of synthetic grass surfacing indicated.

1. Turf Fabric: 12” square.

2. Shock-Attenuation Pad: 12 inches square.

3. Seam Sample: 24 inches square with seam centered in sample.
1.5 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For Installer.
   B. Product Test Reports: For each synthetic grass surfacing assembly.
   C. Field quality-control reports.
   D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For synthetic grass surfacing, including maintenance cleaning instructions, to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS
   A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
      1. Turf Fabric: Minimum of 150 sq. ft. for each type indicated.
      2. Seaming Tape and Adhesive: One roll of seaming tape and one gallon of adhesive.
      3. One new set of maintenance tools, of type recommended by synthetic grass surfacing manufacturer for installation.

1.8 QUALITY ASSURANCE
   A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING
   A. Store materials in location and manner to allow installation of synthetic grass surfacing without excess disturbance of granular base.

1.10 WARRANTY
   A. Special Warranty: Manufacturer agrees to repair or replace synthetic grass surfacing that fails in materials or workmanship within specified warranty period.
      1. Failures include, but are not limited to, the following:
         a. Deterioration and excessive wear.
         b. Deterioration from UV light.
         c. Excessive loss of shock attenuation.
         d. Seam separation, including game lines and markings.
2. Warranty Period: 8 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Turf Fabric: Turf fabric tested according to the following methods, with additional test method conditions for each method according to ASTM F1551.

1. Tuft Bind: Not less than 8 lbf according to ASTM D1335.
2. Breaking Strength: Minimum 200 lbf in warp direction and minimum 200 lbf perpendicular to warp direction, according to ASTM D5034.

B. Synthetic Grass Surfacing: Assembly tested according to the following methods, with additional test method conditions for each method according to ASTM F1551.

1. Shock Attenuation: No greater than 200 G(max) at time of installation according to ASTM F355.
2. Abrasiveness Index: 37 according to ASTM F1015.

C. Permeability: 30 in./h of rainfall capacity according to ASTM F2898 or EN 15330-1.

2.2 SYNTHETIC GRASS SURFACING

A. Synthetic Grass Surfacing: Complete surfacing system, consisting of synthetic yarns bound to water-permeable backing and infill indicated, suitable for playgrounds.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

b. FieldTurf, a Tarkett Sports Company.
c. Forever Lawn Playground Grass

B. Turf Fabric: Woven turf fabric with multicolored fiber and UV resistance, complying with the following:

2. Lead Content of Yarn Fiber: Maximum of 100 ppm according to ASTM F2765.
3. Pile Weight: 41 oz./sq. yd. according to ASTM D5848.
4. Pile Height: 2” according to ASTM D5823.

C. Seaming Method: Sewn.
2.3  MATERIALS

A. Seaming Cord: Seaming cord or thread, recommended by the synthetic grass surfacing manufacturer.

B. Shock-Attenuation Pad: Porous composite consisting of rubber granules bound with urethane adhesive, 8 mm thick. Provide shock-attenuation pad with permeability sufficient to meet synthetic grass surfacing assembly permeability indicated.

PART 3 - EXECUTION

3.1  EXAMINATION

A. Examine base and other conditions, with Installer present, for compliance with requirements for installation tolerances, permeability, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2  INSTALLATION

A. Avoid disturbance of base during installation of shock-attenuation pad and turf fabric.

B. Shock-Attenuation Pad Installation: Roll out pad and allow to relax a minimum of six hours prior to final fit and trim. Stagger head seams between adjacent rows. Fit seams snugly without stretching or forcing.

C. Roll out turf fabric and allow to relax at least four hours prior to seaming.

D. Provide seams flat and snug, with no gaps or fraying. Remove yarns that are trapped within seams. Attach turf fabric to perimeter restraint system as recommended by the manufacturer.

E. Install inlaid game lines and markings by cutting through turf fabric and installing snugly fitting game line turf fabric. Provide seaming tape that extends minimum 6 inches beyond seam.

F. Repair loose seams and bubbles formed due to expansion of turf fabric prior to installation of infill.

3.3  FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:

1. Permeability: 30 in./h of rainfall capacity according to ASTM F2898 or EN 15330-1.
2. Shock Attenuation: No greater than 200 G(max) at time of installation according to ASTM F1936.
3.4 DEMONSTRATION

A. Train Owner's maintenance personnel in proper maintenance procedures for synthetic grass surfacing.

END OF SECTION 321813
SECTION 321816.13 - PLAYGROUND PROTECTIVE SURFACING

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. Unitary, seamless surfacing.

1.3 DEFINITIONS

A. Definitions in ASTM F2223 apply to Work of this Section.

B. Critical Height: Standard measure of shock attenuation according to ASTM F2223; same as "critical fall height" in ASTM F1292. According to ASTM F1292, this approximates "the maximum fall height from which a life-threatening head injury would not be expected to occur."

C. SBR: Styrene-butadiene rubber.

D. Unitary Surfacing: A protective surfacing of one or more material components bound together to form a continuous surface; same as "unitary system" in ASTM F2223.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of protective surfacing.
   1. Include plans, sections, placement and penetration details, and attachment to substrates.
   2. Include accessories and edge terminations.
   3. Include patterns made by varying colors of surfacing and details of graphics.
   4. Include fall heights and use zones for equipment and structures specified in Section 116800 "Play Field Equipment and Structures," coordinated with the critical heights for protective surfacing.

C. Samples for Initial Selection: For each type of exposed finish.
   1. Include Samples of accessories involving color selection.
D. Samples for Verification: For each type of protective surfacing and exposed finish.

1. Include Samples of accessories to verify color and finish selection.
2. Unitary Seamless Surfacing: Minimum 6 by 6 inches
3. Stabilizing Mats: Minimum 12 by 12 inches

E. Product Schedule: For protective surfacing. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.
B. Product Certificates: For each type of unitary surfacing product.
C. Field quality-control reports.
D. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground protective surfacing 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. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for materials and execution.

1. Build mockups for protective surfacing including accessories.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of protective surfacing that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
   a. Reduction in impact attenuation as measured by reduction of critical fall height.
   b. Deterioration of protective surfacing and other materials beyond normal weathering.

2. Warranty Period: 7 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

   A. Source Limitations: Obtain protective surfacing materials from single source from single manufacturer.
      1. Provide geosynthetic accessories of each type from source recommended by manufacturer of protective surfacing materials.

2.2 PERFORMANCE REQUIREMENTS

   A. Impact Attenuation: Critical fall height tested according to ASTM F1292.
   B. Accessibility Standard: Minimum surfacing performance according to ASTM F1951.

2.3 UNITARY, SINGLE-DENSITY, SEAMLESS SURFACING

   A. Description: Manufacturer's standard, site-mixed and applied, single-layer material in thickness as required, tested for impact attenuation according to ASTM F1292 and for accessibility according to ASTM F1951.
      1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
         a. Child Safe Products, Inc.; Everguard
         b. GameTime; a PlayCore, Inc. company; GT Impax Poured Rubber
         c. Surface America, Inc.; Playbound and Evertop (deduct alternate #1)
         d. Xgrass; Pour in Place Playground Safety Surfacing
   
2. Wearing Layer: Formulation of EPDM rubber particles with a minimum of 20 percent and maximum of 26 percent of ethylene propylene-diene-saturated polymethylene main chain, binder, and other organic and inorganic components.

3. Cushioning Layer: Manufacturer’s standard formulation of SBR particles and binder


5. Critical Height:
a. Accommodate playground manufacturer’s critical fall height within the fall protection zone for each playground equipment and account for increases in critical fall height due to changes in finish grade of play surface below playground equipment.

b. 6'-0" outside fall protection zones for each playground equipment.

6. Overall Thickness: Not less than as required for critical height indicated.

7. Primer/Adhesive: Manufacturer's standard primer and weather-resistant, moisture-cured polyurethane adhesive suitable for unit, substrate, and location.

8. Color(s): As selected by Landscape Architect from manufacturer's full range.
   a. Design: Where colored pattern is required, provide as indicated on Drawings.

B. Leveling and Patching Material: Portland cement-based grout or epoxy- or polyurethane-based formulation suitable for exterior use and approved by protective surfacing manufacturer.

2.4 GEOSYNTHETIC ACCESSORIES

A. Drainage/Separation Geotextiles: Comply with Section 312000 "Earth Moving."

B. Drainage/Separation Geotextile: Nonwoven, needle-punched geotextile, manufactured for drainage applications and made from polyolefins or polyesters; with the following minimum properties:

1. Weight: 4 oz./sq. yd.; ASTM D5261.

2. Water Flow Rate: 100 gpm/sq. ft. according to ASTM D4491.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for subgrade elevations, slope, and drainage and for other conditions affecting performance of the Work.

1. Verify that substrates are sound and without high spots, ridges, holes, and depressions.

B. Hard-Surface Substrates: Verify that substrates are satisfactory for unitary, protective surfacing installation and that substrate surfaces are dry, cured, and uniformly sloped to drain within recommended tolerances according to protective surfacing manufacturer's written requirements for cross-section profile.

1. Asphalt Substrates: Verify that substrates are dry, sufficiently cured to bond with adhesive, and free from surface defects, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with protective surfacing or that may interfere with adhesive bond.

C. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Prepare substrates to receive surfacing products according to protective surfacing manufacturer's written instructions.

B. Hard-Surface Substrates: Clean surface free of laitance, efflorescence, curing compounds, and other contaminants incompatible with protective surfacing.

   1. Repair: Fill holes and depressions in unsatisfactory surfaces with leveling and patching material.
   2. Treatment: Mechanically abrade or otherwise prepare concrete substrates according to protective surfacing manufacturer's written instructions to achieve adequate roughness.
   4. Treat control joints and other nonmoving substrate cracks to prevent telegraphing through protective surfacing.

3.3 INSTALLATION OF GEOSYNTHETIC ACCESSORIES

A. Install geosynthetic accessories before edging and according to playground surface system manufacturer's and geosynthetic manufacturer's written instructions and in a manner that cannot become a tripping hazard.

   1. Drainage/Separation Geotextile: Completely cover area beneath protective surfacing, overlapping geotextile sides and edges a minimum of 8 inches with manufacturer's standard treatment for adhesively bonded or taped seams.

3.4 INSTALLATION OF SEAMLESS SURFACING

A. Mix and apply components of seamless surfacing according to manufacturer's written instructions to produce uniform, monolithic, and impact-attenuating protective surfacing of required overall thickness.

   1. Substrate Primer: Apply over prepared substrate at manufacturer's standard spreading rate for type of substrate.
   2. Poured Cushioning Layer: Spread evenly over primed substrate to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation, with a minimum of cold joints.
   3. Intercoat Primer: Over cured cushioning layer, apply primer at manufacturer's standard spreading rate.
   4. Wearing Layer: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation and, except where color changes, with no cold joints. Finish surface to produce manufacturer's standard wearing-surface texture.

   a. Design: Where graphic design is required, place colored, design material as soon as previously placed material is sufficiently cured, using primer or adhesive if required by manufacturer's written instructions.
5. Lacquer Topcoat: Spray or roller applied at manufacturer's standard coating rate in one continuous operation.
6. Edge Treatment: Flush. Fully adhere edges to substrate with full coverage of substrate. Maintain fully cushioned thickness required to comply with performance requirements.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests.

