NAME OF PROJECT: AIRFIELD MAINTENANCE TEMPORARY FACILITY – CONSTRUCTION

BIDS DUE: 1/5/2017 TIME: 2:00 PM Local Time

MEMPHIS SHELBY COUNTY AIRPORT AUTHORITY (MSCAA)
STAFF SERVICES DIVISION
MEMPHIS INTERNATIONAL AIRPORT
3505 Tchulahoma Road
Memphis, TN 38118 (901) 922-8000

BIDDER IDENTIFICATION:

Bidder ____________________________________________________________

Address ____________________________________________________________

TENNESSEE CONTRACTOR LICENSE INFORMATION:

License Number ______________________________________________________

License Classification Applicable to Project ______________________________

License Expiration Date ________________________________________________

Dollar Limit __________________________________________________________

SUBCONTRACTORS (OR PRIME CONTRACTORS) TO BE USED ON THIS PROJECT IN THE BELOW LISTED CAPACITIES:

Note: Where applicable, one contractor/subcontractor performing electrical, plumbing, heating, ventilation, air conditioning, and masonry work must have its license number, applicable classification, expiration date and dollar limit on the BID ENVELOPE containing the BID PROPOSAL. **Prime contractors** who are to perform the electrical, plumbing, heating, ventilation, air conditioning or masonry work MUST list themselves as “Self-Perform” in the Sub-contractor list below.

<table>
<thead>
<tr>
<th>Sub-contractor List</th>
<th>License No.</th>
<th>Applicable Classification</th>
<th>Expiration Date</th>
<th>Dollar Limit</th>
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<tbody>
<tr>
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<td></td>
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</tr>
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<td></td>
<td></td>
<td></td>
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</tr>
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<td>Air Conditioning</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Masonry</td>
<td></td>
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BID ENVELOPE

COMPLETE THIS FORM AND ATTACH IT TO THE OUTSIDE OF THE BID ENVELOPE. PLEASE REVIEW INSTRUCTIONS TO BIDDERS FOR BID PACKAGE DELIVERY AND FOR OTHER INFORMATION AND CONDITIONS. MSCAA RESERVES THE RIGHT, IN ITS SOLE DISCRETION, TO REJECT AND DISQUALIFY YOUR BID IF YOU, YOUR PARENT, SUBSIDIARY, AFFILIATE, OR PREDECESSOR IN INTEREST OR ANY OF YOUR SUBCONTRACTORS, SUPPLIERS, AND/OR THEIR PARENTS, SUBSIDIARIES, AFFILIATES OR PREDECESSORS IN INTEREST HAVE PENDING LITIGATION OR CLAIMS WITH THE MSCAA.
SPECIFICATIONS

FOR

AIRFIELD MAINTENANCE TEMPORARY FACILITY – CONSTRUCTION

MEMPHIS INTERNATIONAL AIRPORT
MEMPHIS, TENNESSEE

MSCAA PROJECT NO. 14-1379-10-01

DATED: November 29, 2016

ISSUED FOR BID
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SPECIFICATIONS
FOR
AIRFIELD MAINTENANCE TEMPORARY FACILITY - CONSTRUCTION
MEMPHIS INTERNATIONAL AIRPORT
MEMPHIS, TENNESSEE
MSCAA NO. 14-1379-10-01
11/29/16

TECHNICAL SPECIFICATIONS – ISSUED FOR BID

I hereby certify that Specifications 024000, 02720, 02827, 081113, 083323, 087100, 088000, 092116, 099000, 104400, and were prepared by me or under my direct supervision and that I am a duly Registered Architect under the laws of the State of Tennessee.

Scott F. Dicus

Date: 11/29/16 Reg. No. 23157
SPECIFICATIONS
FOR
AIRFIELD MAINTENANCE TEMPORARY FACILITY – CONSTRUCTION
MEMPHIS INTERNATIONAL AIRPORT
MEMPHIS, TENNESSEE
MSCAA NO. 14-1379-10-01
November 29, 2016

TECHNICAL SPECIFICATIONS – ISSUED FOR BID

I hereby certify that Specifications 230513, 230529, 230548, 230553, 230593, 230713, 231123, 233113, 233300, 233423, 235400, 235523, 237333, 238126 were prepared by me or under my direct supervision and that I am a duly Registered Engineer under the laws of the State of Tennessee.

Jack A. Griffith, PE

Date: 11/29/16   Reg. No. 114259
SPECIFICATIONS
FOR
AIRFIELD MAINTENANCE TEMPORARY FACILITY – CONSTRUCTION

MEMPHIS INTERNATIONAL AIRPORT
MEMPHIS, TENNESSEE

MSCAA NO. 14-1379-10-01

November 29, 2016

TECHNICAL SPECIFICATIONS – ISSUED FOR BID

I hereby certify that Specifications 033010, 051200, 055000 and 312600 were prepared by me or under my direct supervision and that I am a duly Registered Engineer under the laws of the State of Tennessee.

Mark E. Enoch

Date: 11/29/16  Reg. No. 104924
SPECIFICATIONS
FOR
AIRFIELD MAINTENANCE TEMPORARY FACILITY – CONSTRUCTION

MEMPHIS INTERNATIONAL AIRPORT
MEMPHIS, TENNESSEE

MSCAA NO. 14-1379-10-01

November 29, 2016

TECHNICAL SPECIFICATIONS – ISSUED FOR BID

I hereby certify that Specifications 260500, 260523, 260526, 260529, 260533, 260553, 260923, 260943, 262416, 262726, 263213, 263600, 265100, 265600 were prepared by me or under my direct supervision and that I am a duly Registered Engineer under the laws of the State of Tennessee.

Ryan J. Hertter, PE

Date: 11/29/16 Reg. No. 106919
SPECIFICATIONS
FOR
AIRFIELD MAINTENANCE TEMPORARY FACILITY - CONSTRUCTION

MEMPHIS INTERNATIONAL AIRPORT
MEMPHIS, TENNESSEE

MSCAA NO. 14-1379-10-01

November 29, 2016

TECHNICAL SPECIFICATIONS – ISSUED FOR BID

I hereby certify that Specifications 220513, 220517, 220519, 220523, 220529, 220553, 220719, 221116, 221119, 221316, 221319, 221513, 221519, 224000, and 224500 were prepared by me or under my direct supervision and that I am a duly Registered Engineer under the laws of the State of Tennessee.

Jeremiah E. Watson

Date: 11/29/16   Reg. No.   110226

END OF SECTION
SECTION 00010 - TABLE OF CONTENTS

Division/Section Code  Section Title

NON-TECHNICAL SPECIFICATIONS

DIVISION 0
00001  Project Title Page
00007  Professional Seals
00010  Table of Contents
00015  List of Drawings
00100  Legal Notice to Bidders
00200  Instructions to Bidders/Proposers
00405  Proposal
00410  Proposal Guarantee
00445  Disadvantaged Business Enterprise (DBE) Requirements
00490  Addenda and Modifications
00500  Construction Contract
00605  Certificate of Secretary
00610  Performance Bond & Labor and Material Payment Bond
00630  Application for Payment
00640  Business Diversity Monthly Compliance Report
00765  Supplemental Provisions
00801  Airport Construction Safety Requirements
00802  Airport Security Requirements

General Provisions
Section 10  Definition of Terms
Section 20  Proposal Requirements and Conditions
Section 30  Award and Execution of Contract
Section 40  Scope of Work
Section 50  Control of Work
Section 60  Control of Materials
Section 70  Legal Regulations and Responsibility to Public
Section 80  Execution and Progress
Section 90  Measurement and Payment
Section 105  Mobilization
Section 150  FAA General Provisions Addendum

DIVISION 1
01100  Summary of Work, Sequence of Construction & Liquidated Damages
01210  Allowances
01230  Alternates
01250  Amendment Procedure
01310  Preconstruction Conference & Progress Meetings
01320  Schedules and Reports
01321  Construction Surveying
01325  Delays and Extension of Time
01330  Submittals
01351  Storage and Protection
01352  Nuclear Gages
01455  Quality Control and Quality Assurance Testing Programs
01500  Construction Facilities and Temporary Controls
01600  Product Requirements
01630  Product Substitution Procedures

ISSUED FOR BID 00010
Page 1
<table>
<thead>
<tr>
<th>Division/Section Code</th>
<th>Section Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIVISION 1 (continued)</td>
<td></td>
</tr>
<tr>
<td>01700</td>
<td>Field Engineering</td>
</tr>
<tr>
<td>01720</td>
<td>Project Record Documents</td>
</tr>
<tr>
<td>01741</td>
<td>Cleaning</td>
</tr>
<tr>
<td>01770</td>
<td>Close-Out Procedures</td>
</tr>
<tr>
<td>01771</td>
<td>Affidavit of Contractor</td>
</tr>
<tr>
<td>01772</td>
<td>Final Waiver and Release of Lien: PRIME</td>
</tr>
<tr>
<td>01773</td>
<td>Final Waiver &amp; Release of Lien: SUBCONTRACTOR</td>
</tr>
<tr>
<td>01774</td>
<td>Contractor Warranty Form</td>
</tr>
<tr>
<td>01775</td>
<td>Consent of Surety Company to Final Payment</td>
</tr>
<tr>
<td>01783</td>
<td>Electrical Characteristics, Capacities, and Wiring Diagrams</td>
</tr>
<tr>
<td>01784</td>
<td>Manufacturer's Supervision</td>
</tr>
</tbody>
</table>

**TECHNICAL SPECIFICATIONS**

<table>
<thead>
<tr>
<th>DIVISION 02</th>
<th>EXISTING CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>02 40 00</td>
<td>Demolition</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIVISION 03</th>
<th>CONCRETE</th>
</tr>
</thead>
<tbody>
<tr>
<td>03 30 10</td>
<td>Reinforced Concrete</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIVISION 05</th>
<th>METALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>05 12 00</td>
<td>Structural Steel</td>
</tr>
<tr>
<td>05 50 00</td>
<td>Metal Fabrication</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIVISION 08</th>
<th>OPENINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>08 11 13</td>
<td>Steel Doors and Frames</td>
</tr>
<tr>
<td>08 71 00</td>
<td>Finish Hardware and Schedule</td>
</tr>
<tr>
<td>08 80 00</td>
<td>Glazing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIVISION 09</th>
<th>FINISHES</th>
</tr>
</thead>
<tbody>
<tr>
<td>09 21 16</td>
<td>Gypsum Board Assemblies</td>
</tr>
<tr>
<td>09 90 00</td>
<td>Painting and Coating</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIVISION 10</th>
<th>SPECIALTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 44 00</td>
<td>Fire Protection Specialties</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIVISION 22</th>
<th>PLUMBING</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 05 13</td>
<td>Common Motor Requirements for Plumbing Equipment</td>
</tr>
<tr>
<td>22 05 17</td>
<td>Sleeves and Sleeve Seals for Plumbing Piping</td>
</tr>
<tr>
<td>22 05 19</td>
<td>Meters and Gages for Plumbing Piping</td>
</tr>
<tr>
<td>22 05 23</td>
<td>General-Duty Valves for Plumbing Piping</td>
</tr>
<tr>
<td>22 05 29</td>
<td>Hangers and Supports for Plumbing Piping and Equipment</td>
</tr>
<tr>
<td>22 05 53</td>
<td>Identification for Plumbing Piping and Equipment</td>
</tr>
<tr>
<td>22 07 19</td>
<td>Plumbing Piping Insulation</td>
</tr>
<tr>
<td>22 11 16</td>
<td>Domestic Water Piping</td>
</tr>
<tr>
<td>22 11 19</td>
<td>Domestic Water Piping Specialties</td>
</tr>
<tr>
<td>22 13 16</td>
<td>Sanitary Waste and Vent Piping</td>
</tr>
<tr>
<td>22 13 19</td>
<td>Sanitary Waste Piping Specialties</td>
</tr>
<tr>
<td>22 15 13</td>
<td>General-Service Compressed-Air Piping</td>
</tr>
<tr>
<td>22 15 19</td>
<td>General-Service Packaged Air Compressors and Receivers</td>
</tr>
<tr>
<td>22 40 00</td>
<td>Plumbing Fixtures</td>
</tr>
<tr>
<td>22 45 00</td>
<td>Emergency Plumbing Fixtures</td>
</tr>
</tbody>
</table>
DIVISION 23 HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)
23 05 13 Common Motor Requirements for HVAC Equipment
23 05 29 Hangers and Supports for HVAC Piping and Equipment
23 05 48 Vibration and Seismic Controls for HVAC Piping and Equipment
23 05 53 Identification for HVAC Piping and Equipment
23 05 93 Testing, Adjusting, and Balancing for HVAC
23 07 13 Duct Insulation
23 11 23 Facility Natural-Gas Piping
23 31 13 Metal Ducts
23 33 00 Air Duct Accessories
23 34 23 HVAC Power Ventilators
23 54 00 Furnaces
23 55 23 Gas-Fired Radiant Heaters
23 73 33 Indoor Indirect-Fired Heating and Ventilating Units
23 81 26 Split-System Air Conditioners

DIVISION 26 ELECTRICAL
26 05 00 Common Work Results for Electrical
26 05 23 Control-voltage Electrical Power Cables
26 05 26 Grounding and Bonding for Electrical Systems
26 05 29 Hangers and Supports for Electrical Systems
26 05 33 Raceways and Boxes for Electrical Systems
26 05 53 Identifications for Electrical Systems
26 09 23 Lighting Control Devices
26 09 43 Network Lighting Controls
26 24 16 Panelboards
26 27 26 Wiring Devices
26 32 13 Engine Generators
26 36 00 Transfer Switches
26 51 00 Interior Lighting
26 56 00 Exterior Lighting

DIVISION 31 EARTH WORK
31 26 00 Steel Helical Piers

DIVISION 32 EXTERIOR IMPROVEMENTS
32 11 00 Unbounded Base Courses and Ballasts
32 31 10 Slide Gate Operator

Appendices

Appendix A MSCAA Design Guide – Construction Standards

END OF SECTION 00010
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DIVISION 0 – SECTION 00015

LIST OF DRAWINGS

DRAWINGS, Entitled Airfield Maintenance Temporary Facility – Construction, Issued for Bid, dated 11/29/16, with revisions, as noted on the drawing sheets:

<table>
<thead>
<tr>
<th>SHEET NO.</th>
<th>INDEX OF SHEETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>G000</td>
<td>COVER SHEET</td>
</tr>
<tr>
<td>A001</td>
<td>ARCHITECTURAL SITE PLAN AND PROJECT NOTES</td>
</tr>
<tr>
<td>A002</td>
<td>SITE PLAN - HANGAR ROAD</td>
</tr>
<tr>
<td>A003</td>
<td>SITE PLAN - RUNWAY ROAD</td>
</tr>
<tr>
<td>A011</td>
<td>EQUIPMENT SCHEDULE AND PHOTOGRAPHS</td>
</tr>
<tr>
<td>A102</td>
<td>DEMOLITION PLAN - 2836 HANGAR ROAD</td>
</tr>
<tr>
<td>A201</td>
<td>1ST FLOOR PLAN - 2836 HANGAR ROAD</td>
</tr>
<tr>
<td>A202</td>
<td>1ST FLOOR PLAN - 4000 RUNWAY ROAD</td>
</tr>
<tr>
<td>A203</td>
<td>FLOOR AND DEMOLITION PLANS - 2845 &amp; 2855 HANGAR ROAD</td>
</tr>
<tr>
<td>A411</td>
<td>WALL TYPES AND EXTERIOR DETAILS</td>
</tr>
<tr>
<td>A601</td>
<td>SCHEDULES</td>
</tr>
<tr>
<td>S001</td>
<td>GENERAL &amp; QUALITY ASSURANCE NOTES</td>
</tr>
<tr>
<td>S101</td>
<td>FOUNDATION PLAN &amp; DETAILS</td>
</tr>
<tr>
<td>S102</td>
<td>FRAMING PLAN &amp; ELEVATIONS</td>
</tr>
<tr>
<td>S201</td>
<td>FOUNDATION SECTIONS AND DETAILS</td>
</tr>
<tr>
<td>S202</td>
<td>ROOF FRAMING SECTIONS AND DETAILS</td>
</tr>
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<td>M000</td>
<td>HVAC LEGEND, GENERAL PROJECT NOTES &amp; SCHEDULES</td>
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<tr>
<td>MD101</td>
<td>HVAC FIRST FLOOR DEMOLITION - 2836 HANGAR ROAD - NORTH</td>
</tr>
<tr>
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<td>HVAC FIRST FLOOR DEMOLITION - 2836 HANGAR ROAD - SOUTH</td>
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<tr>
<td>M201</td>
<td>HVAC FIRST FLOOR PLAN NEW &amp; DEMO WORK - 4000 RUNWAY ROAD</td>
</tr>
<tr>
<td>M202</td>
<td>HVAC SECOND FLOOR NEW &amp; DEMO WORK - 4000 RUNWAY ROAD</td>
</tr>
<tr>
<td>M203</td>
<td>HVAC FIRST FLOOR NEW WORK - 2836 HANGAR ROAD - NORTH</td>
</tr>
<tr>
<td>M204</td>
<td>HVAC FIRST FLOOR NEW WORK - 2836 HANGAR ROAD - SOUTH</td>
</tr>
<tr>
<td>M301</td>
<td>HVAC DETAILS</td>
</tr>
<tr>
<td>M302</td>
<td>HVAC DETAILS</td>
</tr>
<tr>
<td>M401</td>
<td>HVAC CONTROLS</td>
</tr>
<tr>
<td>P000</td>
<td>PLUMBING GENERAL NOTES, LEGEND, SCHEDULES AND DETAILS</td>
</tr>
<tr>
<td>PD101</td>
<td>PLUMBING FIRST FLOOR DEMO PLAN 4000 RUNWAY RD</td>
</tr>
<tr>
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<td>PLUMBING FIRST FLOOR DEMO PLAN 2836 HANGAR RD</td>
</tr>
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</tr>
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<td>PLUMBING SITE PLAN 4000 RUNWAY RD</td>
</tr>
<tr>
<td>P201</td>
<td>PLUMBING FIRST FLOOR NEW WORK PLAN 4000 RUNWAY RD</td>
</tr>
<tr>
<td>P202</td>
<td>PLUMBING SECOND FLOOR NEW WORK PLAN 4000 RUNWAY RD</td>
</tr>
<tr>
<td>P203</td>
<td>PLUMBING FIRST FLOOR NEW WORK PLAN 2836 HANGAR RD</td>
</tr>
<tr>
<td>P204</td>
<td>PLUMBING FIRST &amp; SECOND FLOOR NEW WORK PLAN 2836 HANGAR RD</td>
</tr>
<tr>
<td>P301</td>
<td>PLUMBING DETAILS</td>
</tr>
<tr>
<td>P401</td>
<td>PLUMBING ISOMETRIC PLANS</td>
</tr>
<tr>
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<td>ELECTRICAL GENERAL NOTES AND SCHEDULES</td>
</tr>
<tr>
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<td>ELECTRICAL FIRST FLOOR DEMO PLAN 4000 RUNWAY ROAD</td>
</tr>
<tr>
<td>ED102</td>
<td>ELECTRICAL FIRST FLOOR DEMO PLAN 2836 HANGAR ROAD - NORTH</td>
</tr>
<tr>
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<td>ELECTRICAL FIRST FLOOR DEMO PLAN 2836 HANGAR ROAD - SOUTH</td>
</tr>
<tr>
<td>ED104</td>
<td>ELECTRICAL DEMO PLAN 2845 &amp; 2855 HANGAR ROAD</td>
</tr>
<tr>
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<td>INDEX OF SHEETS (continued)</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------</td>
</tr>
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<td>E100</td>
<td>ELECTRICAL SITE PLAN 4000 RUNWAY ROAD</td>
</tr>
<tr>
<td>E200</td>
<td>ELECTRICAL SITE PLAN 2836 HANGER ROAD</td>
</tr>
<tr>
<td>E201</td>
<td>ELECTRICAL FIRST FLOOR NEW WORK PLAN 4000 RUNWAY ROAD - LIGHTING</td>
</tr>
<tr>
<td>E202</td>
<td>ELECTRICAL FIRST FLOOR NEW WORK PLAN 4000 RUNWAY ROAD - POWER</td>
</tr>
<tr>
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<td>ELECTRICAL FIRST FLOOR NEW WORK PLAN 2836 HANGAR ROAD - LIGHTING NORTH</td>
</tr>
<tr>
<td>E204</td>
<td>ELECTRICAL FIRST FLOOR NEW WORK PLAN 2836 HANGAR ROAD - LIGHTING SOUTH</td>
</tr>
<tr>
<td>E205</td>
<td>ELECTRICAL FIRST FLOOR NEW WORK PLAN 2836 HANGAR ROAD - POWER NORTH</td>
</tr>
<tr>
<td>E206</td>
<td>ELECTRICAL FIRST FLOOR NEW WORK PLAN 2836 HANGAR ROAD - POWER SOUTH</td>
</tr>
<tr>
<td>E207</td>
<td>ELECTRICAL NEW WORK PLAN 2845 HANGAR ROAD</td>
</tr>
<tr>
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<td>ELECTRICAL NEW WORK PLAN 2855 HANGAR ROAD</td>
</tr>
<tr>
<td>E301</td>
<td>ELECTRICAL DETAILS</td>
</tr>
<tr>
<td>E401</td>
<td>ELECTRICAL RISER DIAGRAMS</td>
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<td>E402</td>
<td>ELECTRICAL RISER DIAGRAMS</td>
</tr>
<tr>
<td>E403</td>
<td>ELECTRICAL PANEL SCHEDULES</td>
</tr>
<tr>
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<td>ELECTRICAL PANEL SCHEDULES</td>
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</tbody>
</table>

END OF SECTION 00015
LEGAL NOTICE
Request for Bids
MSCAA Project Number 14-1379-10-01
Airfield Maintenance Temporary Facility – Construction

Sealed bids for Airfield Maintenance Temporary Facility will be received by the Memphis-Shelby County Airport Authority (Authority), Staff Services Division, 3505 Tchulahoma Road, Memphis, TN 38118-2718, until 2:00 PM local time on Thursday, January 5, 2017 and, immediately thereafter, will be opened and publicly read. The Bid Documents, including a description of the scope of work, the required response format, and additional instructions may be obtained on or after November 29, 2016 online at www.flymemphis.com.

A MANDATORY Pre-Bid Meeting will be held on Tuesday, December 13, 2016 at 9:30 AM local time at the Authority’s Project Center located at 4225 Airways Boulevard, Memphis, TN. Immediately following the meeting, a tour of the project site will be available. Only those individuals who participate in the meeting will be qualified to submit a response to this Request for Bids.

All Bidders are responsible for checking the Authority’s website up to the submission deadline for any updates, addenda or additional information. The successful Bidder must sign a contract with the Authority that includes Federal Aviation Administration provisions, if applicable, regarding the Buy American Preference, Foreign Trade Restriction, Davis-Bacon, Affirmative Action, Debarment and Suspension, and Drug-Free Workplace, all of which are incorporated herein by reference.

Each bid must be made by a contractor licensed in Tennessee and be accompanied by a 5% Bid Guarantee. The successful bidder must execute a Performance Bond and a Payment Bond in the amount of 100% each of the Contract Price and meet the Disadvantaged Business Enterprise (DBE) participation goal for this project, which is 22%.

The Authority reserves the right to reject any or all responses to this Request for Bids in whole or in part; to waive any informalities, technicalities, or omissions related to this Request for Bids; and to reject responses on any other basis authorized by the Authority’s purchasing policies.

The Authority is an equal opportunity employer and prohibits discrimination based on the grounds of age, race, sex, color, national origin, disability, marital status, military service, or sexual orientation in its hiring and employment practices and in the admission to, access to, or operation of its programs, services, and activities.

By order of:
Scott A. Brockman, A.A.E.
President and CEO
Memphis-Shelby County Airport Authority
DIVISION 0 – SECTION 00200

INSTRUCTIONS TO BIDDERS / PROPOSERS

Instruction for the preparation of proposals and the delivery thereof to the Memphis-Shelby County Airport Authority (MSCAA) are contained in General Provision Section 20 and additionally as follows. Prepare and submit proposals accordingly.

1. RESERVATION OF RIGHTS:

MSCAA reserves the right, in its sole discretion, to reject and disqualify the bid of any bidder that has pending litigation or claims with the MSCAA and to reject the bid when a parent, subsidiary, affiliate, or predecessor in interest of the Bidder has pending litigation or claims with the MSCAA.

MSCAA also reserves the right, in its sole discretion, to reject and disqualify the bid of any bidder if the bid includes any subcontractor(s) or supplier(s) of any tier that have pending litigation or claims with MSCAA, and to reject the bid when a parent, subsidiary, affiliate, or predecessor in interest of the subcontractor or supplier has pending litigation or claims with the MSCAA.

Bidders shall request from MSCAA a list of entities that have pending claims or litigation with MSCAA to avoid including such entities or their parents, subsidiaries, affiliates, or predecessors in interest in their proposal or bid. A list of affected entities may be obtained by a written or telephone request to Development Division at MSCAA, 2491 Winchester Road, Suite 113, Memphis, TN 38116-3856, telephone number (901) 922-8033.

2. PRE-BID CONFERENCE:

A MANDATORY Pre-Bid Meeting will be held Tuesday, December 13, 2016 at 9:30 AM at the Airport Project Center, located at 4225 Airways Blvd, Memphis, TN 38116. The project sites will be available for inspection immediately following the meeting. Only those in attendance may submit a response.

3. DRAWINGS AND SPECIFICATIONS FURNISHED TO CONTRACTOR:

One printed set of contract documents will be furnished to the Contractor who is awarded the work at no cost to him. Contractor may obtain additional printed copies of the contract documents at their reproduction cost. If the Contractor waives his right to one printed set of contract documents, one digital set of contract documents will be furnished to the Contractor at no cost to him.

4. REFUSAL OF ISSUANCE OF PROPOSAL FORM TO BIDDERS IN DEFAULT AND DISQUALIFICATION OF BIDDERS:

See General Provision Section 20 for disqualification of bidders and bidders in default.

5. SUBMIT THE FOLLOWING WITH THE BID IN THE MANNER DESCRIBED BELOW:

A. (1) Proposal
   (2) Proposal Guarantee (Required Bid Security)
   (3) DBE Assurance Statement/Letter of Intent on Bidder’s / Proposer’s Letterhead for each DBE subcontractor, subcontractors’ signatures not required.
   (4) Written quote or proposal or other communication from each DBE upon which the scope of work and dollar value contained in your Assurance Statements is based with items included in the Proposal either circled and/or highlighted.
   (5) DBE Goals Accomplishment Statement
   (6) Information on All Firms that Provide Bids or Quotes

B. The following must be submitted within 24 hours of the proposal submittal deadline:

ISSUED FOR BID 00200
Page 1
(1) DBE Assurance Statement/Letter of Intent on Bidder’s / Proposer’s Letterhead for each DBE subcontractor, subcontractors’ signatures required.

See General Provision Section 20, PROPOSAL REQUIREMENTS AND CONDITIONS.

C. By executing the proposal submittal, the Contractor is confirming that (1) neither the Contractor nor any of Contractor’s potential subcontractors or suppliers have pending claims or litigation, arbitration, or other dispute resolution proceedings where the Owner and the Contractor or potential subcontractors or suppliers are parties; or (2) the Contractor has disclosed in writing any such pending claims or proceedings to Owner through its own writing and/or the writing of Contractor’s potential subcontractors or suppliers and submitted same to Owner with the proposal submittal.

D. If a bid is sent by any means other than hand delivery to the bid opening, the package containing the bid must be addressed as follows:

Memphis-Shelby County Airport Authority
Staff Services Division
Memphis International Airport
3505 Tchulahoma Road
Memphis, TN  38118-2718
Project No. 14-1379-10-01

The bid must be sealed and the project number must be included in the address.

6. CONSIDERATION OF BID:

The Owner reserves the right to reject any or all bids in whole or in part and to waive any informalities, technicalities, or omissions therein.

It is intention of the Owner to award a contract based upon the lowest and best responsive and responsible qualified bidder on the lump sum base bid. Bidder understands and agrees that, after a review of all the bids, the Owner will select the lump sum base bid that best suits the Owner's needs within the sole discretion of the Owner.

7. NO FINANCIAL INTEREST:

Respondent understands and agrees that no Airport Authority employee or member of the Board of Commissioners shall receive any financial benefit arising out of this proposal or its contract, if awarded, either directly or indirectly. Further, any fees paid to any person or entity by contractor for assistance in obtaining this contract, if awarded, with the Authority must be fully disclosed to the Authority.

8. NOT USED.

9. POLICY 807: PROTEST PROCEDURES:

A. Policy 807 (“this policy”) is to establish a fair and uniform process for the filing of any protest relative to any published bid, RFQ, RFP, for any contract requiring the expenditure of Memphis-Shelby County Airport Authority (“Authority” or “Owner”) funds in accordance this Policy including but not limited to the expenditure for capital improvements, materials, and professional services, etc.

1. Right To Protest.
Only active participants in a bid, RFQ, or RFP may protest a decision by the Memphis-
Shelby County Airport Authority in connection with the award of same. Any challenge to
a decision by the Authority in connection with an award must be initiated by a protest in
accordance with this Policy. Failure to file a timely protest in accordance with this Policy
constitutes a failure to exhaust administrative remedies and shall cause a forfeiture of the
right to protest any such decision by the Authority.

2. Filing Requirements.

a) A protest must be in writing and received by the Authority within seven (7) calendar
days of the date of the occurrence of the event that is the subject of the
protest, e.g., the opening of bids or responses, the award, or a determination that
a bidder or respondent is not responsible or that a bid or response is not responsive.

b) A protest must be actually delivered to the addresses of Authority offices during
the Authority’s regular business hours in order to be deemed to be received by the
Authority as required under this Policy.

c) A Protest must be submitted in hard copy and addressed as follows: The
Memphis-Shelby County Airport Authority, Attention: Director of Staff Services,
3505 Tchulahoma Road, Memphis, TN 38118. A Protest sent by telegraphic or
facsimile transmission or by an email or other electronic means will not meet the
filing requirement set forth herein and will not be deemed to be received by the
Authority. The Director of Staff Services shall forward a properly filed Protest to
the Protest Review Panel. The Protest Review Panel shall be appointed to hear the
protest by the President or his designee.

3. Notice to Interested Parties.

Upon the Protest Review Panel’s receipt of a protest, it shall send a written notice of the
protest to all bidders or respondents participating in the related solicitation.

4. Grounds to Protest.

a) A protesting party shall be allowed to file a protest relating to a solicitation on
grounds that the Authority’s decision to accept or reject a particular bid or
response, to determine that the protesting party was not responsible, or to
determine that the protesting party’s bid or response was not responsible in
connection with a solicitation, was arbitrary or capricious or in violation of
applicable law.

b) A protest on any other grounds shall be deemed invalid and will not be considered.
In addition, the protest must state with particularity the factual basis upon which
the protesting party is seeking review by the Protest Review Panel.

c) A protesting party shall be deemed to waive any grounds or facts that are not
expressly set forth in its protest.