B. Perform the following tests with the assistance of a factory-authorized service representative:

1. Perform "Installed Surface Performance Test" according to ASTM F1292 for each protective surfacing type and thickness in each playground area.
2. Perform installed-surface-performance tests at no less than one series of tests for each 1000 sq. ft. of each type and thickness of in-place protective surfacing or part thereof.

C. Playground protective surfacing will be considered defective if it does not pass tests.

D. Prepare test reports.

3.6 PROTECTION

A. Prevent traffic over seamless surfacing for not less than 48 hours after installation.

END OF SECTION 321816.13
SECTION 323123 – WELDED WIRE FENCING

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. Welded wire fencing.

B. Related Sections:
   1. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete post footings.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design welded wire fencing, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Welded wire fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:
   1. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified and on the following:
      a. Wind Loads: 100-110 mph.
      b. Exposure Category: B.
      c. Fence Height: Refer to plans.

C. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for welded wire fencing.
1. Fence and gate posts, rails, and fittings.
2. Welded wire fabric, reinforcements, and attachments.
3. Accessories: Privacy slats.
4. Gates and hardware.

B. Samples for Initial Selection: For components with factory-applied color finishes.

C. Samples for Verification: Prepared on Samples of size indicated below:

   1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

D. Delegated-Design Submittal: For welded wire fences and gate framework 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. Qualification Data: For qualified professional engineer.

B. Product Certificates: For each type of welded wire fence, and gate, from manufacturer.

C. Product Test Reports: For framing strength according to ASTM F 1043.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:

   1. Polymer finishes.
   2. Gate hardware.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing fence grounding. Member company of NETA or an NRTL.

   1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. 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.
C. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.

D. Mockups: Build mockups to set quality standards for fabrication and installation.
   1. Include 10-foot length of fence and gate.

E. Preinstallation Conference: Conduct conference at Project site.
   1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
   2. Review sequence of operation for each type of gate operator.
   3. Review coordination of interlocked equipment specified in this Section and elsewhere.
   4. Review required testing, inspecting, and certifying procedures.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for welded wire fencing shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of welded wire fencing that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WELDED WIRE FENCE

A. General: Subject to compliance with requirements provide Basis of Design product indicated or an Architect approved equal. Comply with CLFMI Product Manual and with requirements indicated below:
   1. Basis of Design: WireWall Riverdale Security Fence
   2. Fabric Height: As indicated on Drawings.
   3. Steel Wire Fabric: Rectangular mesh, oriented vertically as shown on Drawings.
      a. Polymer-Coated Fabric: ASTM F 668, Class 2b over zinc-coated steel wire.
         1) Color: Black, complying with ASTM F 934.
b. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.

2.2 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:

1. Fence Height: As indicated on Drawings.
2. Polymer coating over metallic coating.
   a. Color: Black, complying with ASTM F 934.

2.3 TENSION WIRE

A. Polymer-Coated Steel Wire: 0.177-inch diameter, tension wire complying with ASTM F 1664, Class 2b over zinc-coated steel wire.


B. Aluminum Wire: 0.192-inch diameter tension wire, mill finished, complying with ASTM B 211, Alloy 6061-T94 with 50,000-psi minimum tensile strength.

2.4 FITTINGS

A. General: Comply with ASTM F 626.

B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
2. Rail Clamps: Line and corner boulevard clamps for connecting bottom rails in the fence line-to-line posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches shorter than full height of welded wire fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
   1. Standard Round Wire Ties: For attaching welded wire fabric to posts, rails, and frames, complying with the following:

I. Finish:
   1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. zinc.
      a. Polymer coating over metallic coating.

2.5 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

2.6 FENCE GROUNDING

A. Refer to electrical specifications for grounding requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
   1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

A. Install welded wire fencing to comply with ASTM F 567 and more stringent requirements indicated.

1. Install fencing on established boundary lines inside property line.

3.4 WELDED WIRE FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

a. Concealed Concrete: Top 2 inches below grade to allow covering with surface material.

C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 30 degrees or more.

D. Line Posts: Space line posts uniformly at 10 feet o.c.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

H. Intermediate and Bottom Rails: Install and secure to posts with fittings.

I. Welded wire Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.

K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to welded wire fabric, wrap wire around post a minimum of 180 degrees, and attach other end to welded wire fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

M. Privacy Slats: Install slats in direction indicated, securely locked in place.

1. Vertically, for privacy factor of 70 to 75.

3.5 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.6 GROUNDING AND BONDING

A. Fence Grounding: Refer to electrical specifications.
3.7 FIELD QUALITY CONTROL

A. Grounding-Resistance Testing: Engage a qualified testing agency to perform tests and inspections.
   
   1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance no fewer than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
   
   2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
   
   3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

3.8 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

   B. Lubricate hardware and other moving parts.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain welded wire fencing.

END OF SECTION 323123
SECTION 323300 - SITE FURNISHINGS

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. Seating.
   2. Tables.
   3. Trash receptacles.

B. Related Requirements:
   1. Section 033000 "Cast-in-Place Concrete" for installing pipe sleeves cast installing anchor bolts cast formed voids in concrete footings.
   2. Section 312000 "Earth Moving" for excavation for installing concrete footings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

C. Samples for Initial Selection: For units with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish, not less than 6-inch-long linear components and 4-inch-square sheet components.

E. Product Schedule: For site furnishings. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For site furnishings manufactured with preservative-treated wood.

   1. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
1.5 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For site furnishings to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS
   A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
      1. Bench Replacement Slats: No fewer than two full-size units for each size indicated.
      2. Trash Receptacle Inner Containers: Two full-size units for each size indicated

PART 2 - PRODUCTS

2.1 SEATING
   A. **Manufacturers:** Subject to compliance with requirements, provide products by the following:
      1. **Maglin Site Furniture Inc.**
         a. Ogden bench, 8’ length, backless, pedestal leg
         b. Ogden Seat top, 5’ length, backless, on seatwall

   B. Seat:
      1. Material:
         a. Wood: Ipe; slat direction front to back.
      2. Seat Height: As indicated.
      3. Seat Surface Shape: Flat.
      4. Overall Width: As indicated.
      5. Overall Depth: As indicated.
      6. Arms: None.
      7. Seating Configuration: (4) curved free standing units in courtyard and (1) seat top on seat wall at main entry

   C. Steel Finish: Powder coated steel.
      1. Color: As selected by Landscape Architect from manufacturer's full range.

   D. Wood Finish: Manufacturer's standard finish.
      1. Stain: Manufacturer's standard.
2.2 TABLES

A. **Manufacturers**: Subject to compliance with requirements, provide products by the following:

1. **DuMor Inc.** Model # 298 6’ table with 2 benches, S-1 (embedment) support

B. **Frame**: Steel.

C. **Table Top**:

   1. **Material**:
      a. **Wood**: Ipe
   2. **Feature**: Center umbrella hole.

D. **Steel Finish**: powder coated.

   1. **Color**: As selected by Landscape Architect from manufacturer's full range.

E. **Wood Finish**: Manufacturer's standard finish.

   1. **Stain**: Manufacturer's standard.

2.3 TRASH RECEPTACLES

A. **Manufacturers**: Subject to compliance with requirements, provide products by one of the following:

1. **DuMor Inc.** Receptacle 44
   a. [https://dumor.com/products/receptacles/receptacle-44](https://dumor.com/products/receptacles/receptacle-44)

2. **Maglin Site Furniture Inc.**

B. **Wood Facing Surrounds**: evenly spaced ipe wood slats.

C. **Support Frames**: Steel; welded.

D. **Trash Receptacles**:

   1. **Receptacle Shape and Form**: As indicated; with opening for depositing trash in receptacle top or side.
   2. **Lids and Tops**: Matching facing panels secured by cable or chain, hinged, swiveled, or permanently secured.
      a. **Description**: Elevated flat or shallow dome rain-cap lid.
   3. **Receptacle Height**: As indicated.
   4. **Overall Width**: As indicated.
   5. **Inner Container**: per manufacturer's standard designation
   6. **Disposable Liners**: Provide receptacle designed to accommodate disposable liners.
7. Capacity: Not less than 22 gal.
8. Service Access: Removable lid or top; inner container and disposable liner lift or slide-out for emptying; keyed lock with two keys per receptacle.

E. Steel Finish: color coated.
   1. Color: As selected by Architect from manufacturer's full range.

F. Wood Finish: Manufacturer's standard finish.
   1. Stain: Manufacturer's standard.

2.4 MATERIALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free of surface blemishes and complying with the following:
   1. Rolled or Cold-Finished Bars, Rods, and Wire: ASTM B211.
   2. Extruded Bars, Rods, Wire, Profiles, and Tubes: ASTM B221.
   3. Structural Pipe and Tube: ASTM B429/B429M.
   5. Castings: ASTM B26/B26M.

B. Steel and Iron: Free of surface blemishes and complying with the following:
   1. Plates, Shapes, and Bars: ASTM A36/A36M.
   2. Steel Pipe: Standard-weight steel pipe complying with ASTM A53/A53M, or electric-resistance-welded pipe complying with ASTM A135/A135M.
   3. Tubing: Cold-formed steel tubing complying with ASTM A500/A500M.
   4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A513/A513M, or steel tubing fabricated from steel complying with ASTM A1011/A1011M and complying with dimensional tolerances in ASTM A500/A500M; zinc coated internally and externally.
   5. Sheet: Commercial steel sheet complying with ASTM A1011/A1011M.
   6. Perforated Metal: From steel sheet not less than 0.120-inch nominal thickness; manufacturer's standard perforation pattern.
   7. Expanded Metal: Carbon-steel sheets, deburred after expansion, and complying with ASTM F1267.

C. Stainless Steel: Free of surface blemishes and complying with the following:
   1. Sheet, Strip, Plate, and Flat Bars: ASTM A240/A240M or ASTM A666.
   2. Pipe: Schedule 40 steel pipe complying with ASTM A312/A312M.
   3. Tubing: ASTM A554.
D. Wood: Surfaced smooth on four sides with eased edges; kiln dried, free of knots, solid stock of species indicated.
   1. Wood Species: Manufacturer's standard.
      a. Ipe wood

E. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard, corrosion-resistant-coated or noncorroding materials; commercial quality, tamperproof, vandal and theft resistant, concealed, recessed, and capped or plugged.

F. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M; recommended in writing by manufacturer, for exterior applications.

G. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.

H. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:
   1. Zinc-Coated Tubing: External, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, polymer film. Internal, same as external or consisting of 81 percent zinc pigmented coating, not less than 0.3 mil thick.
   2. Hot-Dip Galvanizing: According to ASTM A123/A123M, ASTM A153/A153M, or ASTM A924/A924M.