5. Time Limit for Resolving Protests.

The Protest Review Panel shall endeavor to resolve a protest within twenty (20) calendar
days after the Authority’s receipt thereof.

The President & CEO or his designee, in consultation with the Chief Operating Officer and the General Counsel, shall have the authority to informally settle and resolve a protest with the protesting party prior to the Protest Review Panel’s consideration of such protest.


In the event a protest cannot be informally resolved, the protest shall proceed to an informal hearing before the Protest Review Panel. The hearing before the Protest Review Panel shall afford an opportunity for the protesting party to present evidence as to why the Authority’s decision was arbitrary or capricious or in violation of applicable law. The protesting party has the burden of proof and persuasion to show by clear and convincing evidence that the Authority’s decision was arbitrary or capricious or in violation of applicable law. The protesting party has the right to be represented at the hearing before the Protest Review Panel by legal counsel of its choosing. MSCAA General Counsel shall attend all hearings of the Protest Review Panel as a nonvoting member to act as attorney for the Panel.

8. Decision to Protest Review Panel.

Within ten (10) calendar days after the close of the hearing before the protest Review Panel, they shall issue a written decision with respect to the protest. The decision shall be sent to the protesting party and all other bidders or respondents participating in the related solicitation. The decision shall state with particularity the reason for the action taken and shall include written findings of fact and conclusions of law in support of the Protest Review Panel’s decision. The Protest Review Panel’s decision shall constitute a final administrative decision. The item that is the subject of the protest may not appear on an agenda of the Board of Commissioners of the Memphis-Shelby County Airport Authority nor executed until the Protest Review Panel has issued its written decision.


In the event of a timely filed protest, the Authority shall not proceed further with the award in the solicitation at issue unless the Protest Review Panel makes a written determination that the protest is deemed invalid in accordance with subsection 8. above, “Decision to Protest Panel,” or that proceeding with the award and consummating the applicable contract is necessary to protect the interests of the Authority.

The Authority may condition its stay of an award upon the protesting party’s providing the Authority with a letter of credit, cash, deposit, or surety bond in the amount of ten percent (10%) of the value of the lowest and best responsive bid or response received in the Solicitation at issue or such other amount as established by the Authority as the Authority determines is necessary to protect it from harm as a result of the delay in making the award and consummating the applicable contract.

If the protest is deemed valid and the bid and/or contract in question is cancelled the aforementioned security shall be returned to the person/entity that provided the security for the protest. If the protest is deemed invalid and denied, the Authority shall be entitled to retain that portion of the security deemed necessary to compensate the Authority for the harm caused to the Authority as a result of the delay, including and up to the full amount of the security provided.

END OF SECTION 00200
DIVISION 0 – SECTION 00405

PROPOSAL

Project Identification: **Airfield Maintenance Temporary Facility – Construction**

Contract Number: MSCAA Project No. **14-1379-10-01**

For Overnight Courier, U.S. Postal Service Mailing, or Hand Delivery Submit to:

Memphis-Shelby County Airport Authority
Memphis International Airport
Staff Services Division
3505 Tchulahoma Road
Memphis, Tennessee 38118

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

2. Bidder accepts all of the terms and conditions of the Legal Notice to Bidders and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for seventy-five (75) days after the day of Bid opening. Bidder will sign and submit the Construction Contract with the Bonds and other documents required by the Bidding Requirements, within ten (10) days after the date of Owner's Notice of Award.

3. In submitting this Bid, Bidder represents, as more fully set forth in the Contract that:

   (a) Bidder has examined copies of all the Bidding Documents and of the following Addenda (receipt of all which is hereby acknowledged):

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<th>Number</th>
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   (b) Bidder has familiarized itself with the nature and extent of the Contract Documents, Work, site, locality, and all local conditions and Laws and Regulations that in any manner may affect cost, progress, performance or furnishing of the Work.
(c) Bidder has studied carefully all reports and drawings of subsurface conditions and drawings of physical conditions which are identified in Division 0 and Division 1 Specifications, and accepts the determination set forth in General Provision Section 20 paragraph 20-06 of the extent of the technical data contained in such reports and drawings upon which Bidder is entitled to rely.

(d) Bidder has obtained and carefully studied (or assumes responsibility for obtaining and carefully studying) all such examinations, investigations, explorations, tests and studies (in addition to or to supplement those referred to in (c) above) which pertain to the subsurface or physical conditions at the site or otherwise may affect the cost, progress, performance or furnishing of the Work at the Contract Price, within the Contract Time and in accordance with other terms and conditions of the Contract Documents, including specifically the provisions of General Provision Section 20 paragraph 20-06; and no additional examination, investigations, explorations, tests, reports or similar information or data are or will be required by Bidder for such purposes.

(e) Bidder has reviewed and checked all information and data shown or indicated on the Contract Documents with respect to existing Underground Facilities at or contiguous to the site and assumes responsibility for the accurate location of said Underground Facilities. No additional examinations, investigations, explorations, tests, reports or similar information or data in respect of said Underground Facilities are or will be required by Bidder in order to perform and furnish the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents.

(f) Bidder has correlated the results of all such observations, examinations, investigations, explorations, tests, reports and studies with the terms and conditions of the Contract Documents.

(g) Bidder has given Owner or Engineer written notice of all conflicts, errors or discrepancies that it has discovered in the Contract Documents and the written resolution thereof by Owner or Engineer is acceptable to Bidder.

(h) This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any person, firm or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.
4. Bidder will complete Base Bid Work for the following price(s).

<table>
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<tr>
<th>ITEM NO.</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
<th>QTY</th>
<th>TOTAL ESTIMATED PRICE</th>
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<tr>
<td>1</td>
<td>All work as detailed in the construction documents.</td>
<td>LS</td>
<td>1</td>
<td>$______________________</td>
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<tr>
<td>2</td>
<td>Lighting Repairs</td>
<td>ALLOW</td>
<td>1</td>
<td>$</td>
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<td>3</td>
<td>Metal Building Repairs</td>
<td>ALLOW</td>
<td>1</td>
<td>$</td>
</tr>
<tr>
<td>4</td>
<td>Mobilization (fixed cost)</td>
<td>LS</td>
<td>1</td>
<td>$</td>
</tr>
<tr>
<td>5</td>
<td>Demobilization (fixed cost)</td>
<td>LS</td>
<td>1</td>
<td>$</td>
</tr>
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**CONTRACT BASE BID TOTAL (TOTAL OF LINE ITEMS 1-5)** $______________________

5. The Owner reserves the right to reject any or all bids in whole or in part and to waive any informalities, technicalities, or omissions therein.

It is intention of the Owner to award a contract based upon the lowest and best responsive and responsible qualified bidder on the lump sum base bid. Bidder understands and agrees that, after a review of all the bids, the Owner will select the lump sum base bid that best suits the Owner's needs within the sole discretion of the Owner.

6. Bidder agrees that the Work: will be completed and ready for final payment within the calendar days (as described in Section 01100) after the date when the Contract Time commences to run. Bidder accepts the provisions of the Contract as to liquidated damages in the event of failure to complete the Work on time.

7. See Section 00200, INSTRUCTIONS TO BIDDERS, for a complete list of documents that are made a condition of this Bid.

8. Communications concerning this Bid shall be addressed to: ________________________________  
(Printed Name)  
The address of Bidder indicated above, or
the following address: _________________________________________________________________  

email address: _____________________________________________________________

9. The terms used in this Bid which are defined in General Provision Section 10 of the Specifications included as part of the Contract Documents have the meanings assigned to them in the Division 0 and Division 1 Specifications.

Submitted on ________________________, 20_______

10. The undersigned Bidder confirms that (1) neither Bidder nor any of Bidder’s potential subcontractors or suppliers have pending claims or litigation, arbitration, or other dispute resolution proceedings where the Owner and Bidder or Bidder’s potential subcontractors or suppliers are parties; or (2) such claims or
proceedings are pending and Bidder is disclosing same through its own writing and/or the writing of
Bidder’s potential subcontractors or suppliers and submitting same to Owner with this proposal submittal.

If Bidder is:

An Individual

______________________________________________________________
(Individual's Printed Name)

______________________________________________________________
(Individual's Signature)

doing business as:_____________________________________________

Business address:_____________________________________________

______________________________________________________________

Phone No.:_______________ FAX No. __________________________ E-Mail _______________________

A Partnership

______________________________________________________________
(Firm Name)

By:__________________________________________________________
(Signature of General Partner and Printed Name)

Business address:_____________________________________________

______________________________________________________________

Phone No.:_______________ FAX No. __________________________ E-Mail _______________________


A Corporation

(Corporation Name)

By: ____________________________  Title: ____________________________
(Signature of person authorized to sign)

(Printed Name)

(Corporate Seal)

Attest: ____________________________
(Signature of Secretary)  (Printed Name)

(State of Incorporation)

Business address: _______________________________________________________

Phone No.:_________________  FAX No. ____________________________  E-Mail ____________________________

A Joint Venture

(Joint Venture)

By: ____________________________
(Signature of Joint Venturer)  (Printed Name)

(Address)

Phone No.:_________________  FAX No. ____________________________  E-Mail ____________________________

By: ____________________________
(Signature of Joint Venturer)  (Printed Name)

(Address)

Phone No.:_________________  FAX No. ____________________________  E-Mail ____________________________

(Each joint venturer must sign. The manner of signing for each individual, partnership and corporation that is a party to the joint venture should be in the manner indicated above).

END OF SECTION 00405

ISSUED FOR BID
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DIVISION 0 – SECTION 00410

PROPOSAL GUARANTEE

KNOW ALL MEN BY THESE PRESENT, that we, the undersigned, _____________________________________________ as Principal, and _____________________________________________ as Surety, are hereby held and firmly bound unto Memphis-Shelby County Airport Authority as Owner, in the sum of ______________________________________________ for the payment of which, well and truly to be made, the said Principal and Surety hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

Whereas the Principal has submitted to Memphis-Shelby County Airport Authority a certain bid, attached hereto and hereby made a part hereof, to enter into a contract in writing for the Airfield Maintenance Temporary Facility – Construction, MSCAA Project No. 14-1379-10-01.

NOW, THEREFORE, if said bid shall be rejected, or in the alternate, if said bid shall be accepted and the Principal shall execute and deliver a contract in accordance with the terms of the Contract Documents and shall furnish a bond for its faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said bid, then this obligation shall be void, otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the amount of this obligation as herein stated.

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

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers,

this _____ day of _____________________________, 20_____.

PRINCIPAL

By:__________________________________________

__________________________________________

(Name and Title)

SURETY

SEAL

By:__________________________________________

__________________________________________

(Attorney-in-Fact)

END OF SECTION 00410
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DIVISION 0 – SECTION 00445

DISADVANTAGED BUSINESS ENTERPRISE (DBE) REQUIREMENTS

MSCAA operates a federal Disadvantaged Business Enterprise (DBE) Program and a non-federal Business Diversity Development Program (BDDP) to ensure full and fair opportunities in MSCAA contracting for businesses owned by socially and economically disadvantaged individuals. Memphis-Shelby County Airport Authority (MSCAA) administers both programs according to the regulations that apply to the federal program, primarily 49 CFR Part 26. Because the BDDP program applies to contracts involving non-federal funds, not every aspect of 49 CFR Part 26 is relevant to the BDDP program. In most areas, 49 CFR Part 26 will guide our operation of the BDDP including, but not necessarily limited to, rules dealing with certification and counting participation. Only firms that are certified consistent with 49 CFR Part 26 and by the MSCAA or Tennessee Department of Transportation Unified Certification Program (TN UCP), as identified below, will be considered to be certified as a Disadvantaged Business Enterprise.

This section, entitled “Disadvantaged Business Enterprise Requirements” is provided in an effort to assist Respondents. The information contained in this section is not intended to, nor does it, supplement or amend any federal regulation. All Respondents are responsible for compliance with all applicable federal and MSCAA rules and requirements.

It is a requirement that all Respondents providing services for the MSCAA take all reasonable steps to ensure that DBE have a full and fair opportunity to compete for and perform contract work without discrimination on the basis of age, race, sex, color, national origin, creed, religion, sexual orientation or disability. In order to satisfy this requirement, Respondents will be expected to timely submit documentation as identified below and throughout the contract period if selected, and cooperate with MSCAA. Failure to timely submit requested documentation, cooperate with MSCAA or answer inquiries truthfully will be considered a material contract breach and may result in termination.

The following documents must be submitted with your response to this solicitation:

DBE Assurance Statement/Letter of Intent. The Respondent must submit an Assurance Statement for each DBE whose participation the Respondent is counting toward the goal. This may include first, second, third and so on tier subcontractors and the Respondent and all subcontractors between the Respondent and the DBE should sign the Assurance Statement. The Respondent must submit this Assurance Statement on Company Letterhead.

For each Assurance Statement, the Respondent must also provide the written quote or proposal from the DBE or other communication from the DBE upon which the scope of work and dollar value contained in your Assurance Statement is based (“quote/proposal”).

For all RFQs using federal monies, the Assurance Statement(s) must still be submitted and list the DBE to be used and their scope of work, but no dollar amount(s) is entered. Dollar amounts(s) will be submitted by the prevailing Respondent upon completion of the selection process.

All portions of the Assurance Statement must be completed (including the description of work, the estimated contract amount, and the estimated dollar value of DBE participation for counting and goal purposes) before the Assurance Statement is signed by either the DBE or the Respondent. If the DBE’s, and if applicable the 2nd/3rd Tier Subcontractor’s signature(s) can be obtained on the completed Assurance Statement before the bid.
submission deadline, the Respondent should submit the fully-completed and fully-signed Assur ance Statement. If the Respondent submits an Assurance Statement that is completed except for the DBE’s, and if applicable, the 2nd/3rd Tier Subcontractor’s signature(s) and a quote/proposal from the DBE as described above, the Respondent will be given 24 hours from the bid submission deadline to submit the completed Assurance Statement signed by the DBE and if applicable the 2nd/3rd Tier Subcontractor. Each Assurance Statement submitted during this 24 hour window must conform to the previously submitted Assurance Statement except for DBE signature. These signed Assurance Statements must be submitted pursuant to the same location and time restrictions that applied to the solicitation response and late signed Assurance Statements will only be accepted for good cause as determined solely by MSCAA.

MSCAA reserves the right to ask questions of the Respondent, investigate and require additional information as it determines necessary in its sole discretion to ensure that the regulations and MSCAA’s rules are followed as it relates to DBE participation.

Respondent DBE Goals Accomplishment Statement
Submit on Company Letterhead

Information on All Firms that Provide Bids or Quotes

We ask, but do not require, that the Respondent submit the following information with the response to this solicitation:

Voluntary Disclosure of Respondent Data

Definition of Socially and Economically Disadvantaged

The rules that govern eligibility and certification of DBE are found generally at 49 CFR Part 26.5 and 26.61 through 26.73. These rules define a DBE as a for-profit, small business concern which is at least fifty-one percent (51%) owned and controlled by one or more socially and economically disadvantaged individuals. In the case of any publicly owned business, at least fifty-one percent (51%) of the stock must be owned by one or more socially and economically disadvantaged individuals. In addition, the personal net worth of the socially and economically disadvantaged owners of the small business concern must not exceed one million three hundred twenty thousand dollars ($1,320,000). As defined by 49 CFR, Part 26.5, a socially and economically disadvantaged individual is any individual who is a citizen (or lawfully admitted permanent resident) of the United States and who is –

(1) Any individual who a recipient finds to be a socially and economically disadvantaged individual on a case-by-case basis.