2.5 WOOD-PRESERVATIVE-TREATED MATERIALS

2.6 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended, so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
D. Preservative-Treated Wood Components: Complete fabrication of treated items before treatment if possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces.

E. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

F. Factory Assembly: Factory assemble components to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.7 GENERAL FINISH REQUIREMENTS

A. 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.

2.8 STEEL AND GALVANIZED-STEEL FINISHES

A. Powder-Coat Finish: Manufacturer's standard polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

E. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

F. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

END OF SECTION 323300
This page intentionally left blank.
SECTION 32 84 00 - PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

A. The Drawings and Specifications herein apply to the Point of Connection and downs stream.

B. Section Includes:

1. Piping.
2. Encasement for piping.
4. Pressure-reducing valves.
5. Automatic control valves.
6. Automatic drain valves.
7. Transition fittings.
8. Dielectric fittings.
9. Miscellaneous piping specialties.
10. Drip irrigation specialties.
11. Quick couplers
12. Controllers.

1.2 DEFINITIONS

A. Irrigation Supply: Upstream of the Point of Connection, the irrigation supply includes the back flow preventer, the meter, feeds and taps.

B. Point of Connection: Defined as the below ground discharge from the backflow preventer.

C. Irrigation System: Defined as components of the system that are located immediately down stream of the point of connection. See Engineering drawings and specifications for upstream portions of the system.

D. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.

E. System Main Feed – The piping and fittings required to move water from the Point of Connection to 5’ beyond the Main Isolation Valve

F. Main Isolation Valve – A master valve capable of shutting off the entire system before the system main splits - as located on the plan.

G. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.

H. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
1.3 PERFORMANCE REQUIREMENTS

A. This Section describes work down stream of the Irrigation Supply. See Division 22 Section "Facility Water Distribution Piping" for taps.

1. Follow NC General Statute 143-355.4 for separate taps for irrigation systems.

B. The design must meet the following design guidelines:

1. Requirements supplied by local municipalities

C. Pressure – The Contractor is responsible for delivering a system capable of delivering working pressures to the equipment that are according to the manufacturer’s recommendations.

1. Contractor is responsible for installing pressure reducing valve as needed to maintain proper working pressures needed for efficient operation of irrigation system within all manufacturer guidelines.

D. Irrigation zone control shall be automatic operation with controller and automatic control valves.

E. High rate delivery systems such as flood bubblers are not allowed.

F. Provide only high efficiency equipment capable of providing water accurately and efficiently. The system shall use drip irrigation for plants and spray for turf.

G. Provide an irrigation system that completely separates lawn irrigation from shrub irrigation. Maintain 100 percent head to head irrigation coverage of areas indicated.

H. No main piping or control wiring shall be located outside property lines or within road right of ways. Other system components may be allowed by the local municipality.

I. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and lights.

J. No valves, fittings, or joints are to be placed under paved surfaces, curbs or sidewalks. Where possible, crossing shall be uninterrupted stretches of pipe within sleeves sized according to the drawings.

K. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:

1. Irrigation System Feed: 400 psig.
2. Irrigation Main Piping and Circuit Piping: 200 psig.

L. The following are soil conditions found at the site:

a. Structure: The soil structure of the site is compacted due to working and construction activity. This compaction will reduce standard infiltration rates.

b. Infiltration Rate:

1) Sandy loam: .5-.8 in/hr.
2) Clay loam: .4-.5 in/hr.
3) Clay: .2-.3 in/hr.
M. Drip Emitters Per Plant – use the following guide to set the number of emitters per plant, based upon a 2 hour watering window [WW] and delivering matched water delivery per zone.

**TABLE 1 – DRIP SYSTEM PERFORMANCE REQUIREMENTS**

<table>
<thead>
<tr>
<th>Type of plant</th>
<th>Plant Size at installation</th>
<th>Gal. Per week</th>
<th>Gal/WW</th>
<th>Minimum # emitters per plant at .5 gph</th>
<th># emitters per plant at 1.0 gph</th>
<th># emitters per plant at 1.5 gph</th>
<th># emitters per plant at 2.0 gph</th>
<th># emitters per plant at 3.0 gph</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>5-7” caliper tree</td>
<td>100</td>
<td>7.1</td>
<td>6</td>
<td>14</td>
<td>5</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2.5” to 4” caliper tree</td>
<td>60</td>
<td>4.3</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Shrub</td>
<td>8-10’ BB shrub</td>
<td>40</td>
<td>2.9</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>5-7’ BB shrub</td>
<td>20</td>
<td>1.4</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>3-6’ container shrub</td>
<td>10</td>
<td>0.7</td>
<td>2</td>
<td>2</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>8” – 30” shrub or ground-cover</td>
<td>7</td>
<td>0.5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Grasses and Perennials</td>
<td>Quart size plant</td>
<td>5</td>
<td>0.4</td>
<td>1</td>
<td>1</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Plugs</td>
<td>4” pot and less</td>
<td>3</td>
<td>Grid of drip. See below</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Minimum emitters per plant equals what is required to fully wet the root ball perimeter, not just one side
- Emitters should be placed 4-6” inside the root ball
- N/A – less than one emitter which is not possible
- Grid of drip should be the same rate as the plant spacing
- The Contractor shall use this table as a guide. Provide refinement of the system for different plant types and soil conditions.
A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Equipment Numbering System

C. Use a coordinated numbering system for shop drawings, as-builts and field labeling as follows:

1. Turf Valves – Use 1-50
2. Drip Valves – Use 51-99
3. Valves, Pressure Regulators & Other Equipment - Use 100 and above

D. Delegated-Design Submittal [Shop Drawings]: For irrigation systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional designer responsible for their preparation. Submittal should include irrigation systems, drawn to scale in a CAD software (contact the Landscape Architect for CAD backgrounds), showing the following:

1. Main piping
2. Circuit piping
3. Automatic control valves
4. Tap.
5. Time clock and rain sensor location
6. Blow-off valves, isolation valves, quick coupler connections,
7. Numbered valves with GPM requirements
8. Coordination with site elements and utilities.
9. Required Pressure at Point of Connection – The irrigation designer shall state the pressure required of irrigation system in PSI.
10. System Pressure Loss – The designer shall state the calculated pressure loss from the Point of Connection to the furthest automated valve in PSI on the drawing.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. System Manual: A hard cover, 3 ring bound, exterior project titled, with table of contents for sprinklers, drip assemblies, controllers, pumps, quick couplers, rain sensors, and automatic control valves to include the following:

1. Product cut sheets designating exact model number(s)
2. Written schedule of operation including a winterization date, start up date, and controller timing schedule suggestions for spring, summer, and fall.
3. Operation and Maintenance information of the provided equipment including a schedule of routine maintenance for cleaning and adjusting equipment.
4. Reduced as-built plans bound with in the manual or in plastic sleeves.
5. Reduced as-built zone diagram with color-coding for zone separation, to be housed within interior of controller box and provided within closeout manual to Owner.
B. Prepare an as-built CAD drawing of the installed system. The drawings shall be legible with no overlapping or hidden graphics. Provide enlargements of crowded or obscured areas. Take field measurements and indicate on the drawings the dimensions of key elements from known site points such as the buildings and roadways to showing installed conditions of the following equipment:
   1. Heads
   2. Main lines and lateral lines
   3. Automatic valves, manual valves, blow-offs and quick couplers
   4. Tap
   5. Circuit and sensor wires
   6. Valve numbers corresponding to the time clock labeling, zone designation, and GPM for each zone.

C. Provide the following equipment to the Owner at time of closeout:
   1. Provide minimum of 1 remote controller for Owner to remote operate the system
   2. Provide minimum of 3 keys necessary for head adjustments.

1.7 MATERIALS MAINTENANCE 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. Drip-Tube System Tubing: Equal to 2% percent of total length installed for each type and size indicated, but not less than 100 feet.
   2. Drip emitters – provide 10 of each type.

1.8 QUALITY ASSURANCE
A. Installer Qualifications: Must be a licensed irrigation contractor in the State of North Carolina according to NC Irrigation Licensing Board.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.9 DELIVERY, STORAGE, AND HANDLING
A. 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.
B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.10 PROJECT CONDITIONS
A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
   1. Notify Architect and Owner no fewer than two days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Owner's written permission.
3. Do not proceed with irrigation work until rough grade approval is given by the Landscape Architect.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes. Supply components having pressure rating equal to or greater than system operating pressure.

B. Underground irrigation System Main Feed shall be the following:
   1. Schedule 80, PVC socket fittings; and solvent-cemented joints.

C. Underground irrigation Main Piping shall be the following:
   1. SDR 200, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.

D. Circuit piping shall be the following:
   1. SDR 200, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.

E. Risers to Aboveground drip lines: Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.

2.2 PIPING JOINING MATERIALS

A. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656. Use a color tinted material.

2.3 MANUAL VALVES

A. Brass Ball Valves:
   1. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. DynaQuip Controls.
      d. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
      e. Hammond Valve.
      f. Jamesbury; a subsidiary of Metso Automation.
      g. Jomar International, LTD.
      h. KITZ Corporation.
      i. Legend Valve.
j. Marwin Valve; a division of Richards Industries.
k. Milwaukee Valve Company.
l. NIBCO INC.
m. Red-White Valve Corporation.
n. RuB Inc.

2. Description:
   b. SWP Rating: 150 psig.
   c. CWP Rating: 600 psig.
   d. Body Design: Two piece.
   e. Body Material: Forged brass.
   f. Ends: Threaded or solder joint if indicated.
   g. Seats: PTFE or TFE.
   h. Stem: Brass.
   i. Ball: Chrome-plated brass.
   j. Port: Full [not reduced].

B. Plastic Ball Valves:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. American Valve, Inc.
      b. Asahi/America, Inc.
      c. Colonial Engineering, Inc.
      d. Fischer, George Inc.
      e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
      f. IPEX Inc.
      g. Jomar International, LTD.
      h. KBI (King Bros. Industries).
      i. Legend Valve.
      j. NIBCO INC.
      k. Sloane, George Fischer, Inc.
      l. Spears Manufacturing Company.
      m. Thermoplastic Valves Inc.
      n. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      c. Body Material: PVC.
      d. Type: Union.
      e. End Connections: Socket or threaded.
      f. Port: Full.

2.4 PRESSURE-REDUCING VALVES

A. Water Pressure Regulators:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cash Acme; a division of The Reliance Worldwide Corporation.
   b. Conbraco Industries, Inc.; Apollo Valves.
   c. Honeywell International Inc.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   e. Zurn Plumbing Products Group; Wilkins Water Control Products.

2. Description:

   b. Body Material: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved.
   c. Pressure Rating: Initial pressure of 150 psig.
   d. End Connections: Threading for NPS 2 and smaller.

2.5 AUTOMATIC CONTROL VALVES

A. Low Flow Drip Control Valves:

   1. Description: Molded-plastic body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid. For flow ranges below 5 gpm.
   2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

      a. Buckner; a division of Storm Manufacturing Group Inc.
      b. Ceres Products Company.
      c. Champion Irrigation Products.
      d. Dig Corporation.
      e. Greenlawn Sprinkler Company.
      f. Hit Products Corporation.
      g. Hunter Industries Incorporated.
      h. Irritrol Systems.
      i. Nelson, L. R. Corporation.
      j. Netafim USA.
      k. Olson Irrigation Systems.
      l. Orbit Irrigation Products, Inc.
      m. Rain Bird Corporation.
      n. Superior Controls Co., Inc.
      o. Toro Company (The); Irrigation Division.
      p. Weathermatic.

2.6 AUTOMATIC DRAIN VALVES

A. Description: Spring-loaded-ball type of corrosion-resistant construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig.
2.7 TRANSITION FITTINGS

A. General Requirements: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Cascade Waterworks Manufacturing.
   b. Dresser, Inc.; DMD Division.
   c. Ford Meter Box Company, Inc. (The).
   d. JCM Industries.
   e. Smith-Blair, Inc; a Sensus company.
   f. Viking Johnson.

2. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

C. Metal to Plastic Transition Fittings at Point of Connection:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Harvel Plastics, Inc.
   b. Spears Manufacturing Company.

2. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-socket or threaded end.

2.8 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI WH 201, with bellows or piston-type pressurized cushioning chamber and in sizes complying with PDI WH 201, Sizes A to F.

B. Pressure Gages: ASME B40.1. Include 4-1/2-inch- diameter dial, dial range of two times system operating pressure, and bottom outlet.

C. Detectable Warning Tape: Provide detectable warning tape with "IRRIGATION LINE" clearly marked and a unique color.

2.9 QUICK COUPLERS

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:

4. Toro Company (The); Irrigation Division.
5. Weathermatic.

B. Description: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap;

C. Key – Provide factory-fabricated brass one-piece swiveling connector with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet. Provide one key per installed quick coupler with a minimum number of two.

2.10 RAIN SENSOR

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:

4. Toro Company (The); Irrigation Division.
5. Weathermatic.

B. Description: UL listed, UV stabilized plastic housing rain sensor with the following properties:

1. Hardwire installation
2. 2-5 minute time duration to system shut down
3. Time to reset should be less than 4 hours
4. Operating temperature range 32 – 130 degrees
5. 24 volt, 3amp
6. Matched to controller station
7. Selectable rain shut off indexes at 1/8", ¼", ½", ¾" of rainfall

2.11 DRIP IRRIGATION SPECIALTIES

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. Agrifim.
2. Aquarius Brands, Inc.
3. Buckner; a division of Storm Manufacturing Group Inc.
4. Dig Corporation.
5. Geofflow, Inc.
8. Irritrol Systems.
9. Maxijet, Inc.
10. NDS/Raindrip.
11. Netafim USA.
13. Orbit Irrigation Products, Inc.
15. Roberts Irrigation Products, Inc.
17. Toro Company (The); Irrigation Division.

B. Drip Tubes with Direct-Attached Emitters

1. Tubing: Flexible PE or PVC with plugged end.
2. Emitter: Attached to pipe drip device.
   a. Body Material: UV Resistant PE or Vinyl
   b. Design Flow: .5 to 2.0 gph.
   c. Pressure compensating from 7-50 psi
   d. Minimum operation pressure if 15 psi
   e. Minimum filtration 120 mesh
   f. Self flushing design
   g. Includes an internal low pressure 1.5 psi check valve
   h. Spacing: custom spaced for specific plant materials on site with pop-in emitters

3. Off Ground Supports: Flexible plastic staples

C. NPS 3/4, with corrosion-resistant internal parts; capable of controlling outlet pressure to approximately 20 psig.

D. Filter Units: Plastic housing with corrosion-resistant internal parts; of size and capacity required for devices downstream from unit.

   1. Provide screening to 120 mesh size.
   2. Minimum size 3/4"
   3. Flow Range 1-12 gpm
   4. maximum pressure 140 psi
   5. Polyamide staking ring type filter

E. Air Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.

F. Vacuum Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.

2.12 CONTROLLERS

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. Buckner; a division of Storm Manufacturing Group Inc.
   2. Champion Irrigation Products.
   3. Hit Products Corporation.
   5. Irritrol Systems.
   8. Netafim USA.
   9. Orbit Irrigation Products, Inc.
11. Superior Controls Co., Inc.
12. Toro Company (The); Irrigation Division.
13. Weathermatic.

B. Description:
1. General: Time clocks must provide the following features:
   a. Timing Device: Adjustable, 24-hour, 14-day clock, with automatic operations to skip operation any day in timer period, to operate every other day, or to operate two or more times daily
   b. A minimum of programming three fully independent programs with four start times per program.
   c. Manual or Semiautomatic Operation: Allows this mode without disturbing preset automatic operation
   d. Controller Stations for Automatic Control Valves: Each station is variable from approximately 5 to 120 minutes. Include switch for manual or automatic operation of each station
   e. Quantity of stations equal to the zones required plus 4 empty zones.
   f. Rain Sensor: Adjustable from one to seven days, to shut off water flow during rain
   g. Non-volatile memory for holding programs during power outages
   h. 120 volt input, 24 VAC output
   i. Control Transformer: 24-V secondary, with primary fuse
   j. Surge Protection: Metal-oxide-varistor type on each station and primary power
   k. With a cistern, pump start capability
   l. Hand held remote included with system
   m. Lockable cabinet with two matching keys.

2. Exterior Control Enclosures: NEMA 250, Type 4, weatherproof and provision for grounding.
   a. Body Material: Enameled-steel sheet metal or Stainless-steel sheet metal
   b. Mounting: Surface type for wall.

3. Wiring: UL 493, Type UF multiconductor, with solid-copper conductors; insulated cable; suitable for direct burial.
   a. Feeder-Circuit Cables: No. 12 AWG minimum, between building and controllers.
   b. Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jackets of different colors for multiple-cable installation in same trench.
   c. Splicing Materials: Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.

2.13 BOXES FOR AUTOMATIC CONTROL VALVES

A. Plastic Boxes:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Armorcast Products Company.
      b. Carson Industries LLC.
c. Nationwide Plastics, Inc.
d. NewBasis.
e. Oldcastle, Inc.
f. Orbit Irrigation Products, Inc.
g. USFilter/Plymouth Products, Inc.

2. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.
   a. Size: As required for valves and service.
   b. Shape: Round and rectangular
   c. Sidewall Material: Structural foam plastic.
   d. Cover Material: Structural foam plastic
   e. UV resistant
   f. Stainless steel screw lock
   g. Color: green

B. Drainage Backfill: #57 stone.

PART 3 - EXECUTION

3.1 EARTHWORK
   A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."
   B. Install detectable warning tape directly above Main Line piping only at 12" below finished grade.
   C. Provide minimum cover over top of underground piping according to the following:
      1. System Main Feed: Minimum depth of 30 inches below finished grade.
      2. Main Line Piping: Minimum depth of 18 inches below finished grade
      3. Circuit Piping: Minimum of 12 inches below finished grade
      4. Sleeves: 24 inches or 12" below finished grade or pavement gravel sub-bases, whichever is deeper
         a. Extend sleeves 30" beyond edge of pavement.

3.2 PREPARATION
   A. Set stakes to identify locations of proposed irrigation system. Obtain Architect's approval before excavation.
   B. Confirm that the rough grades have been established prior to topsoil spreading.
   C. Examine the site compared to the system design and notify the Architect of changes.
      1. Submit design changes to the Architect if revisions to the design are warranted
   D. Verify existence of required sleeving.
   E. Store pipe and fitting for project in an area that will not introduce dirt and debris into the interior.
3.3 PIPING INSTALLATION

A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.

B. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.

C. Install piping free of sags and bends.

D. Install groups of pipes parallel to each other, spaced to permit valve servicing.

E. Install fittings for changes in direction and branch connections.

F. Install unions adjacent to valves and to final connections to other components with NPS 2 or smaller pipe connection.

G. Install expansion loops in control-valve boxes for plastic piping.

H. Lay piping on solid subbase, uniformly sloped without humps or depressions.

I. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing.

J. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet. Install below ground in control-valve boxes.

K. Water Hammer Arresters: Install between connection to building main and circuit valves aboveground or in control-valve boxes.

L. Install sleeves made of Schedule 80 PVC pipe and socket fittings, and solvent-cemented joints. Extend 30” beyond pavement or curb edges.

M. Install piping in sleeves under parking lots, roadways, and sidewalks. Avoid fittings within sleeves.

N. Install transition fittings for plastic-to-metal pipe connections according to the following:
   1. Underground Piping:
      a. NPS 1-1/2 and Smaller: Plastic-to-metal transition fittings.
      b. NPS 2 and Larger: AWWA transition couplings.

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. PE Piping Fastener Joints: select rubber gasket materials, size, type and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

E. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

3. PVC Non-pressure Piping: Join according to ASTM D 2855.

3.5 VALVE INSTALLATION

A. Isolation valves: Install isolation valves with handles oriented to surface.


C. Automatic Control Valves: install according to manufacture’s recommendations with manual adjustment handles oriented to the surface.

D. Drain Valves: Install in underground piping in boxes for automatic control valves.

3.6 QUICK COUPLER INSTALLATION

A. Install quick coupler as per manufacturers’ recommendations at a height below mower damage level.

B. Install approximately 6” by 6” by 6” concrete collar underground, covered by 1” of soil.

C. Paint exposed plastic parts black.

3.7 RAIN SENSOR INSTALLATION

A. Hardwire connection from time clock to sensor.

B. Place in an open area with no overhang as approved by the landscape architect or as shown on the plan.

C. Installation should be neat with organized wiring.

3.8 DRIP IRRIGATION SPECIALTY INSTALLATION
A. Install freestanding emitters on pipe riser to mounting height indicated.

B. Install manifold emitter systems with tubing to emitters. Plug unused manifold outlets. Install emitters on off-ground supports at height indicated.

C. Install multiple-outlet emitter systems with tubing to outlets. Plug unused emitter outlets. Install outlets on off-ground supports at height indicated.

D. Install drip tubes with direct-attached emitters on ground.

E. Install drip tubes with remote-discharge on ground with outlets on off-ground supports at height indicated.

F. Install off-ground supports of length required for indicated mounted height of device.

G. Install application pressure regulators and filter units in piping near device being protected, and in control-valve boxes.

H. Install air relief valves and vacuum relief valves in piping, and in control-valve boxes.

3.9 AUTOMATIC IRRIGATION-CONTROL SYSTEM INSTALLATION

A. Equipment Mounting: Install interior/ exterior controllers at eye level on wall.

1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Install control cable in same trench as irrigation piping and at least 2 inches beside piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas. Install warning tape during backfill operation.

3.10 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Section "Facility Water Distribution Piping" for water supply from exterior water service piping, water meters, protective enclosures, and backflow preventers. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.