(2) Any individual in the following groups, members of which are rebuttably presumed to be socially and economically disadvantaged:

   (i) “Black Americans” which includes persons having origins in any of the Black racial groups of Africa;

   (ii) “Hispanic Americans” which includes persons of Mexican, Puerto Rican, Cuban, Dominican, Central or South American, or other Spanish or Portuguese culture or origin, regardless of race;

   (iii) “Native Americans” which includes persons who are American Indians, Eskimos, Aleuts, or Native Hawaiians;
(iv) “Asian-Pacific Americans” which includes persons whose origins are from Japan, China, Taiwan, Korea, Burma (Myanmar), Vietnam, Laos, Cambodia (Kampuchea), Thailand, Malaysia, Indonesia, the Philippines, Brunei, Samoa, Guam, the U. S. Trust Territories of the Pacific islands (Republic of Palau), the Commonwealth of the Northern Marianas Islands, Macao, Fiji, Tonga, Kiribati, Tuvalu, Nauru, Federated States of Micronesia, or Hong Kong;

(v) “Subcontinent Asian Americans” which includes persons whose origins are from India, Pakistan, Bangladesh, Bhutan, the Maldives islands, Nepal or Sri Lanka;

(vi) Women;

(vii) Any additional groups whose members are designated as socially and economically disadvantaged by the SBA, at such time as the SBA designation becomes effective.

**DBE Liaison Officer**

The DBE Liaison Officer is responsible for developing, implementing, and monitoring the DBE program on a day-to-day basis in coordination with other appropriate officials; carrying out technical assistance for a DBE; and, disseminating information on available business opportunities so that a DBE is provided an equitable opportunity to bid on MSCAA contracts. The DBE Liaison Officer reports directly to the President of the MSCAA. For questions or information related to the DBE program, contact Joe Claiborne at (901) 922-2556.

**DBE Certification**

MSCAA certifies all of its DBEs through internal processes. The MSCAA compiles a directory of firms who have met the selection criteria for eligibility as a DBE, including 49 CFR Part 26. You can review the searchable directory of certified firms for MSCAA at our website ([https://mscaa.mwdbe.com/](https://mscaa.mwdbe.com/)). In the right hand column, you will find links to both the TN UCP Directory and the MSCAA DBE/ACDBE Directory. The TN UCP is a cooperative of entities which are recipients of federal funds that have developed a “one-stop shop” for certification throughout the State of Tennessee of which MSCAA is a certifying member. In order to be considered as meeting the DBE goal for a contract, each business wishing to participate as a DBE or a joint venture DBE, must either be:

1. **certified by the MSCAA or the TN UCP** in accordance with 49 CFR Part 26, or;
2. **receive affirmation from the MSCAA or the TN UCP** that their certification from another entity is consistent with and acceptable to the MSCAA or the TN UCP.

Persons or entities who consider themselves a DBE but who are not certified by MSCAA, the TN UCP as a DBE, have not received affirmation from the MSCAA or the TN UCP that their certification from another entity is consistent with and acceptable to the MSCAA or the TN UCP will not be considered. Unless a firm meets the criteria above by the time the responses to this solicitation are due, its participation will not be considered as meeting the DBE goal in the solicitation. Each business wishing to participate as a DBE or a joint venture DBE must be certified at the time of bid opening and a current copy of the DBE’s certification must be attached to the Assurance Statement.
Identification of Contract Goal and Requirements

As an example: “For this contract, the DBE goal is established as **22%**.” In order to be responsive, a Respondent must either meet the goal or make good faith efforts to do so. Good faith efforts are defined in Appendix A to 49 CFR Part 26 and discussed in the following section.

If a Respondent’s DBE Assurance Statement proposes a DBE percentage less than the established goal, the Respondent must, at the time of making the response, submit appropriate documentation justifying its submitted DBE percentage. MSCAA reserves the right to request additional documentation or information from Respondent regarding its DBE Assurance Statement and, if applicable, any good faith efforts documentation. If MSCAA enters into a contract based on the Respondent’s DBE Goals Accomplishment Statement and documentation, the DBE percentage accepted by MSCAA will become a contractual requirement. If the Respondent’s DBE Assurance Statement proposes to attain a DBE percentage higher than the established goal, the established goal will remain the contractual requirement.

Respondents shall not contract with, demand, require or coerce a DBE into any agreement or into the signing of any Assurance Statement or any other document which prohibits the DBE from providing subcontracting quotations or doing business with other Respondents. The DBE shall be free to provide their services to any number of Respondents. To ensure that all obligations under sub-contracts awarded to a DBE are met, the MSCAA will review the agreement between the Respondent and DBE, and Respondent’s DBE involvement efforts during the performance of the contract. The Respondent shall bring to the attention of the MSCAA any situation in which regularly scheduled progress payments are not made to a DBE. If, in the opinion of the MSCAA, the Respondent has made significant deviations from the DBE program commitments, it shall be considered a breach of contract.

Good Faith Efforts Statement and Requirements

In order to be responsive, Respondents must either meet the DBE goal or make good faith efforts to meet the goal. Respondents who do not meet the goal must establish adequate good faith efforts by submitting documentation along with the Respondent DBE Goals Accomplishment Statement. This statement should show that they took all necessary and reasonable steps to achieve the DBE goal, which could reasonably be expected to obtain sufficient DBE participation, even if they were not fully successful. The Respondent’s DBE Goals Accomplishment Statement and supporting documents should conform to the good faith requirements outlined in Appendix A of 49 CFR Part 26.

The following is a list of types of actions that may be part of a Respondent’s efforts to obtain DBE participation and may be included in the Respondent DBE Goals Accomplishment Statement and documentation. This list is not intended to be a mandatory checklist, nor is it intended to be exclusive or exhaustive. Other factors or types of efforts may be relevant in appropriate cases:

A. Soliciting through all reasonable and available means (e.g. attendance at pre-bid meetings, advertising and/or written notices) the interest of all certified as a DBE who have the capability to perform the work of the contract. The Respondent must solicit this interest within sufficient time to allow the DBE to respond to the solicitation and take appropriate steps to follow-up initial solicitations to determine interest.

B. Selecting portions of the work to be performed by a DBE in order to increase the likelihood that the goals of the will be achieved.

C. Providing any interested DBE with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation.

D. Negotiating in good faith with any interested DBE. It is the Respondent’s responsibility to make a portion of the work available to DBE subcontractors and suppliers and to select those
portions of the work or material needs consistent with the available DBE subcontractors and suppliers, so as to facilitate DBE participation.

E. Not rejecting any DBE as being unqualified without sound reasons based on a thorough investigation of their capabilities.

F. Making efforts to assist any interested DBE in obtaining bonding, lines of credit, or insurance as required by the recipient or contractor.

G. Making efforts to assist any interested DBE in obtaining necessary equipment, supplies, materials, or related assistance or services.

H. Effectively using the services of available minority/women community organizations; minority/women contractors’ groups; local, state, and Federal minority/women business assistance offices; and other organizations as allowed on a case-by-case basis to provide assistance in the recruitment and placement of any DBE.

I. Making efforts to identify and assist eligible firms, which are not yet certified by the MSCAA or the TN UCP as a DBE, to obtain certification. These types of efforts will have special weight where it appears that the relevant firms will be certified in time for the execution of the contract.

If a Respondent has not met the DBE goal and submits Respondent DBE Goals Accomplishment Statement and documentation, the Respondent should summarize in detail all good faith efforts taken by the Respondent, including, but not limited to, the activities listed above in A through I, and supporting documentation. While the Respondent should submit documentation to support its good faith efforts at the time of bid submission, MSCAA may ask questions of Respondent or request additional documentation after review of Respondent’s DBE Goals Accomplishment Statement and any documentation. In submitting the information required under this section, Respondent understands and agrees that the determination of whether Respondent has met the DBE goal or established good faith efforts to meet the goal is a judgment call that MSCAA will make.

COUNTING THE DBE PARTICIPATION

DBE participation shall be counted toward meeting the DBE goal as outlined in 49 CFR Part 26, especially 26.55. When the Respondent completes an Assurance Statement, the Respondent must include not only the total value of the work to be performed and/or the materials to be supplied by the DBE but also the total amount of DBE participation that should be counted toward meeting the goal. For example, if a DBE is a regular dealer or supplier of pipe but does not install the pipe, then the Respondent can generally count the dollar value spent on the pipe at 60%. This would mean that if the DBE was supplying $100,000 of pipe then the contract amount would be $100,000 but the total amount of DBE participation would be $60,000 for counting and meeting the goal purposes. If you have any questions about counting, we strongly urge you to consult 49 CFR Part 26. The following may be helpful to you in counting DBE participation and in determining which sections of Part 26.55 you need to review in more detail:

(a) When a DBE participates in a contract or subcontract, the provider will count only the value of the work actually performed by the DBE toward the DBE goals. In a construction contract (and other similar contracts), this will include the work performed by the DBE’s own forces and supplies purchased or equipment leased by the DBE as described below, especially (d) (but not supplies or equipment the DBE subcontractor purchases from the prime contractor or its affiliate.) The Respondent will count the entire amount of fees or commissions charged by a DBE for providing a bona fide service toward goals provided that we determine the fees to
be reasonable and not excessive. When a DBE subcontracts part of the work of its contract to another firm, the value of the subcontracted work may be counted toward DBE goals only if the subcontractor is itself a DBE.

(b) When a DBE performs as a participant in a joint venture, the Respondent will count a portion of the total dollar value of the contract equal to the distinct, clearly defined portion of the work of the contract that the DBE performs with its own forces toward DBE goals.

(c) The Respondent will count expenditures to a DBE contractor toward DBE goals only if the DBE is performing a commercially useful function on that contract. A DBE performs a commercially useful function when it is responsible for execution of the work of the contract or subcontract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. To determine whether a DBE is performing a commercially useful function, the Respondent will evaluate industry practices, the amount of work subcontracted, whether the amount the firm is to be paid under the contract is commensurate with work it is actually performing, and the DBE credit claimed for its performance of the work, and other relevant factors. The Respondent will determine questions of commercially useful function with regard to trucking companies under 49 CFR Part 26.55 (d).

(d) The Respondent will count expenditures with the DBE for materials or supplies toward DBE goal in the manner described in 49 CFR Part 26.55 (e). Please review Part 26.55(e) carefully. It is important to note that the rule counts expenditures differently based upon whether the DBE is a manufacturer as defined by the rule (normally counted at 100% percent of the cost), a regular dealer as defined by the rule (normally counted at 60% of the cost) or neither of the two (normally counted at the entire amount of fees or commissions, or fees or transportation charges, provided they are reasonable). It is important to note that materials and supplies provided by a DBE that is not a regular dealer in those materials and supplies do not count toward meeting the goal. For example, if the DBE is a regular dealer of piping, the DBE cannot purchase office equipment and then supply that office equipment to the prime and count any portion of the cost of the office equipment toward meeting the goal. Such conduct for DBE counting purposes is prohibited by the rules and is considered to be an impermissible and illegal pass-through.

(e) If a firm is not currently certified as a DBE, in accordance with the standards of subpart D of this part, at the time of the execution of the contract, the Respondent will not count the Firm’s participation toward any DBE goals, except as provided for in 49 CFR Part 26.87(i).

(f) The Respondent will not count the dollar value of work performed under a contract with a firm after it has ceased to be certified toward any goals except as provided in 49 CFR Part 26.87(j).

(g) The Respondent will not count the participation of a DBE subcontractor toward a contractor’s final compliance with its DBE obligations on a contract until the amount being counted has actually been paid to the DBE.

SANCTIONS FOR NON-COMPLIANCE

In case of the Respondent’s non-compliance with DBE and/or BDDP requirements as applicable, including, but not limited to, documentation, cooperation, and truthfulness, MSCAA shall impose such contract sanctions as it may determine to be appropriate. This may include but is not limited to:

a) Withholding of payments to the Respondent under the Contract until the Respondent complies; and/or
b) Cancellation, termination, or suspension of the Contract, in whole or in part; and/or

c) Payment by the Respondent to MSCAA of an amount equal to the difference in the DBE dollar value contracted for and the dollar value achieved in documented DBE participation or any lesser amount or penalty as deemed appropriate by MSCAA, which dollar value shall be considered liquidated damages for failure to perform the requirements of this Contract and for which Respondent and all of its subcontractors agree to be bound.

**PROMPT PAYMENT/RETAINAGE**

The Respondent agrees to pay each subcontractor under this prime contract for invoices submitted or normal progress payments for work completed satisfactorily or supplies provided satisfactorily pursuant to its contract and no later than fifteen (15) days from the receipt of each payment it receives from the MSCAA.

There is no retainage or other sums allowed to be withheld from progress payments or any other payments and any exceptions to this prompt pay/retainage provision must be requested in writing by Respondent (Contractor) and approved in writing by an MSCAA Vice-President or higher prior to the delay or withholding of any payments under this provision.

Respondent (Contractor) will include the following paragraphs in all contracts and/or agreements related to the work [under this Contract] with subcontractors or suppliers and will require all its subcontractors and suppliers to include this paragraph in any contracts and/or agreements related to the work [under this Contract] with any other third parties and any other lower tier subcontractors or suppliers:

“It is understood and agreed by all involved parties that payment for work completed satisfactorily or supplies provided satisfactorily will be made to the appropriate party no later than fifteen (15) days from receipt of payment for that work or those supplies.

There is no retainage or other sums allowed to be withheld from progress payments or any other payments and any exceptions to this prompt pay/retainage provision must be requested in writing to MSCAA and approved in writing by an MSCAA Vice-President or higher prior to the delay or withholding of any payments under this provision.”

**49 CFR Part 26**

The Respondent shall carry out the applicable requirements of 49 CFR Part 26 in the award and administration of MSCAA contracts. Respondent agrees to provide all its subcontractors and suppliers and to require all its subcontractors and suppliers on this project to provide a complete copy of the *Disadvantaged Business Enterprise (DBE) Requirements* of this contract to all those who provide supplies or work related to this contract and to require all those providing supplies or work to be bound by these requirements as it relates to their work related to this contract.
DBE ASSURANCE STATEMENT/LETTER OF INTENT

RESPONDENT:

Name of Firm: ____________________________
Address: ____________________________________________
City: ________________________ State: __________ Zip: __________
Telephone: __________________________

DBE:

Name of Firm: ____________________________
Address: ____________________________________________
City: ________________________ State: __________ Zip: __________
Telephone: __________________________

Description of work to be performed by DBE:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

The Respondent is committed to utilizing the above-named DBE for the work described above. The estimated dollar value of this work is $__________, which is ________% of the total base bid proposal.

AFFIRMATION

The above-named DBE affirms that it will perform the portion of the contract for the estimated dollar value as stated above.

By: ____________________________________________
   Signature of DBE and Title Date Name

By: ____________________________________________
   Signature of 2nd/3rd Tier Subcontractor and Title Date Name

If the Respondent does not receive award of the prime contract, any and all representations in this letter of Intent and Affirmation shall be null and void.

By: ____________________________________________
   Signature of Respondent and Title Date Name

(SUBMIT ON RESPONDENT’S LETTERHEAD FOR EACH DBE SUBCONTRACTOR.)
RESPONDENT DBE GOALS ACCOMPLISHMENT STATEMENT

The undersigned Respondent has satisfied the requirements of the bid/proposal specification in the following manner (please complete the appropriate spaces):

______ The Respondent is committed to a minimum of _____% DBE utilization on this contract.

______ The Respondent is unable to meet the DBE goal of _____% but is committed to a minimum of _____% DBE utilization on this contract and submits the attached narrative and documentation demonstrating good faith efforts consistent with Appendix A of 49 CFR 26. The Respondent should attach as many pages as necessary to provide a full and complete narrative and supporting documentation of good faith efforts made. This narrative must be written on company letterhead and signed.

Please provide an explanation for the percentage quoted above:
Provide an explanation of the dollar value of DBE’s participation and compensation and how this has been determined to meet the specific goal requirements of this solicitation in whole or part.

________________________________________________________________________
________________________________________________________________________

If DBE and company will enter into a Joint Venture, please describe the terms of the relationship and attach a copy of the contract between the parties.

________________________________________________________________________
________________________________________________________________________

________________________________________________________________________

It is the present intent of the Respondent to utilize the specific DBE firms identified in this proposal in the execution of this contract. If for any reason, one or more of the DBE identified here are unable or unwilling to participate, the Respondent will make good faith efforts to replace the DBE with a similar DBE. The Authority DBE Good Faith Procedures are provided in this package and apply to this proposal.

Respondent’s Name: _______________________________________________________

State Registration No.: ___________________________________________________

Federal Tax ID No.: _____________________________________________________

By: ____________________________________________________________________

Signature and Title Date

(SUBMIT THIS PAGE ON RESPONDENT’S LETTERHEAD)
VOLUNTARY DISCLOSURE OF RESPONDENT DATA

For Title VI Compliance, we ask for voluntary disclosure of the following information:

Gender: Male
Female

Race: Caucasian
Black American
Hispanic American
Native American
Subcont. Asian American
Asian-Pacific American
Other (please specify)

(DO NOT SUBMIT THIS PAGE ON LETTERHEAD)
**Information on All Firms that Provided Bids or Quotes to:**

This requirement applies to all firms, regardless of whether they are subs or primes, regardless of the gender or race of their owners, and regardless of whether they are ultimately chosen to participate in the contract. Please list below the name, address, phone number and contact person for every firm that provided you a bid or a quote on this project – even if you ultimately decided not to use the firm in preparing your final bid. The first line should be used for the prime contractor on this project. All sections must be completed to the best of your ability.

**MSCAA Proj./Bid No.: __________________________**

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<th>Selected? Y/N</th>
<th>Full Address of Firm</th>
<th>Point of Contact</th>
<th>Phone No.</th>
<th>DBE? Y/N</th>
<th>Firm Age yrs</th>
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*Footnote: Please enter the letter for the category that best identifies your annual gross revenue.

**AGRR** = Annual Gross Revenue Ranges:
A = Less than $500,000   B = $500,000 - $1 Million   C = $1 - $2 Million   D = $2 - $5 Million   E = Over $5 Million
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DIVISION 0 – SECTION 00490

ADDENDA AND MODIFICATIONS

1. INTERPRETATIONS - ADDENDA AND MODIFICATIONS

A. If, during the bidding period Bidder finds discrepancies, ambiguities, omissions, or is in doubt as to meaning or intent of Contract Documents, notify the Owner or Engineer not less than seven (7) days prior to Bid Date. All such necessary clarifications, information, interpretations or amendments shall be answered in the form of written addenda to Drawings and Specifications, and shall be issued simultaneously to all holders of complete sets of Documents.

B. No Addenda will be issued less than two days prior to the Bid opening date. Neither the Owner nor Engineer shall be responsible for oral interpretations or instructions during the bidding period.

C. All Addenda are incorporated by reference into the Contract. Failure of any Bidder or sub-bidder to receive any addenda shall not relieve the Bidder of any obligation with respect to the Bid.

D. All Addenda and Modifications to the Contract Documents shall be inserted and indexed in this location behind this page.

END OF SECTION 00490
LUMP SUM CONSTRUCTION CONTRACT
FOR
AIRFIELD MAINTENANCE TEMPORARY FACILITY - CONSTRUCTION

BY AND BETWEEN
THE MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY
AND
(CONTRACTOR NAME)

MSCAA PROJECT NO. 14-1379-10-01

THIS LUMP SUM CONSTRUCTION CONTRACT (hereinafter referred to as “Contract”) is made and entered into as of the _____ day of _______________, 20___, between MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY, a body politic and corporate under the laws of Tennessee (hereinafter referred to as “Owner” or “Sponsor”) doing business at 2491 Winchester Road, Suite 113, Memphis, Tennessee 38116-3856, and CONTRACTOR NAME, a {insert LEGAL ENTITY TYPE and STATE} doing business at {insert Contractor address}, (hereinafter referred to as “Contractor,” “Bidder,” or “Offeror”). Owner and Contractor may sometimes be referred to herein individually as “Party” or collectively as “Parties.”

RECITALS

1. WHEREAS, the Owner desires to have constructed certain work in Memphis, Tennessee, more particularly described as Airfield Maintenance Temporary Facility - Construction, MSCAA Project No. 14-1379-10-01 (herein referred to as “the Project”); and

2. WHEREAS, the Contractor desires to enter into this Contract as an independent contractor and is ready, willing and able to construct the Project in accordance with the terms and subject to the conditions of this Contract; and

3. WHEREAS, the “Program Manager” is to act as the Owner's representative, and the Owner will advise the Contractor in writing of the name of the Program Manager; and

4. WHEREAS, the “Engineer” is the Owner’s representative with responsibility for design of the technical specifications, and the Owner will advise the Contractor in writing of the name of the Engineer; and

NOW, THEREFORE, in consideration of good and valuable consideration, received or to be received, the sufficiency of which the Parties acknowledge, the Parties agree as follows:

ARTICLE 1

SCOPE OF THE WORK AND TERM OF AGREEMENT

Section 1.01. Scope of the Work. The general scope of the work is more particularly described in Exhibit A, which is attached hereto and incorporated herein by reference. Contractor agrees that the Project shall be constructed in accordance with the terms of this Contract and the “Contract Documents” as defined in Article 2 of this Contract. The term “Work” includes, but is not limited to, all labor, materials, supplies, tools, equipment and services necessary to construct the Project as described in the Contract Documents, whether or not all materials and equipment are incorporated or will be incorporated in the Project; and all Work deemed necessary to fully close the Project including demobilization.

Section 1.02. Term of Agreement and Completion. The term of this Agreement shall commence upon Owner’s issuance of the Notice to Proceed pursuant to Section 3.01 and shall continue until the Work is completed in accordance with the Contract Documents, unless earlier terminated by the provisions set forth in Section 23 of this Agreement.
ARTICLE 2

CONTRACT DOCUMENTS

Section 2.01. Definition. The “Contract Documents” include this Contract, the Legal Notice, Instructions to Bidders, the Proposal, the Proposal Guaranty, the drawings and the specifications, the Federal Aviation Authority (“FAA”) General Provisions (“GP”), all addenda, and exhibits or modifications to any of them, issued prior to or after execution of this Contract. The Contract Documents are more particularly described in Exhibit B, which is attached hereto and incorporated herein by reference. As used in this Contract, a “modification” is either:

(a) a written and signed Contract Amendment to this Contract; or
(b) an accepted Request for Proposal (“RFP”); or
(c) an Engineer’s Supplemental Instruction (“ESI”); or
(d) a Construction Change Directive (as defined in Section 9.01(c) of this Contract).

Section 2.02. Intent of Contract Documents. The intent of the Contract Documents is to include all design, architecture and engineering, except as otherwise expressly provided in the Contract Documents, materials, appliances, labor and services of every kind necessary for the proper execution of the Work and the terms and conditions of payment for the Work. The Contract Documents are to be considered as one document, and whatever is called for by any one of the Contract Documents shall be as binding as if called for by all.

Section 2.03. Coordination of the Contract, Plans and Specifications. This Contract, the plans, specifications, and all referenced standards cited in the Contract Documents are essential parts of the Contract requirements. A requirement occurring in one of the Contract Documents is as binding as though occurring in all. They are intended to be complementary and used to describe and provide for a complete project. In case of dimensional discrepancies, calculated dimensions will govern over scaled dimensions. In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:

(a) This Contract.
(b) The Addenda, with those of later date having precedence over those of earlier date.
(c) The Technical Specifications.
(d) The Plans.
(e) Cited standards for materials or testing and cited FAA General Provisions and advisory circulars.

Section 2.04. Errors in Contract Documents. Prior to commencing the Work, the Contractor shall review all of the Contract Documents for the purpose of identifying any error, inconsistency, omission, discrepancy or variance that may be contained therein. If the Contractor finds any error, inconsistency, omission, discrepancy or variance in the Contract Documents, it shall notify the Owner at least ten (10) days before beginning the affected portion of the Work. The Owner shall make any correction, interpretation or clarification promptly, basing its decision on the intent of the Contract Documents. Failure of the Contractor to timely notify the Owner of any such error, inconsistency, discrepancy or variance within the time provided by this paragraph shall bar the Contractor from making any claim for additional time or compensation caused by any such error, inconsistency, discrepancy or variance even if the error, inconsistency, discrepancy or variance caused the Contractor to incur additional expense or time of performance.

ARTICLE 3

PROGRESS OF THE WORK

Section 3.01. Commencement and Completion. The Contractor shall commence the Work upon receipt of the written Notice to Proceed, as defined in Section 01100 of the Specifications, from the Owner and shall achieve substantial completion of the Work, as defined in Section 01100 of the Specifications. The Contractor warrants that it will deliver the Project to the Owner free from any and all mechanics’ liens or other encumbrances. Contractor further agrees
to promptly (which is defined for purposes of this paragraph as no more than three (3) days from receipt of any lien or other notice) notify the Owner of the existence of any and all mechanics' liens filed by any subcontractors, materialmen, suppliers or sub-subcontractors. If any mechanics' liens are filed, Contractor shall, at its expense, bond off any such mechanics’ liens within three (3) days from receipt of a written request of Owner to do so. Time is of the essence, and the substantial completion date may be altered only as provided in this Contract. Substantial completion shall occur when the Work is sufficiently complete in accordance with the Contract Documents, so the Owner can occupy or utilize the Work for its intended use, and when only minor punch list work remains to be done and a certificate of occupancy has been issued. The Owner will, upon written request of the Contractor, issue a certificate establishing the substantial completion date at any time after substantial completion has occurred.

Section 3.02. The Progress Schedule. Contractor shall fully comply with the requirements for the scheduling the Work as set forth in Section 01100 and Section 01320 of the Specifications. The Owner reserves the right to reschedule the Work, or the sequence of the activities of the Contractor, for no additional compensation should Owner deem such rescheduling to be in its best interest. At least fifteen (15) days prior to the due date of the first payment to be made hereunder by the Owner and thereafter on a monthly basis, the Contractor shall submit to the Owner a cash flow projection depicting the projected monthly cash flow for the entire Project.

Section 3.03. Extension of Substantial or Final Completion Date.  

(a) Except as otherwise expressly provided herein, the “Substantial Completion Date” or “Final Completion Date” shall be extended only for such number of calendar days that the Work is actually delayed by a casualty, a fire, or a Contract Amendment (hereinafter referred to as “Excusable Delays”). No extensions to the Substantial Completion Date shall be granted due to the negligence or fault of the Contractor or its subcontractors, non-availability of materials or non-availability of labor. No extension to the Substantial Completion Date shall be granted for the period of time during a delay in the performance of the Work which is caused in part by the Owner, the Engineer, and in part by the Contractor or one for whom the Contractor is responsible (“Concurrent Delay”). A request for a time extension based upon inclement weather shall be governed by the provisions of Section 01320 (3.05) of the Specifications.

(b) In order to obtain an extension of the Final Completion Date or the Substantial Completion Date due to an Excusable Delay, the Contractor in each instance shall give written notice to the Owner within seven (7) days after the occurrence of each Excusable Delay. If the Contractor fails to issue written notice to the Owner, its right to an extension, if any, will be deemed waived. The Owner shall render a written decision, which shall be made in good faith, granting or refusing the request of the Contractor for an extension within a reasonable time after receipt of the request for a time extension. If a Contract Amendment is agreed to by the Contractor and Owner, any extension of the Substantial Completion Date caused by the Contract Amendment work must be stated in the Contract Amendment and the Contractor will be barred from later seeking an extension to the Substantial Completion Date or Final Completion Date because of the Contract Amendment work. No extension to the Substantial Completion Date or the Final Completion Date shall be granted due to the aggregate number of Contract Amendments.

Section 3.04. No Damage for Delay. Contractor agrees to perform the Work and to require the subcontractors to perform the Work in a timely and proper method so as to meet the dates reflected on the progress schedule. In the event that the Contractor is delayed in the performance of the Work through no fault of the Contractor or its subcontractors, and for causes set forth in Section 3.03(a), and defined therein as Excusable Delay, then the Contractor may seek a time extension in accordance with the provisions of Section 3.03(b). Contractor agrees that such time extension is its sole and exclusive remedy for any damages regardless of the cause of such delays. Contractors also agrees that the Owner shall not be liable for any other monetary damages sustained by Contractor for acceleration, disruption, inefficiencies, suspension or resequencing of the Work or any other damages related to the progress schedule regardless of the cause of such damages. The Owner shall not be liable for consequential damages of any nature for any reason at any time.

Section 3.05. Liquidated Damages. Per Section 01100 of the Specifications, liquidated damages will be assessed for the Project. The Contractor shall proceed with the Work at such rate of progress to ensure full completion within the specified duration.

ARTICLE 4

PAYMENT

Section 4.01. Lump Sum Price. The Owner and Contractor agree that the Contractor shall be paid the following price Contract Amount and 00/100 Dollars ($000.00) (“Lump Sum Price”) for all of the Work and other obligations to be
performed by the Contractor in the base bids. The Lump Sum Price shall include all profit and overhead, including without limitation field overhead, general conditions and home office overhead of the Contractor. The Lump Sum Price also includes all allowances specified in the Contract Documents.

Section 4.02. Payment Procedures. As Work proceeds under the Agreement, payments ("Progress Payments") shall be made by the Owner to the Contractor in accordance with the following procedure:

(a) By the 1st day of each calendar month during the performance of the Work (business day does not include a Saturday, Sunday or holiday), the Contractor shall submit to the Owner an Application and Certificate for Payment, based on the Work completed during the previous month (previous month being the first day through the last day of the month), using a form approved by the Owner. Contractor shall not be paid any amounts exceeding the Lump Sum Price set forth in Section 4.01 of this Contract, unless modified by a properly executed written Contract Amendment in accordance with the provisions of Article 9 of this Contract.

(b) Each Application and Certificate for Payment shall be accompanied by: (1) lien waivers of the Contractor and its Subcontractors conditioned upon payment by the Owner of the amount sought in the Application; (2) other documentation as may be requested by the Owner for the proper review of the Application and Certificate for Payment; (3) a list of current subcontractors, sub-subcontractors and material suppliers; (4) the Business Diversity Monthly Compliance Reports; and (5) all documents required by the Owner Controlled Insurance Program ("OCIP") Manual, as applicable.

(c) The Owner or Engineer shall promptly review each Application and Certificate for Payment and recommend for approval such amount as is properly due under the Contract Documents.

(d) Payments by the Owner shall be made within thirty (30) days from the date on which an Application and Certificate for Payment has been submitted and approved by the Owner or the next working day if the thirtieth day is a Saturday, Sunday or holiday.

Section 4.03. Mobilization. The work which is conducted in preparation for the construction activities, which includes but is not limited to, movement of personnel, equipment, stockpiles, supplies to the project site, (all as more particularly described in Article 3.01 of Section 01100 of the Specifications) shall be designated as "Mobilization." The Mobilization lump sum amount for this Contract shall be Sixty Thousand and 00/100 Dollars ($60,000.00), which is a fixed amount that shall not change for the Term of the Contract.

Section 4.04. Demobilization. The activities which are conducted by the Contractor in order to complete the work and conduct any closeout items, which includes but is not limited to, removal of personnel, equipment, Contractor owned stockpiles, supplies and incidentals from the project site, (all as more particularly described in Article 3.01 of Section 01100 of the Specifications) shall be designated as "Demobilization." The Demobilization lump sum amount for this Agreement shall be Thirty-Five Thousand and 00/100 Dollars ($35,000.00), which is a fixed amount and shall not change for the Term of the Contract.