C. Connect wiring between controllers and automatic control valves.

3.11 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

B. Equipment Nameplates and Signs: Brand each valve box where isolation valve, automatic control valves, pressure regulator valve, or filter is housed with a unique name that appears on the time clock and the as-built drawings.
1. Text: Minimum ½’ letters branded into plastic valve box housing.
   a. Turf Valves – Use 1-50
   b. Drip Valves – Use 51-99
   c. Valves, Pressure Regulators & Other Equipment - Use 100 and above

   C. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tapes over underground piping during backfilling of trenches. See Division 31 Section "Earth Moving" for warning tapes.

3.12 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. System Main Feed & Main Line Leak Test: After installation, charge system and test for leaks with a pressure indicator over a 24 hour period. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   4. Test spray heads for too little or too much pressure. Make adjustments in the system, including installing pressure compensation devices or boosting overall system pressure to provide a functioning system.

B. Any irrigation system or product will be considered defective if it:
   1. Does not pass tests and inspections.
   2. Does not provide manufacturer’s recommended pressures throughout the system
   3. Does not provide complete separation of grass and planting areas [individual trees may be over sprayed]
   4. Does not provide matched precipitation rates throughout the lawn
   5. Does not provide drip system delivery target rates for plant types.
   6. Sprays water onto pavements, buildings, or signage.
   7. Does not provide for easy maintenance as follows:
      a. Ball valves, filters, regulators are poorly oriented for hand access
      b. Automatic Valves are poorly oriented for access
      c. Irrigation equipment is installed at a grade that would encourage damage from mowers

C. Defective irrigation systems or components shall be repaired at no cost to the Owner.

3.13 FLUSH OUT CLEANING

A. Flush dirt and debris from piping before installing sprinklers and other devices.

B. Clean or replace all filters.

3.14 STARTUP SERVICE
A. Perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Verify that controllers are installed and connected according to the Contract Documents.
   3. Verify that electrical wiring installation complies with manufacturer's submittal.

3.15 ADJUSTING

A. Provide at least three programmed time schedules.
   a. One is for immediate post planting where the system is run at high rates for a short duration.
   b. Second is for a longer term establishment period, where distribution rates are reduced but still higher for plant establishment.
   c. Third is a long term summer schedule distributing about 1" of precipitation to lawn areas per week and 70 gallons per week to shrubs.

B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices so they will be flush with finish grade or as recommended by the manufacturer.

D. Adjust drip system to provide gallons per week delivery targets by adding and subtracting emitters.

3.16 DEMONSTRATION

A. Train Owner's maintenance personnel by providing the following instruction:
   1. Review the as-built materials with the owner
   2. Demonstrate how to program the clock.
   3. Demonstrate how to adjust heads
   4. Demonstrate how to clean filters and pressure regulation
   5. Review the site components of the system, identify valve boxes

END OF SECTION 32 84 00
SECTION 329200 - TURF AND GRASSES

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. Seeding.
   2. Sodding.

B. Related Sections:
   1. Division 31 Section "Site Clearing" for topsoil stripping and stockpiling.
   2. Division 31 Section "Earth Moving" for excavation, filling and backfilling, and rough grading.
   3. Division 32 Section "Planting Irrigation" for turf irrigation.
   4. Division 33 Section "Subdrainage" for subsurface drainage.

1.3 DEFINITIONS

A. Substantial Completion: The proper installation of seed, sod, and meadow with final grades, mulch and irrigation functioning (if provided) with no indication of widespread plant death. For seeded and meadow areas, the seed must show germination with green shoots visible. It is possible to grant substantial completion to portions of the site without total project completion however all construction activities must be completed in the requested area.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscs. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

E. Planting Soil: The prepared earth [existing or imported as specified herein] used to backfill lawn or sod areas.
F. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

G. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

H. Turf: A groundcover established from either lawn type seeds, lawn type sod or meadow seeds.

1.4 ACTION SUBMITTALS

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

1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

1.5 INFORMATIONAL SUBMITTALS

A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

B. Qualification Data: For qualified landscape Installer.

C. Product Certificates: For soil amendments and fertilizers, from manufacturer.

D. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf and meadows during a calendar year. Submit at time of Substantial Completion.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf and meadow establishment.

1. Professional Membership: Installer shall be a member in good standing of National Association of Landscape Professionals, the NC Landscape Contractors’ Licensing Board, or AmericanHort.

2. Experience: Three years' experience in turf installation in addition to requirements in Division 01 Section "Quality Requirements."

3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: All personnel who handle herbicides and pesticides shall be State licensed, for commercial.

B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Soil Analysis: For each un-amended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. Test soil components of Planting Soils Type A and B
2. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
3. Test shall include mechanical analysis of sand, silt and clay components.
4. The soil-testing laboratory shall oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Architect. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
5. Soil tests shall include the following information:
   a. Percentage of sand, silt and clay.
   b. Cation exchange capacity.
   c. Percent of organic matter.
   d. Stated recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
   e. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.8 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.
Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

<table>
<thead>
<tr>
<th>Grass Type</th>
<th>Fall Season</th>
<th>Spring Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool season grasses</td>
<td>September 15-December 15</td>
<td>February 1 to May 15</td>
</tr>
<tr>
<td>Warm season grasses</td>
<td>Sept 1 to Oct 15</td>
<td>May 15-July 15</td>
</tr>
</tbody>
</table>

B. Water Source:

1. The Contractor shall provide water for:
   a. The construction period until Substantial Completion for the last phase of work.
   b. Substantial Completion for the last phase of work through the maintenance period.

2. The Contractor shall supply watering labor as follows:
   a. The construction period until Substantial Completion for the last phase of work.
   b. Substantial Completion for the last phase of work through the maintenance period.

1.9 MAINTENANCE

A. Initial Maintenance Service for sod and seed areas: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after lawns are installed and continue until plantings are acceptably healthy, well established, and deemed satisfactory per Part 3; but for not less than the Construction Maintenance Period below.

1. Construction Maintenance Period: 6 months. The Construction Maintenance Period will begin from the date of Substantial Completion for the last phase of work. Partial areas of turf deemed satisfactory per Part 3 require continued maintenance until all areas are
deemed satisfactory per Part 3 and until final date of Construction Maintenance Period; whichever elapses last.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

<table>
<thead>
<tr>
<th>Lawn Type</th>
<th>Seed Mix</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm Season</td>
<td>Hybrid Bermuda</td>
<td></td>
</tr>
</tbody>
</table>

2.2 TURFGRASS SOD

A. Turfgrass Sod: Number 1 Quality/Premium, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: Tiffway 417 Bermudagrass

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
   1. Provide lime in form of ground dolomitic limestone or calcitic limestone depending on soil test.

2.4 ORGANIC SOIL AMENDMENTS

A. Soil Conditioner: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch sieve; soluble salt content of 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
   1. Organic Matter Content: 70 percent of dry weight.
   2. Sources: Agricultural, bark, biosolids; municipal compost; or source-separated or compostable mixed solid waste.
      a. Free of toxic materials to plant growth
2.5 FERTILIZERS

A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
   1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
   1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.6 PLANTING SOILS

A. Planting Soil Type A: Existing, in-place surface soil. Verify suitability of existing surface soil to produce viable planting soil. Remove stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Mix surface soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:
   1. Depth of soil conditioner to mix in Planting Soil: 3/8” to 4”.
   2. Weight of Slow-Release Fertilizer per 1000 Sq. Ft. consult soil test.
   3. Weight of dolomitic limestone per soil test.

B. Planting Soil Type B: Imported sandy loam topsoil formed under natural conditions blended with organic matter. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
   1. Depth of soil conditioner to mix in Planting Soil: 3/8” to 4”.
   2. Weight of Slow-Release Fertilizer as per soil test
   3. Weight of dolomitic limestone as per soil test.

2.7 MULCHES

A. General: The Contractor shall select the mulching products that best suit the grass seed selected. Choose from the following mulches:
   1. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
2. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

B. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.8 PESTICIDES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance. Notify the Architect immediately and do not start landscape construction operations if:
   1. Grades or site features do not match the design.
   2. There is ponding or areas that do not appear to drain
   3. The subsoil contains foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
   4. If the soils are frozen or moist beyond that required to produce optimal working conditions.
   5. Excessively dry soil that is not workable and which is too dusty.
   6. If the subsoil is over compacted.
   7. If irrigation main and lateral lines have not been installed.
   8. If irrigation main or lateral line trenches have not been compacted.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Erosion Control Seeding Contamination – Evaluate the erosion control seeding used and confirm that potential seed sources will not interfere with the establishment of seeded lawns or meadows. Confer with the General Contractor on usage of erosion control seeding and potential threats to establishing lawns or meadows.
3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.
3. Protect areas that should not receive seed such as planting beds.

3.3 TURF AREA PREPARATION

A. Limit turf subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches.

1. General
   a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
   b. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, trash, and other extraneous matter.
   c. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
   d. Reduce elevation of planting soil to allow for soil thickness of sod.

2. Apply amendments directly to final grade before loosening. Mix to a total depth of 4”.
3. Thoroughly blend planting soil with organic amendments off-site before spreading
4. Apply lime and fertilizers on surface, and thoroughly blend planting soil.

C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
2. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.
   a. Note any areas on the plan that indicate tree root zones. These areas may require the use of hand tools.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.
3.4 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.
2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at the following rates

<table>
<thead>
<tr>
<th>Turf Type</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid Bermuda</td>
<td>2 lbs per 1000 sf</td>
</tr>
</tbody>
</table>

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with erosion-control mats where shown on Drawings; install and anchor according to manufacturer's written instructions.

E. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a rate to form a continuous blanket 1 inch in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Bond straw mulch by spraying with non-asphalt emulsion at a rate to resist wind and erosion. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

F. Protect seeded areas from hot, dry weather or drying winds by applying hydromulch within 4 hours after completing seeding operations.

3.5 HYDROSEEDING – TWO STEP PROCESS

A. Mix specified seed, commercial fertilizer, and fiber mulch in water, using equipment specifically designed for hydoseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with nonasphaltic tackifier.
2. Spray-apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre.

3.6 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to
subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 or in the bottom of swales with steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.7 TURF RENOVATION

A. Renovate existing turf.

B. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
2. Install new planting soil as required.

C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

D. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

E. Mow, dethatch, core aerate, and rake existing turf.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 4 inches.
1. Confirm that there are no protected root zone areas that would require special procedures.

I. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.

J. Apply seed or sod as shown on the plans and as required for new turf.

K. Water newly planted areas and keep moist until new turf is established.
3.8 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Repair turf as necessary because of settling, erosion or settlement or other processes.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain irrigation systems, temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow bermudagrass to a height of 1 inch.

D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.9 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 3 by 3 inches.
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
3. Satisfactory Plugged Turf: At end of maintenance period, the required number of plugs has been established as well-rooted, viable patches of grass, and areas between plugs are free of weeds and other undesirable vegetation.
4. Satisfactory Sprigged Turf: At end of maintenance period, the required number of sprigs has been established as well-rooted, viable plants, and areas between sprigs are free of weeds and other undesirable vegetation.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.10 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.11 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 329200
SECTION 329300 - PLANTS

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. Plants.
   2. Planting soils.