Section 4.05. Payment for Material Stored On-Site.

(a) Payment for the actual unit cost of materials suitably stored on the site of the Work ("Work Site") and intended for incorporation in the Work will be made by the Owner to the Contractor subject to the provisions of Section 4.02 of this Contract, Section 90-07 of the FAA General Provisions of the, and the following conditions:

(1) The Contractor shall furnish supporting evidence satisfactory to the Owner evidencing the cost of the materials and shipment to the Work Site.

(2) The materials shall not be stored on the Work Site for more than ninety (90) calendar days before they are installed without the written consent of the Owner.

(3) The materials shall be stored on the Work Site in accordance with applicable recommendations of the manufacturer and the instructions of the Owner.

(4) A representative of the Owner or Engineer may inspect and inventory any stored materials.
(b) Payment will not be made for materials stored away from the Work Site without the written consent of Owner. In the event that the Owner consents to payment for materials stored off-site, such payment shall be conditioned upon submission by the Contractor of bills of sale or such other documentation satisfactory to the Owner to establish the title of the Owner to such materials or equipment, and the submission of satisfactory insurance certificates for the stored materials.

(c) Notwithstanding any provision herein to the contrary, if payments are to be made on account of materials or equipment not incorporated in the Work but delivered and suitably stored at the Work Site, such payments shall be conditioned upon submission by the Contractor of bills of sale or such other documentation satisfactory to the Owner to establish the title of the Owner to such materials or equipment, and the submission of satisfactory insurance certificates for the stored materials to protect the interest of the Owner.

(d) Regardless of ownership or insurance, the Contractor shall remain the guardian and protector of all materials and equipment stored or incorporated into the Work.

Section 4.06. Use of Payments. The Contractor shall use all sums paid to it pursuant to this Contract for the performance of the Work in accordance with the Contract Documents. Upon the request of the Owner or Engineer, the Contractor shall furnish satisfactory proof of payment, including, but not limited to, partial release of liens and the Business Diversity Monthly Compliance Report, as to the disposition of any monies paid to the Contractor by the Owner.

Section 4.07. Payment Not a Waiver. Neither the approval or making of any payment to the Contractor, nor the partial or entire use or occupancy of the Work by the Owner, shall be deemed an acceptance of any portion of the Work.

Section 4.08. Final Payment.

(a) “Final Payment,” by the Owner shall constitute a waiver of all claims by the Owner for performance of the Work except for claims of the Owner arising from unsettled liens, incomplete or defective workmanship, defective materials, failure to perform in accordance with the progress schedule, or for the breach of any guarantees of warranties provided or to be provided by the Contractor under this Contract. Acceptance of the Final Payment by the Contractor shall constitute a waiver and release of any and all claims which the Contractor may then have or in the future have against the Owner or the Engineer arising from the Work or this Contract.

(b) Final Acceptance of the Work shall occur only after all Work (including punch list items) provided for in the Contract Documents has been finally completed and accepted in writing by the Owner, and only after the Contractor has provided the Owner with instructions and operating manuals, parts lists, “record” drawings and all other items required by the Contract Documents.

(c) Within thirty (30) days after “Final Acceptance” of the Work, the Final Payment of amounts found properly due under the Contract Documents shall be paid to the Contractor.

(d) Final Payment shall not become due until the Contractor submits to the Owner the following:

1. An affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or its property might in any way be responsible, have been paid or otherwise satisfied; and

2. A consent of surety to Final Payment; and

3. Other data establishing payment or satisfaction of all such obligations, such as receipts, releases and waivers of liens arising out of the Work, to the extent and in such form as may be designated by the Owner or Engineer; and

4. Any documents required by Article 6 of this Contract.

(e) If any subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify it. If any lien is filed by a subcontractor and remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorney’s fees incurred by Owner.
(f) The Owner shall issue a “Certificate of Final Completion” when, in its sole discretion, the Project has been completed and all conditions required by this Section 4.07 have been complied with by Contractor.

Section 4.08. The Right of Owner to Withhold Payment. The Owner may withhold or, on account of subsequent evidence, nullify, the whole or part of any Progress Payment, including the Final Payment, to such extent as may be necessary to reasonably protect itself from any of the following:

(a) unacceptable work as further described in Section 50-10 of the FAA General Provisions; or
(b) third-party claims filed or reasonable evidence indicating probable filing of such claims; or
(c) reasonable doubt that the Work will be substantially completed by the Substantial Completion Date; or
(d) failure of the Contractor to make payments properly to subcontractors or for equipment, materials, services or labor; or
(e) reasonable evidence of fraud, over-billing or overpayment; or
(f) failure of the Contractor to perform the Work in accordance with the Contract Documents; or
(g) a reasonable doubt that the Work can be completed for the unpaid balance of the Lump Sum Price; or
(h) damage to the Owner, or to another contractor, subcontractor or sub-subcontractor caused by the Contractor; or
(i) failure to provide certified payroll records; or
(j) failure to provide any documents required by the Owner Controlled Insurance Program (OCIP); or
(k) failure to keep the record drawings current each month in accordance with Article 6 of this Contract.

ARTICLE 5

EQUIPMENT AND MATERIALS

Section 5.01. Materials Provided by Contractor.

(a) Unless otherwise provided in the Contract Documents, the Contractor shall provide all equipment, materials, labor, services, water, and power to the Work Site, as well as all tools, equipment, lights, transportation, and other facilities necessary for the performance of the Work.

(b) All equipment, machinery, material, and articles incorporated in the Work shall be new and unused unless otherwise specified in the Contract Documents. When not specified in detail in the Contract Documents, the equipment, machinery, material, and articles incorporated in the Work shall be of the most suitable grade and quality for the purpose intended.

Section 5.02. Type of Equipment Used.

(a) When any equipment, machinery, material, or article is referred to by trade name, make, or catalog number followed by the words “or equal,” the reference shall be regarded as establishing the minimum standard of quality and performance required and shall not be construed as limiting competition. The Contractor may, with the prior written approval of the Owner, use other equipment, machinery, materials, or articles which are at least equal in quality and performance to that named in the Contract Documents; provided, however, that in no event shall such approval be construed as a waiver of the right of the Owner to require equipment, machinery, materials, or articles which conform to the standard of quality and performance established by reference to the trade name, make, or catalog number of the equipment, machinery, materials, or articles for which the substitution has been approved. Any cost of redesign and additional expense resulting from the substitution shall be at the sole expense of the Contractor.
(b) The name of the manufacturer, model number, and other identifying information respecting the performance, capacity, nature, and rating of equipment, machinery, materials, and articles proposed in substitution of those specified in the Contract Documents shall be submitted to the Owner in sufficient time to avoid delays in the Work.

**Section 5.03. Non-Conforming Materials.**

(a) Equipment, machinery, materials or articles installed or used in the Work which do not comply with the requirements of the Contract Documents, and which have not been previously approved in writing by the Owner shall be installed or used at the risk of the Contractor of subsequent rejection by the Owner.

(b) The Contractor shall be fully and solely responsible for quality control for all equipment, machinery, materials or articles used in the performance of the Work.

**Section 5.04. Owner Furnishing Equipment or Fixtures.** The Owner may directly furnish any and all of the equipment or fixtures required for the Project. In the event the Owner elects to do so, the Lump Sum Price shall be reduced by the amount which was to be charged by Contractor for such equipment or fixtures as set forth and included in the Contract Documents. A Contract Amendment reducing the Lump Sum Price for that item of Work shall be executed by Owner and Contractor to reflect a reduction in the Lump Sum Price for that item of Work and that the Owner is to furnish the equipment or fixtures. The Contractor shall assume responsibility for and be fully responsible for the care, custody, and control of all Owner furnished equipment or fixtures after said equipment or fixtures arrives on the Work Site or in any approved offsite storage facility, as set forth in Section 60-08 of the FAA’s General Provisions.

**ARTICLE 6**

**RECORD DRAWINGS AND DATA**

**Section 6.01. Record Drawings.** A complete set of drawings shall be maintained by the Contractor at the Work Site for the purpose of accurately indicating all record conditions. The drawings shall be kept up-to-date and marked each day to show all changes and variations and each entry shall be dated and verified as made. At the completion of the Work and prior to Final Payment, a complete set of marked record drawings shall be furnished by the Contractor to the Owner. If the record drawings are not kept current each month, the Owner shall have no obligation to pay the Contractor until the record drawings are made current.

**Section 6.02. Operation and Maintenance Data.**

(a) The Contractor shall furnish complete and necessary data for the operation, repair, and maintenance of each operating component of the Work (hereinafter referred to as “the Data”). The Data shall include prints of shop drawings, “as-installed” conditions, sources of equipment and principal materials, specified tests and performance data, repair and maintenance data, lubrication instructions and recommendations, parts lists, and other catalog data or information required to operate and maintain any part of the Work. Care shall be taken to include all pertinent data and to exclude inapplicable or duplicative information.

(b) Prior to Final Payment, a set of Data shall be furnished to the Owner in an electronic PDF format. In addition, three (3) complete sets of the Data in a form directed by the Owner shall be provided to the Owner, indexed alphabetically by components, grouped together and securely bound in a durable folder or binder that is labeled and indexed to show its contents.

(c) Installation information for all machinery and equipment also shall be kept on the site of the Work during construction, but used or marked prints or data sheets are not to be used in assembling the final maintenance and operating manuals described in paragraph (b) of this Section 6.02.

(d) Operations and maintenance demonstrations by the manufacturer of all machinery and equipment shall be complete in all respects and shall specify the appropriate and inappropriate uses of the machinery and equipment.

**Section 6.03. Information from Suppliers.** The Contractor shall make it a requirement or condition of purchase from its suppliers of equipment and/or materials: (1) to furnish complete and adequate operating and maintenance data pertaining to their equipment and/or materials; (2) to assign to the Owner any warranty, express or implied, furnished by the manufacturer of the equipment and/or materials; and, (3) to assign to the Owner any customary maintenance or repair service, spare parts supply service, or personnel support service furnished by the manufacturer of the equipment and/or
materials. If the terms and conditions of any warranty, maintenance or repair service, spare parts supply service, or personnel support service furnished by manufacturer of the equipment and/or materials are negotiable, they shall be negotiated by the Owner and the manufacturer.

ARTICLE 7

SUBCONTRACTS

Section 7.01. Definition.
(a) As used in the Contract Documents, a “subcontractor” is a person or organization that has a contract with the Contractor to perform any portion of the Work or to furnish any equipment or materials to the Project.

(b) As used in the Contract Documents, a “sub-subcontractor” is a person or organization that has a contract with a subcontractor to perform any portion of the Work or to furnish any equipment or materials to the Project.

Section 7.02. No Contractual Relationship with Owner. Nothing contained in the Contract Documents or otherwise shall create any contractual relationship between the Owner and any subcontractor or sub-subcontractor, and no subcontract or sub-subcontract shall relieve the Contractor of its responsibilities and obligations should any subcontractor or sub-subcontractor fail to perform its work in a satisfactory manner. The Contractor agrees to be as fully responsible to the Owner for the acts and omissions of its subcontractors and their sub-subcontractors and of persons either directly or indirectly employed by them as it is for the acts and omissions of persons directly employed by Contractor.

Section 7.03. Award of Subcontracts.
(a) Unless the Owner gives its written approval to Contractor, the Contractor shall not enter into a subcontract or purchase order with any entity that is a party in any litigation, arbitration, or other dispute resolution proceeding with the Owner. The Contractor shall request written confirmation from any potential subcontractor or supplier prior to the execution of any subcontract or purchase order that there is no pending litigation, arbitration, or other dispute resolution proceeding where the Owner and the potential subcontractor or supplier are parties. Such written confirmation shall be sent to the Owner within seven (7) days from the receipt of bids.

(b) If the Owner refuses to accept any subcontractor or material supplier (or sub-subcontractor) or person or organization because of such pending litigation, arbitration, or other dispute resolution proceeding, the Contractor shall submit an acceptable substitute at no additional cost to Owner.

Section 7.04. Change of Subcontractors. The Owner may require a change of any subcontractor. The Lump Sum Price shall be adjusted accordingly due to the Owner’s requiring a change of any subcontractor, sub-subcontractor, or material supplier previously approved in writing by the Owner, unless the change was required because the subcontractor, sub-subcontractor or material supplier was unable to timely or properly perform its work in accordance with the Contract Documents.

Section 7.05. No Substitution of Subcontractors. The Contractor shall not make any substitution for any subcontractor nor allow the substitution of any sub-subcontractor who has been accepted by the Owner, unless the substitution is required and previously approved by the Owner. Acceptable reasons for substitution (other than where required by the Owner) shall be limited to the following:

(a) Inability of the subcontractor or sub-subcontractor to provide bonds, if required; or

(b) Failure of the subcontractor or sub-subcontractor to perform according to approved schedules or other provisions of the Contract Documents; or

(c) Other reasons which would reasonably render the subcontractor or sub-subcontractor unable to perform its work according to the Contract Documents as evidenced in writing by the Contractor.

Section 7.06. Subcontract Terms. All portions of the Work performed by a subcontractor or sub-subcontractor shall be pursuant to an appropriate agreement between the Contractor and the subcontractor (and where appropriate between subcontractors and sub-subcontractors) which shall contain provisions that:
(a) Preserve and protect the rights of the Owner under the Contract Documents, including, but not limited to, the obligation to indemnify the Owner as set forth in Article 21 of this Contract with respect to the portion of the Work to be performed under the subcontract (or sub-subcontract) so that the subcontracting will not prejudice such rights; and

(b) Require that such Work be performed in accordance with the requirements of the Contract Documents; and

(c) Require submission to the Contractor of applications for payment under each subcontract to which the Contractor is a party; and

(d) Require that all requests for additional compensation, extensions of time or otherwise with respect to subcontracted portions of the Work be submitted to the Contractor (via any subcontractor or sub-subcontractor where appropriate) in sufficient time so that the Contractor may comply in the manner provided in the Contract Documents for like requests by the Contractor upon the Owner; and

(e) Name the Owner as an additional insured under all applicable insurance policies; and

(f) Require compliance with the federal Disadvantaged Business Enterprise (“DBE”) requirements, including, but not limited to, non-discrimination and prompt pay provision;- and

Section 7.07. Subcontractor Relations Requirements. By appropriate written agreement, the Contractor shall require each subcontractor, to the extent of the Work to be performed by the subcontractor, to be bound by the obligations, terms and conditions of this Contract and the Contract Documents, and to assume toward the Contractor all the obligations, terms, conditions and responsibilities which the Contractor, by this Contract and the Contract Documents, assumes toward the Owner and the Engineer. Each subcontract agreement shall preserve and protect the rights of the Owner and the Engineer under this Contract and the Contract Documents with respect to the Work to be performed by the subcontractor so that subcontracting thereof will not prejudice the rights of the Owner or the Engineer. The Contractor shall require each subcontractor to enter into similar agreement with sub-subcontractors. The Contractor shall make available to each proposed subcontractor, prior to the execution of the subcontract agreement, copies of this Contract and the Contract Documents to which the subcontractor will be bound. Subcontracts shall similarly make copies of this Contract and the Contract Documents available to their respective proposed sub-subcontractors.

ARTICLE 8
PAYMENT TO SUBCONTRACTORS

Section 8.01. Payments to Subcontractors from the Contractor. The Contractor shall pay each subcontractor an amount equal to the percentage of completion allowed to the Contractor on account of the work of each subcontractor. The Contractor shall also require each subcontractor to make similar payments to its sub-subcontractors.