B. Related Sections:
   1. Division 01 Section "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
   2. Division 31 Section "Site Clearing" for protection of existing trees and plantings, topsoil stripping and stockpiling, and site clearing.
   3. Division 31 Section "Earth Moving" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
   4. Division 32 Section "Turf and Grasses" for turf (lawn) and hydroseeding
   5. Division 33 Section "Subdrainage" for below-grade drainage of landscaped areas, paved areas, and wall perimeters.

1.3 ALLOWANCES

A. Allowances for plants are specified in Division 01 Section "Allowances."

   1. Perform planting work under quantity allowances and only as authorized. Authorized work includes work required by Drawings and the Specifications as authorized in writing by Architect.
   2. Notify Architect weekly of extent of work performed that is attributable to quantity allowances.
   3. Perform work that exceeds quantity allowances only as authorized by Change Orders.

B. Furnish trees as part of tree allowance.

1.4 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Division 01 Section "Unit Prices."
1. Unit prices apply to authorized work covered by quantity allowances.
2. Unit prices apply to additions to and deletions from Work as authorized by Change Orders.

1.5 DEFINITIONS

A. Substantial Completion: The proper installation of plant material with final grades, mulch and irrigation (if provided) functioning with no indication of widespread plant death. It is possible to grant substantial completion to portions of the site without total project completion however all construction activities must be completed in the requested area.

B. Backfill: The planting soil used to replace or the act of replacing earth in an excavation.

C. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

D. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

E. Finish Grade: Elevation of finished surface of planting soil.

F. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

G. Planting Area: Areas to be planted.

H. Planting Soil: The prepared earth [existing or imported as specified herein] used to backfill planting areas or to create planting beds.

I. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

J. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

K. Stem Girdling Roots: Roots that encircle the stems (trunks) or main roots of trees below the soil surface.

L. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
M. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

N. Environmental Conditions: Physical, chemical, and biotic factors affecting ecological community and ability for plants to survive.

O. Detrimental Conditions: Environmental conditions harmful to the health of proposed plants that can be corrected through supplemental site improvements. Harmful conditions include, but shall not be limited to the following: poor soil, poor drainage, or contaminated soil.

1.6 ACTION SUBMITTALS

A. Samples for Verification: For each of the following:
   1. Mulch: A 1-quart volume of each mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
   2. Mineral Mulch: 1 quart volume of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on the site; provide an accurate indication of color, texture, and makeup of the material.

B. Soil Analysis: For each un-amended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of the soil.

   1. Test soil components of Planting Soil Type A
   2. Testing methods and written recommendations shall comply with USDA’s Handbook No. 60.
   3. Test shall include mechanical analysis of sand, silt and clay components.
   4. The soil-testing laboratory shall oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Architect. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
   5. Soil tests shall include the following information:
      a. Percentage of sand, silt and clay.
      b. Cation exchange capacity.
      c. Percent of organic matter.
      d. Stated recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
      e. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.
1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

B. Substitutions: The Contractor shall provide the products specified. Changes must be made by written submittal with reason and alternate suggestion.

C. Environmental Conditions: Prior to contract acceptance by Contractor, submit written description of environmental conditions preventing compliance with warranty.
   1. As applicable, submit detrimental conditions and/or substitutions submittals.

D. Detrimental Conditions: Per encounter, submit written description of detrimental conditions with recommendation for correcting condition. Include cost estimate.

E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of all plants during a calendar year. Submit at time of Substantial Completion.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.
   1. Professional Membership: Installer shall be a member in good standing of either the National Association of Landscape Professionals or the American Nursery and AmericanHort.
   2. Experience: Five years' experience in landscape installation in addition to requirements in Division 01 Section "Quality Requirements."
   3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the following:
      c. Actively licensed by the North Carolina Landscape Contractors’ Licensing Board.
      d. Four year degree in horticulture, landscape architecture or agronomy.
   5. Selection of plants purchased under allowances will be made by Architect, who will tag plants at their place of growth before they are prepared for transplanting.

B. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
   1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and
container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.

2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

C. Plant Pre-Approvals: Utilize the following methods for plant selection.

1. Container Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

2. Large Plant Tagging: The Architect will accompany the Contractor for a scheduled trip to nurseries to tag large shrubs and trees as directed by the Architect.
   a. The Architect will tag all shade trees, flowering trees and large shrub material.
   b. The Contractor will pretag plant materials and submit photos prior to nursery tagging to confirm the nursery has acceptable material for consideration.
   c. The Contractor shall provide the cost of travel, meals and accommodations for the trip. He shall provide 3 weeks notice of the trip to the Architect.

D. Additional Plant Material Observation: Architect may observe plant material either at site before planting or once installed for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

E. Substitutions: Substitutions will be permitted only upon submission of proof that a specified plant is not obtainable and with written approval of proposed substitution by Landscape Architect.

1. Contractor shall propose the use of the nearest obtainable variety of the plant having the same essential characteristics that is equal to or greater in size to original specified plant.

F. Detrimental Conditions: The contractor shall notify the Owner and Landscape Architect in writing of all conditions considered detrimental to growth of plant material. State condition and submit proposal including costs for correcting condition.

G. Preinstallation Conference: Conduct conference at Project site.

1. The following individuals must be present:
   a. GC Contractor’s site representative responsible for the Landscape Contractor’s work
   b. The Landscape Contractor’s branch manager [or Owner] and job estimator.
c. The Project supervisor who will be directly responsible for field work and/or paperwork.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

B. Bulk Materials:
   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
   2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
   3. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

C. Do not prune trees and shrubs before delivery.

D. Protect bark, branches, and root systems from sunscald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

E. Handle planting stock by root ball or container.

F. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

G. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

H. If plants are stored for over 24 hours provide the following:
   1. Set balled stock upright on ground and cover ball with soil, peat moss, sawdust, or other acceptable material to prevent wind, cold, or heat damage to the roots.
   2. Provide shade to shade requiring trees and shrubs.
   3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

1.10 PROJECT CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:

1. Notify Owner and Architect no fewer than two days in advance of proposed interruption of each service or utility.
2. Do not proceed with interruption of services or utilities without Architect's written permission.

C. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: Feb 1 to May 15
3. Tree Planting: October 1 to April 1.
4. Installation outside the above planting periods requires approval by Landscape Architect and written guarantee from Contractor to provide and monitor temporary irrigation. Request may be denied due to site conditions failing to satisfy specification requirements, weather conditions, or City watering restrictions.

D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

E. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated or acceptable to Landscape Architect.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

F. Under no circumstances should work proceed prior to establishment of appropriate grades.

G. Water Source:

1. The Contractor shall provide water for:
   a. The construction period until Substantial Completion for the last phase of work.
   b. Substantial Completion for the last phase of work through the maintenance period.

2. The Contractor shall supply watering labor as follows:
   a. The construction period until Substantial Completion for the last phase of work.
   b. Substantial Completion for the last phase of work through the maintenance period.

H. Unusual Field Conditions: It is the Contractor’s responsibility to communicate to the Architect unusual field conditions found at the project site before and during construction. The presence of unusual field conditions such as wind, wetness, soil issues, invasive weeds, will require the Contractor take note and advise the Architect on how best to remedy the discovery.
1.11 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
   b. Structural failures including plantings falling, blowing over or settling out of plumb.
   c. Faulty performance of tree stabilization or subdrainage.
   d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Periods from Date of Substantial Completion:
   a. Trees, Shrubs, Vines, Ornamental Grasses, Ground Covers, Biennials, Perennials, and Other Plants, metal edges, decorative mulches, landscape drainage features, landscape grading: 12 months.
   b. Annuals: 3 months.

3. Inspections:
   a. Perform maintenance checkups at 3 month intervals to verify that plant material is being properly maintained. Notify Owner in writing of any deficiencies.
   b. Eleven months into warranty period, request in writing a year-end inspection by Owner and Landscape Architect.

4. Include the following remedial actions as a minimum:
   a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
   b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
   c. There will be no limitation on replacements of each plant except for losses or replacements due to species intolerance of environmental conditions.

1) Contractor shall notify Landscape Architect in writing of any concerns related to species intolerance of environmental conditions prior to purchase of plant material; otherwise, purchased plant material will be accepted by Contractor as tolerant of environmental conditions. Detrimental conditions shall be corrected prior to installation of plant material and shall not be considered grounds for warranty exclusion.

   d. Provide extended warranty for period equal to original warranty period, for replaced plant material. As required, continue extended warranty until leaf out to ensure health of replaced material. Plants shall be deemed dead if leaf out does not occur prior to end of spring.
5. All replacements shall be plants of the same kind as originally planted and shall be of size equal to that attained by adjacent plants of the same kind at the time replacement is made. They shall be furnished and planted as specified herein.

6. Removal and replacement shall be at no cost to the Owner.

1.12 MAINTENANCE SERVICE

A. Initial Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than Construction Maintenance Period below. Maintenance requirements at 12 month warranty review noted in Part 3 are exceptions when a shorter Construction Maintenance Period is specified below.

1. Construction Maintenance Period: 6 months. The Construction Maintenance Period will begin from the date of Substantial Completion for the last phase of work. Partial areas of the site substantially completed require continued maintenance until all areas of the site are deemed substantially complete and until final date of Construction Maintenance Period.

B. For Mechanized Tree Spade Trees: Provide 6 months of watering by refilling slow release water bags from the date of installation.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.

2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

3. Provide trees from active, consistently aged specimens.

4. Unless directly specified, provide only trees that are genetic clones of the requested variety.

B. Select Balled and Burlapped material from nurseries who utilize root pruning practices and have a systematic approach to hardening off newly dug material.
C. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

D. Provide small trees and shade trees that are grown on their own roots, not utilizing grafting or budding techniques (unless directed in the plant list).

E. Provide container plant material that is free from circling roots or pot bound conditions.

F. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

G. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

H. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
   1. Provide lime in form of ground dolomitic limestone.

2.3 ORGANIC SOIL AMENDMENTS

A. Soil Conditioner: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch sieve; soluble salt content of 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
   1. Pine bark soil conditioner: finely ground, well composted, pine bark mulch with a maximum particle size of ¼”.
   2. Organic Matter Content: 70 percent of dry weight.
   3. Sources: Agricultural, bark, biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
      a. Free of toxic materials to plant growth
      b. Free of weed seeds.

2.4 FERTILIZERS

A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
B. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory. Several different blends may be necessary to meet the requirements.

2.5 PLANTING SOILS

A. Planting Soil Type A: Existing, in-place surface soil. Verify suitability of existing surface soil to produce viable planting soil. Remove stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Mix surface soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:

1. Screen to remove extraneous materials.
2. Ratio of soil conditioner to Surface Soil by Volume: 1:5.
3. Weight of Slow-Release Fertilizer per 1000 Sq. Ft. consult soil test.
4. Weight of dolomitic limestone per soil test.