Section 8.02. Withholding of Payment by the Owner. If the Owner withholds monies for any cause which is the fault of the Contractor and/or the fault of a particular subcontractor, the Contractor shall pay all other subcontractors, in accordance with the terms of their applicable subcontract, if not in conflict with this Contract and applicable law, any time after the progress payment by the Owner should otherwise have been issued, for its Work to the extent completed. Notwithstanding this Section 8.02, Contractor may withhold funds from any subcontractor that is not performing its work in accordance with the Contract Documents.

Section 8.03. Independent Obligation to Pay. The obligation of the Contractor to pay its subcontractors (and their obligation to pay sub-subcontractors) is an independent obligation from the obligation of the Owner to make payment to the Contractor. The Owner shall have no obligation to pay or to see to the payment of any monies to any subcontractor or sub-subcontractor. The provisions of this Contract are solely intended for the benefit of the Owner and Contractor and not for any other person. Nothing in this Contract is intended to create any third party rights against the Owner.

Section 8.04. Payments to Sub-Subcontractors. This Contract is governed by federal prompt pay provisions where applicable and as set forth in Exhibit “E” to this Contract. To the extent that Tennessee statutes are not superseded by applicable federal statutes in this area, state statutes also will apply. Contractor agrees to require each of its subcontractors (1) to pay their subcontractors for invoices submitted or normal progress payments for work completed satisfactorily pursuant to its contract with each subcontractor and (2) to make such payments to their respective
subcontractors no later than ten (10) days after any such subcontractors receive payment from the prime contractor or their respective subcontractor, as applicable.

ARTICLE 9

CHANGES

Section 9.01. Changes in the Work.

(a) The Owner, without invalidating this Contract, may order extra work or make changes by altering, adding to or deducting from the Work by executing a Contract Amendment or a Construction Change Directive in a form provided by the Owner or Engineer. All Work performed pursuant to a valid Contract Amendment or a Construction Change Directive shall be performed under the conditions of this Contract and the Contract Documents.

(b) The Owner shall have authority to make changes in the Work not involving extra cost, not involving an extension to the Substantial Completion Date, and not inconsistent with the purposes of the Work, but otherwise, no extra Work or change in the Work shall be made unless pursuant to a Contract Amendment or a Construction Change Directive and no claim by Contractor for additional cost or fee or any extension of the Substantial Completion Date shall be valid unless so ordered in a written Contract Amendment or a Construction Change Directive.

(c) Engineer’s Supplemental Instructions (ESI) are written instruments prepared by the Owner or Engineer to issue additional instructions or interpretations or to order changes in the Work not involving extra costs or fees, or any extension of the scheduled Substantial Completion Date. Contractor shall give prompt written notice to Owner if it believes that the contents of an ESI require extra costs or fees, or affect the Substantial Completion Date.


(a) A Construction Change Directive is a written order prepared by the Owner, Program Manager, or Engineer and signed by the Owner, Engineer or Program Manager directing a change in the Work and stating a proposed basis for adjustment, if any, in the Lump Sum Price or the Substantial Completion Date, or both. The Owner may, by Construction Change Directive, without invalidating this Contract, order changes in the Work consisting of additions, deletions or other revisions.

(b) A Construction Change Directive shall be used in the absence of an agreement on the terms of a Contract Amendment.

(c) If the Construction Change Directive provides for an adjustment to the Lump Sum Price, the adjustment shall be based on one of the following methods:

(1) Mutual acceptance of a lump sum properly itemized and supported by sufficient documentation to permit evaluation; or

(2) Unit prices stated in the Contract Documents or subsequently agreed upon; or

(3) Cost to be determined in a manner agreed upon by the Parties and a mutually acceptable fixed or percentage fee; or

(4) As provided in paragraph (f) of this Section 9.02.

(d) Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Owner of the Contractor’s agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Lump Sum Price or the Substantial Completion Date.

(e) A Construction Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in the Lump Sum Price, the Substantial Completion Date or the method of determining the adjustment. Such agreement shall be effective immediately and shall be recorded as a Contract Amendment.
(f) If the Contractor does not respond promptly or disagrees with the method for adjustment in the Lump Sum Price, the method and the adjustment shall be determined by the Owner on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Lump Sum Price, a reasonable allowance for overhead and profit. In such case, the Contractor shall keep and present, in such form as the Owner may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purpose of this paragraph shall be limited to the following:

1. The actual cost for labor, including social security and unemployment insurance, fringe benefits required by agreement, and workers’ or workmen’s compensation insurance; and/or
2. The actual cost of materials, supplies, machinery, and equipment, including cost of transportation, whether incorporated or consumed; and/or
3. The actual cost of subcontractors and sub-subcontractors; and/or
4. The actual cost of premiums for all bonds and insurance, permit fees and sales, use or similar taxes related to the Work; and/or
5. The actual additional costs of supervision and field office personnel, if any, directly attributable to the change.

(g) Pending final determination of cost to the Owner, amounts not in dispute may be included in Certificates and Applications for Payment. The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Lump Sum Price shall be actual net cost, as confirmed by the Owner. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be calculated on the basis of net increase, if any, with respect to that change.

Section 9.03. Contract Amendment Procedure. If the Owner desires extra Work or changes in the Work, the Owner shall submit a Request for Proposal (“RFP”) to the Contractor. The Contractor shall furnish to the Owner a statement setting forth in detail the proposal of the Contractor for performing the extra Work or changes and the effect of the extra Work or changes, if any, in the Lump Sum Price and the Substantial Completion Date attributable to the extra Work or changes set forth in the request of the Owner. If the Owner approves in writing the proposal of the Contractor, a Contract Amendment in the form provided by the Owner shall be executed by the Parties and the Lump Sum Price and the Substantial Completion Date shall be adjusted accordingly. In preparing Lump Sum quotes in response to an RFP, the Contractor shall prepare a cost breakdown that provides sufficient detail for the Owner or Engineer to determine that the quoted costs are reasonable and allowable and to verify that markups are properly calculated according to the terms of this Contract.

Section 9.04. Changes in the Lump Sum Price. Any increase or decrease in the Lump Sum Price attributable to a Contract Amendment performed by the Contractor or any of its subcontractors shall be governed by the provisions of Section 90-05 of the FAA’s General Provisions.

Section 9.05. Time and Materials. In the event that the Owner and the Contractor cannot agree on the amount or time extension, if any due, to the Contractor for a Contract Amendment, the Owner may, in writing, direct the Contractor to proceed with the performance of such Work. The Contractor agrees to comply with any such directive issued by the Owner. If any additional compensation is due to the Contractor as a result of a directive, it will be calculated pursuant to the provisions of Section 150-90 of the FAA General Provisions Addendum.

Section 9.06. Unconditional Obligation to Proceed. Notwithstanding anything herein to the contrary, the Contractor will proceed with the Work so as to complete the Work on or before the Substantial Completion Date even if it has a dispute with the Owner concerning a Construction Contract Amendment, a Construction Change Directive or any extension of time which is or could be due to the Contractor pursuant to a Contract Amendment, a Construction Change Directive or otherwise.

Section 9.07. Request for Additional Compensation. If for any reason the Contractor believes that additional compensation is due for work not clearly provided for in the Contract Documents, the Contractor shall provide written notice to the Owner at least three (3) days before beginning the work which is not clearly provided for in the Contract Documents. If such notification is not given, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor shall not in any way be construed as proving or substantiating the validity
of the request for additional compensation. When the work, which is the basis for the Contractor's request for additional compensation, has been completed, the Contractor shall, within ten (10) calendar days, submit evidence of costs incurred by the Contractor and a narrative which provides the basis for the request for additional compensation.

ARTICLE 10

THE UNDERSTANDING OF THE CONTRACTOR

Section 10.01. Examination of Work Site. The Contractor acknowledges that it has, by careful examination, satisfied itself as to the nature and location of the Work, the conformation of the ground conditions, the character, quality and quantity of the materials, equipment, supplies, machinery, and facilities needed preliminary to and during the performance of the Work, the general and local conditions, and all other matters which can in any way affect the Work.

Section 10.02. Sufficiency of Contract Documents and Representations of Contractor.

(a) The Contractor acknowledges that the Contract Documents are sufficient to enable it to determine the cost of all of the Work and that the Work can be completed in accordance with the Contract Documents for the Lump Sum Price.

(b) The Contractor acknowledges that any observed errors, discrepancies, omissions, ambiguities, or conflicts in the Contract Documents will be brought to the attention of the Owner, as set forth in Section 2.04 of this Contract, and in a timely manner in order to ensure substantial completion of the Work by the Substantial Completion Date. The Contractor shall be responsible for using its best efforts to discover and observe errors, discrepancies, omissions, ambiguities, or conflicts in the Contract Documents. In addition, the Contractor acknowledges that the Owner has not made nor shall it be deemed to have made any warranties, guarantees, or representations of any kind whatsoever regarding the sufficiency of the Contract Documents or any conditions relating to the Work.

(c) Contractor represents that it has reviewed and checked all information and data shown or indicated on the Contract Documents with respect to existing underground use facilities at or contiguous to the Work Site and, subject to the provisions of Section 10.03 of this Contract, assumes responsibility for the accurate location of said underground use facilities. No additional examinations, investigations, explorations, tests, reports, studies or similar information or data in respect of said underground use facilities are or will be required by Contractor in order to perform and furnish the Work for the Lump Sum Price and substantially complete the Work by the Substantial Completion Date. However, notwithstanding anything herein to the contrary, the Contractor may, at its sole expense after receiving written permission from the Owner, and subject to any limitations specified by the Owner or Engineer, conduct any additional testing it deems necessary.

Section 10.03. Differing Work Site Conditions. If conditions are encountered at the Work Site that are: (1) subsurface physical conditions, which differ materially from those indicated in the Contract Documents; or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the observing Party shall be given to the other Party promptly before conditions are disturbed and in no event later than seven (7) days after the first observance of the conditions. The Owner or Engineer will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost, or time required, for performance of any part of the Work; will recommend an equitable adjustment in the Lump Sum Price or the Substantial Completion Date, or both. However, any equitable adjustment in the Lump Sum Price shall not include additional general conditions costs. If the Owner determines that the conditions at the Work Site are not materially different from those indicated in the Contract Documents and that no change in the terms of this Contract is justified, the Owner shall so notify the Contractor in writing, stating the reasons. Claims by either Party in opposition to such determination must be made within fourteen (14) days after the Owner has given notice of the decision.

Section 10.04. No Oral Modification. No oral agreement or conversation with any officer, agent or employee of the Owner or its representatives, including the Engineer, either before or after the execution of this Contract, shall affect or modify any of the terms or obligations contained in this Contract or the Contract Documents.
ARTICLE 11

SUPERVISION OF THE WORK; SAFETY AND SECURITY

Section 11.01. The Superintendent of the Contractor. The Contractor shall designate in writing to the Owner and keep on the Project during its progress a competent employee who has responsibility to oversee the Work ("Superintendent"). The Superintendent shall be satisfactory to the Owner. The Superintendent shall be changed upon written request of the Owner, but shall not be changed by the Contractor except with the consent of the Owner, unless the Superintendent ceases to be in its employ. The Superintendent shall represent the Contractor, and all directions given to him by the Owner shall be as binding as if given to the Contractor directly. The Superintendent shall devote his full time to the Work and shall maintain an office on the Work Site. The Superintendent shall direct, coordinate and supervise all Work, inspect all materials delivered to the Work Site to ascertain whether or not they comply with the requirements of the Contract Documents, and reject all non-conforming materials or workmanship.

Section 11.02. Order and Discipline. The Contractor shall at all times be responsible for enforcing strict discipline and good order among its employees, and all employees of its subcontractors and sub-subcontractors. If any person on the Work Site shall appear to be incompetent, disorderly or intemperate, in any way disrupts or interferes with the Work, or is in any other manner not qualified for or unfaithful to the job entrusted to him, such person shall be discharged from the Project immediately and shall not again be employed on the Work Site without the prior written consent of the Owner.

Section 11.03. Cleaning Up.

(a) During the performance of the Work, the Contractor shall keep the Work Site clean and free of all rubbish, waste materials, debris and other materials in accordance with the instructions set forth in the Contract Documents. At the end of each working day, the Contractor shall remove all waste materials, rubbish, debris, and other materials from and about the Work Site as well as all surplus materials, and shall leave the Work Site clean in accordance with the Contract Documents.

(b) The Contractor shall establish an active ongoing program to eliminate any foreign objects from the Work Site that may cause damage to aircraft or cause personal injury to other persons.

(c) The Contractor shall pay particular attention to haul routes used to and from the Work Site to prevent any construction debris from being dropped or tracked that may present a hazard.

(d) The Contractor, upon written notice from the Owner, shall promptly cut the grass and clean debris around the Work Site. If the Contractor fails to clean up any debris which is deposited as a result of construction operations, the Owner will, after notice, immediately do so. The cost thereof will be charged to the Contractor at actual cost per hour, but not less than the minimum rate of Two Hundred Fifty Dollars ($250.00) per hour. The Contractor shall assume full responsibility for failure to perform cleanup operations required by this Section 11.03.

(e) All materials delivered to the Work Site shall be stored and handled so as to preclude inclusion of any foreign substances, and to prevent any discoloration or damage which might reduce its effectiveness as part of the Work.

Section 11.04. Safety and Security.

(a) The Contractor shall be solely responsible for and oversee all safety orders, precautions and programs necessary for the safety of the Work. The Contractor shall take the precautions set forth in the Contract Documents in order to ensure the safety of all persons involved in the Work, all other persons whom the Work might affect, all equipment and materials incorporated in the Work, all property on the Work Site and adjacent to it, and the Owner’s business operations which are functioning on the Work Site or in the vicinity of it.

(b) The Contractor shall keep an accurate record of all persons who are on the Work Site and shall provide a copy of such list to the Owner with each monthly Application and Certificate for Payment. The Contractor, its subcontractors, their sub-subcontractors and all employees of same, shall comply with all security rules made by the Owner and the Federal Aviation Administration. In addition, Contractor shall comply with the construction safety and health guidelines which are set forth in Exhibit D.

(c) The Contractor shall conform to Owner’s rules and regulations for airport operations.
(d) Prior to the commencement of the Work, the Contractor shall provide to the Owner a list of all of its employees who will perform any portion of the Work.

Section 11.05. Observation of the Work.

(a) The Engineer, the Owner and persons designated by the Owner, shall at all times have access to the Work Site whenever it is in preparation or progress and the Contractor shall provide proper facilities for such access and for observation. If the Owner or the Engineer discovers any defective Work in connection with any observation, it shall be reported to the Contractor in writing and the Contractor shall correct it.

(b) If the Contract Documents, the written instructions of the Owner, laws, ordinances, rules or regulations, or any public authority require any of the Work to be specifically tested or inspected, the Contractor shall give the Owner timely notice of its readiness for inspection and testing, and of the date set for such test or inspection. Inspections by the Owner or Engineer shall be promptly made. If any of the Work should be covered up without the approval or consent of the Owner, the Engineer or any public authority, it shall be uncovered for examination, if required by the Owner, the Engineer, or such other public authority, at the sole expense of the Contractor.

(c) Re-examination of questioned Work that has been previously tested or inspected by the Engineer or the Owner may be ordered by the Engineer or the Owner and, if so ordered, the questioned Work shall be uncovered by the Contractor. If such Work is found to be in compliance with the Contract Documents, the Owner shall pay the actual cost of the re-examination. If such Work is found not to be in compliance with the Contract Documents, the Contractor shall bear the costs of the re-examination.

(d) The Contractor shall not be required to provide professional services which constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor’s responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, then the Contractor shall promptly and at its expense secure such services. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, shop drawings and other submittals prepared by such professional. Shop drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional’s written approval when submitted to the Owner or Engineer. The Owner and the Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals.