B. Planting Soil Type B: Imported sandy loam topsoil formed under natural conditions blended with organic matter. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

1. Ratio of soil conditioner to Topsoil by Volume: 1:10.
2. Weight of Slow-Release Fertilizer as per soil test
3. Weight of dolomitic limestone as per soil test.

2.6 MULCH

A. Mulch: Well-composted, stable, and weed-free organic matte, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch sieve; soluble salt content of 2 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Triple shredded hardwood
2. Color: Natural.

2.7 SUB DRAINAGE
A. Drainage pipe: 4” black corrugated slotted PE pipe pre-wrapped in a geo-textile fabric capable of filtering clay soil from migrating into the pipe.

B. Drainage Gravel: Washed, sound crushed stone or gravel complying with ASTMD448.

2.8 HERBICIDES

A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.9 PESTICIDES

A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

1. Use pesticides on an as-needed basis.

2.10 TREE STABILIZATION MATERIALS

A. Upright and Guy Stakes: Rough-sawn, sound, new hardwood Stakes and Guys:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.

2. Guys and Tie Wires: ASTM A 641/A 641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch in diameter.

3. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.

4. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
1. Verify that subgrades are correct prior to spreading topsoil or spreading amendments.
2. Conduct water percolation tests to verify that planting depths and drainage will meet the needs of the plants that have been selected. Inform the Architect of any drainage issues.
3. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
4. Along roadways and in landscape islands, remove gravel and asphalt from landscape beds.
5. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
6. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
7. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

3.3 GENERAL REQUIREMENTS FOR ALL PLANTING TYPES

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.
E. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.

1. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
2. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
3. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
4. Maintain supervision of excavations during working hours.
5. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
6. If subdrainage is shown on Drawings or required under planting areas, insure contact between the root ball and subdrain pipe.

F. After excavation examine the area for potential drainage difficulties matched to plant varieties and inform the Architect of potential poorly drained areas. Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits. Discuss variations in the depth of planting with the Architect prior to planting.

G. Fill excavations with water and allow it to percolate away before positioning trees and shrubs.

H. Set out and space plants according to the planting plans and notes in even rows with triangular spacing unless otherwise indicated.

I. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

J. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

K. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

L. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

M. Backfill plants with the materials and methods indicated in the Tables below and with the following instructions:

1. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
2. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

3. Continue backfilling process. Water again after placing and tamping final layer of soil.

3.4 MASS PLANTING AREA REQUIREMENTS

A. Preparation - Loosen subgrade of planting areas to a minimum depth indicated in the table below. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

Table 2

<table>
<thead>
<tr>
<th>PLANT TYPE</th>
<th>TREATMENT AREA</th>
<th>SUBSOIL TREATMENT</th>
<th>EXCAVATION BACKFILL</th>
<th>PLANTING SOIL* DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrub and Ground-cover masses</td>
<td>entire planting area</td>
<td>Loosen 8” deep</td>
<td>Use Planting Soil B</td>
<td>6”</td>
</tr>
<tr>
<td>Mass perennials</td>
<td>entire planting area</td>
<td>Loosen 4” deep</td>
<td>Use Planting Soil B</td>
<td>6”</td>
</tr>
</tbody>
</table>

1. Spread planting soil to a depth indicated in Table 2 but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet. Mix planting soil with the subsoil to form an uneven soil horizon line.

2. Subsoil removed from excavations may not be used as planting soil.

3.5 TREES AND SHRUBS PLANTING REQUIREMENTS

A. Preparation - Loosen area of planting areas to a minimum depth indicated in the table below. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

Table 4

<table>
<thead>
<tr>
<th>Treatment area</th>
<th>Subsoil treatment</th>
<th>Backfill from excavation</th>
<th>Planting Soil* depth in treatment area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solitary Trees</td>
<td>10 wider than the root ball</td>
<td>Loosen 12” deep</td>
<td>Use Planting Soil B</td>
</tr>
<tr>
<td>Solitary Shrubs</td>
<td>10 wider than the root ball</td>
<td>Loosen 12” deep</td>
<td>Use Planting Soil B</td>
</tr>
</tbody>
</table>

B. Subsoil removed from excavations may not be used as planting soil.

3.6 MECHANIZED TREE SPADE PLANTING
A. Supply trees as indicated in the plant list as harvested local trees.

B. The Architect shall tag all trees to be locally harvested with tree spade techniques.

C. Trees shall be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than the manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.

D. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.

E. Cut exposed roots cleanly during transplanting operations.

F. Use the same tree spade to excavate the planting hole as was used to extract and transport the tree.

G. Plant trees as shown on Drawings, with the following procedures:
   1. Lower trees without damaging trunk or major branches
   2. Fit the root ball into the hole leaving a minimum of gap between the root ball and hole.
   3. Fill the remaining gap with a 70% sandy loam topsoil, 30% organic matter and fertilizer blend. Use water to carry mixture to the bottom of the excavation to insure the gap is full. Allow to drain and return the next day and repeat as necessary until all gaps are filled.
   4. Stake the tree with appropriate cabling systems and insure the tree is plumb.
   5. Mulch the tree planting area.

H. Where possible, orient the tree in the same direction as in its original location.

I. Supply one slow release watering bag per 4.5” caliper of tree.

3.7 PLANT STABILIZATION

A. Install plant stabilization as follows unless otherwise indicated:

<table>
<thead>
<tr>
<th>PLANT SIZE</th>
<th>STABILIZATION METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>6” in Caliper and Greater</td>
<td>Anchor 4 guys to wood deadmen buried at least 36 inches below grade. Provide turnbuckle and compression spring for each guy wire and tighten securely. Allow enough slack to avoid rigid restraint of tree. Provide soft flexible protection of the trunk from the guy wires. Attach flags to each guy wire, 30 inches above finish grade.</td>
</tr>
<tr>
<td>3” to 6” in Caliper</td>
<td>Anchor 3 guys to 30” wood stakes. Install guy wires allowing enough slack to avoid rigid restraint of tree. Provide soft flexible protection of the trunk from the guy wires. Attach flags to each guy wire, 30 inches above finish grade.</td>
</tr>
</tbody>
</table>
3.8 PLANT PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Do not apply pruning paint to wounds.

3.9 PLANTING AREA MULCHING

A. Layout mulch beds carefully with smooth lines and as indicated on the drawings. Mulch backfilled surfaces of planting areas and other areas indicated.

B. Organic Mulch in Planting Areas: Apply over whole surface of mass planting areas or on isolated plantings as follows:

1. Initial Mulch Application to New Planting Areas:
   a. 2” minimum depth for trees, shrubs and groundcovers. Do NOT exceed 3 inches depth.
   b. 1 ½” minimum depth for groundcovers, perennials, and annual beds. Do NOT exceed 2 inches depth.

2. Mulch Application to Existing Planting Areas:
   a. Supplement mulch as needed to restore entire mulch profile to depths noted for initial mulch application to New Planting Areas.

C. Do not place mulch within 3 inches of tree or large shrub trunks.

3.10 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of weeds, insects and disease.

1. Supplement mulch when entire mulch profile is 50 percent of depth required for initial mulch application to New Planting Areas. Restore entire mulch profile to depth indicated in these specifications.

B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
1. Supplement entire mulch profile to depth indicated in these specifications. Do not over-apply mulch which can negatively affect the health of plants.

C. Include the following required action at 12 months from Substantial Completion as part of warranty review:
   1. Remove tree staking systems, above and below grade.
   2. Remove tree saucers.
   3. Expose root crowns of all trees planted on the job.

3.11 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

C. After installation and before Substantial Completion remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.12 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 329300
SECTION 334100 – STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:
   1. Special fittings for expansion and deflection.
   2. Backwater valves.
   3. Cleanouts.
   4. Drains.
   5. Corrosion-protection piping encasement.
   6. Precast concrete or block and brick manholes and catch basins.
   7. Trench Drains
B. Contractor to coordinate with and comply with all Town of Fuquay-Varina and NCDOT standard construction details and specifications.
C. Related Sections:
   1. Division 31 Section "Earthwork" for backfill of utility lines.
   2. Division 33 Section “Common Work Results for Utilities”

1.3 DEFINITIONS
A. EPDM: Ethylene-propylene-diene-monomer rubber.
B. PE: Polyethylene plastic.
C. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS
A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water. Pipe joints shall be at least silttight, unless otherwise indicated.
1.5 SUBMITTALS

A. Product Data: For the following:
   1. Special pipe fittings.
   2. Drains.

B. Shop Drawings: For the following:
   1. Manholes: Include plans, elevations, sections, details, and frames and covers.
   2. Catch Basins and Stormwater Inlets. Include plans, elevations, sections, details, and frames, covers, and grates.
   3. Pipe and fittings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
   1. Notify Architect 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.

1.8 TRAFFIC CONTROL

A. Provide all required traffic control either identified on the drawings or as directed by the Town of Fuquay-Varina and the NCDOT.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service and Extra-Heavy classes.
B. Gaskets: ASTM C 564, rubber.
C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.
B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
C. Shielded, Stainless-Steel Couplings: CISPI 310, with ASTM A 666, Type 301, stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

1. Manufacturers:
   a. ANACO.
   c. Fernco Inc.
   d. Ideal Div.; Stant Corp.
   e. Mission Rubber Company; a division of MCP Industries, Inc.
   f. Tyler Pipe; Soil Pipe Div.

2. Couplings for NPS 1-1/2 to NPS 4: 2-1/8-inch wide shield with 2 bands.
3. Couplings for NPS 5 and NPS 6: 3-inch wide shield with 4 bands.
4. Couplings for NPS 8 and NPS 10: 4-inch wide shield with 4 bands.

D. Heavy-Duty, Shielded, Stainless-Steel Couplings, NPS 10 and Smaller: With ASTM A 666, Type 301 or Type 304, stainless-steel shield; 2 or more stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

1. Manufacturers:
   a. ANACO.
b. Clamp-All Corp.
d. Ideal Div.; Stant Corp.
e. Mission Rubber Company; a division of MCP Industries, Inc.
f. Tyler Pipe; Soil Pipe Div.

2. Couplings for NPS 1-1/2 to NPS 4: 3 inches.
3. Couplings for NPS 5 to NPS 10: 4 inches.

E. Heavy-Duty, Shielded, Stainless-Steel Couplings, NPS 12 and NPS 15: With ASTM A 666, Type 301 or Type 304, stainless-steel shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

1. Manufacturers:
   a. ANACO.
   b. Ideal Div.; Stant Corp.
   c. Mission Rubber Company; a division of MCP Industries, Inc.
   d. Tyler Pipe; Soil Pipe Div.

2. Couplings: 5-1/2-inch wide shield with 6 bands.

F. Heavy-Duty, Cast-Iron Couplings: ASTM A 48, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.

1. Manufacturers:
   a. MG Piping Products Co.

2. Couplings for NPS 1-1/2 to NPS 4: 2-1/8-inch wide housing with 2 bolts.
3. Couplings for NPS 5 and NPS 6: 3-1/8-inch wide housing with 4 bolts.
4. Couplings for NPS 8 and NPS 10: 4-inch wide housing with 4 bolts.

G. Unshielded Couplings: ASTM C 1461, rigid, sleeve-type, reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:
   a. ANACO.

2. Couplings for NPS 1-1/2 to NPS 4: Sleeve with two bands.

2.5 ALUMINUM PIPE AND FITTINGS

A. Corrugated Aluminum Pipe and Fittings: ASTM B 745/B 745M, Type I with fittings of similar form and construction as pipe.

1. Special-Joint Bands: Corrugated steel with O-ring seals.

2.6 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 10 and Smaller: 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.
   3. Corrugated PE Pipe and Fittings NPS 12 to NPS 48: AASHTO M 294M, Type S, with smooth waterway for coupling joints.
   4. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

B. Corrugated PE Pipe and Fittings NPS 56 and NPS 60: AASHTO MP7, 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 MP7, corrugated, matching pipe and fittings.

2.7 PVC PIPE AND FITTINGS


B. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T-1 wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

C. PVC Profile Gravity Sewer Pipe and Fittings: ASTM F 794 pipe, with bell-and-spigot ends; ASTM D 3034 fittings, with bell ends; and ASTM F 477, elastomeric seals.

2.8 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, with bell-and-spigot or groove and tongue ends and gasketed joints with ASTM C 443, rubber gaskets.
   1. Class III, Wall.
   2. Class IV, Wall.
   3. Class V, Wall.
2.9 NONPRESSURE-TYPE PIPE 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 Concrete Pipes: ASTM C 443, rubber.
3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
4. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:
   b. Fernco Inc.
   c. Logan Clay Products Company (The).
   d. Mission Rubber Company; a division of MCP Industries, Inc.
   e. NDS Inc.
   f. Plastic Oddities, Inc.

D. Shielded Flexible Couplings: 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.

1. Manufacturers:
   a. Cascade Waterworks Mfg.
   c. Mission Rubber Company; a division of MCP Industries, Inc.

E. Ring-Type Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

1. Manufacturers:
   a. Fernco Inc.
   b. Logan Clay Products Company (The).
   c. Mission Rubber Company; a division of MCP Industries, Inc.

F. Nonpressure-Type Rigid Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:
2.10 SPECIAL PIPE FITTINGS

A. Ductile-Iron Flexible Expansion Joints: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include 2 gasketed ball-joint sections and 1 or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated.

1. Manufacturers:
   a. EBAA Iron Sales, Inc.
   b. Romac Industries, Inc.
   c. Star Pipe Products.

B. Ductile-Iron Deflection Fittings: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for up to 15 degrees of deflection.

1. Manufacturers:
   a. EBAA Iron Sales, Inc.

C. Ductile-Iron Expansion Joints: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron or steel with protective coating, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for expansion indicated.

1. Manufacturers:
   b. EBAA Iron Sales, Inc.
   c. JCM Industries.
   d. Smith-Blair, Inc.

2.11 CLEANOUTS

A. Gray-Iron Cleanouts: 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.

1. Manufacturers:
   b. MIFAB Manufacturing, Inc.
   d. Wade Div.; Tyler Pipe.
   e. Watts Industries, Inc.
2. Top-Loading Classification(s): Light, Medium, Heavy and Extra-heavy duty.

3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

1. Manufacturers:
   a. Canplas Inc.
   b. IPS Corporation.
   c. NDS Inc.
   d. Plastic Oddities, Inc.
   e. Sioux Chief Manufacturing Company, Inc.
   f. Zurn Industries, Inc.; Zurn Light Commercial Specialty Plumbing Products.

2.12 DRAINS

A. Gray-Iron Area Drains: ASME A112.21.1M, round body with anchor flange and round secured grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.

1. Manufacturers:
   b. MIFAB Manufacturing, Inc.
   d. Wade Div.; Tyler Pipe.
   e. Watts Industries, Inc.
   g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.

2. Top-Loading Classification(s): Medium and heavy duty.

2.13 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Diameter: 48 inches minimum, unless otherwise indicated.
2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
3. Base Section: 6-inch minimum thickness for floor slab and 5-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
4. Riser Sections: 5-inch minimum thickness, and lengths to provide depth indicated.
5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
8. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 15-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches.
9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
11. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange and 26-inch diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
   a. Material: ASTM A 536, Grade 60-40-18 ductile iron, unless otherwise indicated.
   b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil minimum thickness applied to all surfaces, unless otherwise indicated.

2.14 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
   1. Cement: ASTM C 150, Type II.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio.
   2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious materials ratio.
   2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.15 CATCH BASINS

A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
2. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
3. 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. 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.
6. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch diameter frame and grate.
7. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 36 inches.
8. Pipe Connectors: ASTM C 923), 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 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 ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch diameter flat grate with small square or short-slotted drainage openings.

1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

2.16 STORMWATER INLETS

A. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to utility standards.

B. Gutter Inlets: Made with horizontal gutter opening, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

C. Combination Inlets: Made with vertical curb and horizontal gutter openings, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

D. Frames and Grates: Heavy-duty frames and grates according to utility standards.

E. Curb Inlets: Vertical curb opening, of materials and dimensions indicated.
F. Gutter Inlets: Horizontal gutter opening, of materials and dimensions indicated. Include heavy-duty frames and grates.

G. Combination Inlets: Vertical curb and horizontal gutter openings, of materials and dimensions indicated. Include heavy-duty frames and grates.

H. Frames and Grates: Dimensions, opening pattern, free area, and other attributes indicated.

2.17 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.

B. Riprap Basins: Broken, irregular size and shape, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."


2.18 MISCELLANEOUS MATERIALS

A. Paint: SSPC-Paint 16.

B. PE Sheeting: ASTM D 4397, with at least 8-mil thickness or other equivalent, impervious material.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earthwork."

3.2 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
a. Unshielded or 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.

B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

C. Gravity-Flow, Nonpressure Sewer Piping: Use any of the following pipe materials for each size range:

1. NPS 4 to NPS 6: Hub-and-spigot, Extra-Heavy Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. NPS 4 to NPS 6: Hubless cast-iron soil pipe and fittings; heavy-duty, shielded, stainless-steel couplings; and coupled joints.
3. NPS 4 and NPS 6: Corrugated PE drainage pipe and fittings, silttight couplings, and coupled joints.
4. NPS 4 and NPS 6: PVC sewer pipe and fittings, gaskets, and gasketed joints.
5. NPS 8 to NPS 12: Corrugated PE drainage pipe and fittings in NPS 8 and NPS 10 and corrugated PE pipe and fittings in NPS 12, silttight couplings, and coupled joints.
6. NPS 8 to NPS 12: PVC sewer pipe and fittings, gaskets, and gasketed joints.
7. NPS 12: Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.
8. NPS 15: Corrugated PE pipe and fittings, silttight couplings, and coupled joints.
9. NPS 15: PVC sewer pipe and fittings, gaskets, and gasketed joints.
10. NPS 15: Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.
11. NPS 18 to NPS 36: Corrugated PE pipe and fittings, silttight couplings, and coupled joints.
12. NPS 18 to NPS 36: PVC sewer pipe and fittings, gaskets, and gasketed joints.
13. NPS 18 to NPS 36: Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.
14. NPS 42 to NPS 60: Corrugated PE pipe and fittings, silttight couplings, and coupled joints.
15. NPS 42 to NPS 60: Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.

3.3 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 design considerations into account. 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. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

F. Install gravity-flow, nonpressure 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 36-inch minimum cover.
4. Install piping below frost line.
5. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
6. Install hubless cast-iron soil piping according to CISPI C310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
7. Install ductile-iron culvert piping according to ASTM A 716.
8. Install ductile-iron and special fittings according to AWWA C600 or AWWA M41.
9. Install corrugated steel piping according to ASTM A 798/A 798M.
10. Install corrugated aluminum piping according to ASTM B 788/B 788M.
11. Install PE corrugated sewer piping according to CPPA's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."
12. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
13. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

G. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A 674 or AWWA C105:

2. Hubless cast-iron soil pipe and fittings.
3. Ductile-iron pipe and fittings.
4. Special pipe fittings.

3.4 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:


4. Join ductile-iron culvert piping according to AWWA C600 for push-on joints.

5. Join ductile-iron and special fittings according to AWWA C600 or AWWA M41.

6. Join corrugated steel sewer piping according to ASTM A 798/A 798M.

7. Join corrugated aluminum sewer piping according to ASTM B 788/B 788M.

8. Join corrugated PE piping according to CPPA 100 and the following:
   a. Use silttight couplings for Type 2, silttight joints.
   b. Use soiltight couplings for Type 1, soiltight joints.

9. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.


11. Join dissimilar pipe materials with nonpressure-type flexible or rigid couplings.

   B. Join dissimilar pipe materials with pressure-type couplings.

3.5 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout 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 light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.

2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.

3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.

4. Use extra-heavy-duty, top-loading classification cleanouts in road areas.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.6 DRAIN INSTALLATION

A. Install type of drains in locations indicated.

1. Use light-duty, top-loading classification drains in earth or unpaved foot-traffic areas.

2. Use medium-duty, top-loading classification drains in paved foot-traffic areas.

3. Use heavy-duty, top-loading classification drains in vehicle-traffic service areas.

4. Use extra-heavy-duty, top-loading classification drains in road areas.

B. Embed drains in 4-inch minimum depth of concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.
E. Assemble trench sections with flanged joints.
F. Embed trench sections in 4-inch minimum concrete around bottom and sides.

3.7 MANHOLE INSTALLATION
A. General: Install manholes, complete with appurtenances and accessories indicated.
B. Install precast concrete manhole sections according to ASTM C 891.
C. Construct cast-in-place manholes as indicated.
D. Install PE sheeting on earth where cast-in-place-concrete manholes are to be built.
E. Install FRP manholes according to manufacturer's written instructions.
F. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.

3.8 CATCH BASIN INSTALLATION
A. Construct catch basins to sizes and shapes indicated.
B. Set frames and grates to elevations indicated.

3.9 CONCRETE PLACEMENT
A. Place cast-in-place concrete according to ACI 318/318R.

3.10 DRAINAGE SYSTEM INSTALLATION
A. Assemble and install components according to manufacturer's written instructions.
B. Install with top surfaces of components, except piping, flush with finished surface.
C. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.
D. Embed channel sections and drainage specialties in 4-inch minimum concrete around bottom and sides.
E. Fasten grates to channel sections if indicated.
F. Assemble channel sections with flanged or interlocking joints.
G. Embed channel sections in 4-inch minimum concrete around bottom and sides.
H. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.
2. Remove top of manhole or structure 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.

I. Backfill to grade according to Division 31 Section "Earthwork."

3.11 PAINTING

A. Prepare ferrous frame and cover surfaces according to SSPC-PA 1 and paint according to SSPC-PA 1 and SSPC-Paint 16. Do not paint surfaces with foundry-applied, corrosion-resistant coating.

3.12 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section "Earthwork." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.13 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 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. 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 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 soil-tight 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.

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.

3.14 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 334100
This page intentionally left blank.