ARTICLE 12

PERMITS, LICENSES, LAWS AND REGULATIONS

Section 12.01. Contractor to Secure All Permits. The Contractor shall secure and pay for all construction related permits, including the building permit. The Contractor shall be responsible for all inspections required by governmental authorities in conjunction with the issuance of said permits. Contractor shall secure and pay for all governmental fees, licenses and other permits necessary for the lawful and proper execution and completion of the Work.

Section 12.02. Compliance with Laws. The Contractor shall give all notices and shall comply with all laws, ordinances, rules, regulations and orders of any public authority having jurisdiction over the Work, which have any bearing on the execution of the Work. If the Contractor observes that any of the Contract Documents are at variance in any respect with any such laws, ordinances, rules, regulations and orders, it shall promptly notify the Owner and the Engineer in writing and any necessary changes shall be made by the Contractor. If the Contractor fails to give such notice or executes any of the Work in a manner contrary to any such laws, ordinances, rules, regulations or orders, the Contractor shall bear all resulting costs to correct said Work to comply with such laws and regulations and be liable for any resulting fines, penalties, judgments or damages imposed on or incurred by the Owner.
ARTICLE 13

TAXES AND OTHER FEES AND COSTS

Section 13.01. Payment of Taxes by Contractor.

(a) Any and all taxes, excises, duties and assessments in any manner levied, assessed or imposed by any government or subdivision or agency having jurisdiction over the Work shall be the sole responsibility and liability of the Contractor.

(b) The Contractor shall promptly pay and discharge when due, unless the validity or application is being contested by the Contractor in good faith, any and all taxes, excises, duties and assessments, together with any interest and penalties, if any, the responsibility and liability for which the Contractor has assumed pursuant to the provisions of paragraph (a) of this Section 13.01, unless any such tax, excise, duty or assessment is levied, assessed or imposed upon the Owner, in which case the Owner shall promptly give the Contractor notice of such levy, assessment or imposition, whereupon the Contractor shall promptly pay and discharge the same. Upon the written request and at the sole expense of the Contractor, the Owner shall assist the Contractor in contesting the validity or application of any such levy, assessment or imposition, and in the event a refund of all or any part of any tax, excise, duty or assessment (including interest and penalties, if any), said refund shall be refunded to the Contractor (less the amount of expenses associated with such contest not previously reimbursed by the Contractor to the Owner).

(c) The Contractor shall pay all applicable fees, and for all damage to sidewalks, streets, Owner's property, and other public property or to any public utilities caused by the performance of this Contract.

Section 13.02. Damage to Owner Property. Contractor agrees to promptly notify Owner of any damage caused to Airport property arising from Contractor's activities at the Airport. Contractor also agrees to comply with any request made by the Owner for reimbursement of costs associated with any damage to Airport property arising from work performed at the Airport by Contractor or any of Contractor's representatives, managers, employees, agents, contractors, subcontractors, licensees or invitees or from the conduct of same. This provision shall survive the termination of this Contract.

ARTICLE 14

SHOP DRAWINGS AND SAMPLES; MATERIAL TESTING

Section 14.01. Definitions.

(a) As used in this Contract, “shop drawings” are drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are prepared by the Contractor, any subcontractor, sub-subcontractor, manufacturer, supplier or distributor, and which illustrates some portion of the Work.

(b) As used in this Contract, “samples” are physical examples furnished by the Contractor to illustrate materials, equipment or workmanship.

Section 14.02. Submissions.

(a) Contractor shall submit to Owner all shop drawings in electronic format or as hard copies in accordance with the specifications. Contractor shall review, stamp with its approval and submit, in orderly sequence so as to cause no delay in the Work or the work of any other contractor, all shop drawings and samples required by the Contract Documents or subsequently by the Owner or Engineer. Shop drawings and samples shall be properly identified as specified in the Contract Documents or as the Engineer or Owner may require. At the time of submission, the Contractor shall inform the Engineer and the Owner by separate written correspondence of any deviation in the shop drawings or samples from the requirements of the Contract Documents.

(b) By approving and submitting shop drawings and samples, the Contractor represents that it has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and other data, and that it has checked and coordinated each shop drawing and sample with the requirements of the Work and the Contract Documents.
Section 14.03. Review of the Engineer.

(a) The Engineer will review and act upon shop drawings and samples with reasonable promptness so as to cause no unreasonable delay in the Work, but only for conformance with the design concept of the Work and with the information given in the Contract Documents. The review of the Engineer or its agents of a given item shall not indicate approval of an assembly in which the item functions.

(b) The approval of the Engineer of shop drawings or samples shall not relieve the Contractor of its responsibility for any deviation from the requirements of the Contract Documents unless the Contractor has informed the Engineer and the Owner by separate written letter of such deviation at the time of submission and the Owner or Engineer has given written approval of the specific deviation, nor shall the approval of the Engineer relieve the Contractor from responsibility for errors or omissions in the shop drawings or samples.

Section 14.04. Corrections Made by Contractor. The Contractor shall make any corrections required by the Owner or Engineer and shall submit the required number of corrected copies of shop drawing or new samples until approved by Owner. The Contractor shall direct specific attention in writing or on resubmitted shop drawings or samples to revisions other than the corrections requested by the Engineer or the Owner on previous submissions.

Section 14.05. Prior Approval Required. No portion of the Work requiring a shop drawing or sample submission shall be commenced until the submission has been approved by the Owner or Engineer. All such portions of the Work shall be performed in accordance with approved shop drawings and samples and the Contract Documents.

Section 14.06. Submittal Schedule. Within seven (7) days after execution of this Contract, the Contractor shall provide the Owner and the Engineer with a preliminary submittal schedule of the dates that each shop drawing or sample will be submitted for approval. Within thirty (30) days after execution of this Contract, the Contractor shall provide the Engineer and the Owner with a final schedule of the dates that each shop drawing or sample will be submitted for approval. The sequence of the submittals of the Contractor shall be scheduled so as to permit an orderly review by the Engineer. The schedule shall allow reasonable added time according to the number or complexity of shop drawings or samples in each submittal for the checking, correction and rechecking of corrections, as well as for return of approved or rejected shop drawings and samples to the Contractor. The submittal schedules shall allow not less than fourteen (14) calendar days for the Engineer to review any shop drawing or sample.


(a) If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any portion of the Work to be inspected, tested or approved, the Contractor shall give the Owner timely notice of its readiness so the Owner or Engineer may observe such inspection, testing or approval. The Contractor shall bear all costs of such inspections, tests or approvals required by public authorities. Unless otherwise provided, the Owner shall bear all costs of other inspection, tests or approvals.

(b) If the Owner or Engineer determines that any Work requires special inspection, testing or approval which paragraph (a) of this Section 14.07 does not include, the Owner or Engineer will instruct the Contractor to order such special inspection, testing or approval, and the Contractor shall give notice as provided in paragraph (a) of this Section 14.07. If such special inspection or testing reveals a failure of the Work to comply with the requirements of the Contract Documents, the Contractor shall bear all costs thereof, including compensation for the Owner’s or Engineer’s additional services made necessary by such failure; otherwise, the Owner shall bear such costs and an appropriate Contract Amendment shall be issued.

(c) Required certificates of inspection, testing or approval shall be secured by the Contractor and promptly delivered to the Owner.

(d) If the Owner or Engineer is to observe the inspections, tests or approvals required by the Contract Documents, they will do so promptly.
ARTICLE 15
 THE RIGHT OF THE OWNER TO INSPECT AND AUDIT

Section 15.01. Right to Audit. The Contractor shall keep full and accurate records of all costs incurred and items billed in connection with any Work which records shall be open to audit by the Owner, or any authorized representative of the Owner, including but not limited to the Federal Aviation Administration and the Comptroller General of the United States during the course of the Project and until four (4) years after the final payment by the Owner to the Contractor. In addition, the Contractor shall make it a condition of all subcontracts and sub-subcontracts entered into in furtherance of the Work that any and all subcontractors and sub-subcontractors will keep accurate records of costs incurred and items billed in connection with the subcontract (or sub-subcontract) and that such records shall be open to audit by the Owner, or any authorized representative of the Owner, including but not limited to the Federal Aviation Administration and the Comptroller General of the United States during the course of the Work and until four (4) years after final payment by the Owner to the Contractor.

Section 15.02. Review of Subcontracts. Upon request of the Owner or Engineer, the Contractor shall provide the Owner with an executed copy of all subcontracts, sub-subcontracts and purchase orders entered into in furtherance of the Work.

ARTICLE 16
SEPARATE CONTRACTS

Section 16.01. The Right of the Owner to Award Separate Contracts. The Owner reserves the right to award other contracts in connection with work at or in the vicinity of the Work and the Contractor agrees to cooperate fully and not to unreasonably interfere with the work of such other contractors.

Section 16.02. Cooperation. The Contractor shall afford the other contractors of Owner the opportunity for the introduction and storage of their materials and equipment to their work sites and for the execution of their work. The Contractor shall properly connect and coordinate the Work with work of any other contractors of the Owner.

Section 16.03. Inspection of Work of Other Contractors. If any part of the Work depends, for proper execution or result upon, the work of another contractor of Owner, the Contractor shall inspect and promptly report to the Engineer and the Owner any discrepancies or defects in such work that render it unsuitable for such proper execution or results. Failure of the Contractor to so inspect and report shall constitute an acceptance of the Work of the other contractor as fit and proper to receive the Work.

Section 16.04. Responsibility for Damage. Should the Contractor cause damage to the work or property of any other contractor of the Owner, including, but not limited to, delay, disruption, suspension of work and/or acceleration damages, the Contractor shall settle all claims with such other contractor if the other contractor will so settle. If such other contractor sues the Owner on account of any damage alleged to have been so sustained, the Owner shall notify the Contractor who shall defend such proceedings at the expense of the Contractor, or provide counsel of Owner’s choice for Owner at the expense of Contractor, and if any judgment or award against the Owner results, the Contractor shall pay or satisfy it and shall reimburse the Owner for all attorney’s fees and other litigation costs which the Owner has incurred.

ARTICLE 17
WARRANTIES OF THE CONTRACTOR

Section 17.01. Warranty of Title. The Contractor warrants and guarantees that title to all Work, materials and equipment covered by an Application and Certificate for Payment, whether incorporated in the Work or not, will pass to the Owner, free and clear of all liens, claims, security interests or encumbrances (hereinafter “Liens”) and that none of the Work, materials or equipment covered by an Application and Certificate for Payment will have been acquired by the Contractor, or by any other person performing any part of the Work or furnishing materials and equipment for the Work, subject to an agreement under which a Lien is retained by the seller or supplier.

Section 17.02. Special Warranties. When special guarantees or warranties are required by the Contract Documents for specific parts of the Work, the Contractor shall procure certified copies of such guarantees or warranties,
countersign them and submit them to the Owner in triplicate. Delivery of such guarantees or warranties will not relieve the Contractor from any obligations assumed under any provision of this Contract or the Contract Documents.

Section 17.03. Assignment of Warranties. The Contractor hereby assigns to the Owner any and all existing assignable warranties, service life policies and patent indemnities of manufacturers of materials, equipment or items incorporated in the Work. Upon the request of the Owner or the Engineer, the Contractor shall give the Owner assistance in enforcing the rights of the Owner arising under such warranties, service life policies and patent indemnities. At the request of the Owner or the Engineer, the Contractor shall give notice (with copies to the Owner) to any such manufacturers of the assignment of such warranties, service life policies and patent indemnities.

Section 17.04. General Warranty and Correction of Work.

(a) In addition to any special guarantees or warranties contained in the Contract Documents, the Contractor warrants to the Owner that all materials and equipment furnished in performance of the Work will be new unless otherwise specified, and that all Work will be of good quality, free from faults and defects and in conformance with the Contract Documents. All work not so conforming to these standards shall be considered defective.

(b) The Contractor shall promptly correct all defective Work to comply with the Contract Documents whether observed before or after the substantial completion date and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting defective Work.

(c) If, within one (1) year after the substantial completion date, or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee or warranty required by the Contract Documents, any of the Work is found to be defective and not in accordance with the Contract Documents, the Contractor shall correct it promptly after receipt of a written notice from the Owner, or the Engineer, to do so.

(d) All defective or non-conforming Work shall be removed from the site of the Work if necessary, and the Work shall be corrected to comply with the Contract Documents without cost to the Owner. The Contractor also shall bear the cost of making good all work of other contractors destroyed or damaged by removal or correction of the defective Work of Contractor.

(e) If the Contractor fails to timely and properly correct defective Work, the Owner may correct it and hold the Contractor liable for all costs, expenses and damages, including attorney’s fees and litigation costs incurred by Owner in correcting it.

(f) In addition to the foregoing warranty, a warranty period of one (1) year shall apply under the same terms and conditions as the original warranty, to any work, supplied in correction of defective work under warranty pursuant to the provisions of this Section 17.04 and the Contractor shall assign to the Owner any warranties, including extended warranties, which are available in connection with the performance of such correction of defective Work. The warranty period shall commence on the date the Owner accepts the corrective Work of the Contractor.

ARTICLE 18

RIGHT OF THE OWNER TO DO WORK

Section 18.01. Right of the Owner to do Work. If the Contractor should neglect to perform the Work properly or fails to do anything required by the Contract Documents, and the Contractor does not correct the untimely or improper performance within seven (7) days after written demand is made, the Owner may, without prejudice to any other remedy it may have under this Contract or at law or in equity, make good any deficiencies in the Work, including, but not limited to, supplementing the workforces of the Contractor and deduct all costs of doing so from the payment then due or thereafter due the Contractor. The Owner shall not be required to give multiple notices to the Contractor in order to exercise its rights under this paragraph.

Section 18.02. Deduction for Uncorrected Work. If the Owner deems it inexpedient to correct deficiencies in the Work pursuant to Section 18.01 of this Contract, the Owner may deduct the reasonable cost of correcting the deficiencies, including any attorney’s fees and additional fees and expenses of the Engineer, from the payment then due or thereafter due to the Contractor, but the making of such a deduction shall in no way be deemed an election of remedies by the Owner.
Section 18.03.  Correction of Work before Final Payment.

(a) The Contractor shall promptly remove from the Work Site all materials, equipment or other items rejected by the Engineer or the Owner as failing to conform to the Contract Documents, whether incorporated in the Work or not, and the Contractor shall promptly replace and re-execute its original work to comply with the Contract Documents without expense to the Owner. In addition, the Contractor shall bear the expense of making good all work of other contractors destroyed or damaged by such removal or replacement.

(b) If the Contractor does not remove rejected material, equipment or other items within a reasonable time (as fixed by written notice from the Owner, or the Engineer), the Engineer or the Owner may remove such items and store them at the expense of the Contractor, or dispose of such material, equipment or other items at the sole discretion of the Owner. If the Contractor does not pay the expense of such removal or storage within ten (10) days, the Owner may, upon ten (10) days written notice, sell such items at auction or at private sale and shall account for the net proceeds of such sale, after deducting all the costs and expenses of removal that should have been borne by the Contractor.

ARTICLE 19

INSURANCE

Section 19.01.  Insurance Requirements. The Contractor shall fully comply with all requirements relating to insurance for the Project as set forth in this Article 19.

Section 19.02.  Owner Controlled Insurance Program. The Owner has established an Owner Controlled Insurance Program (OCIP). To the extent required by the Owner, Contractor shall fully participate in and comply with all requirements of the OCIP. A copy of the OCIP Manual is attached hereto as Exhibit C and incorporated herein by reference. However, if the OCIP is not used, Contractor agrees to meet the requirements for Insurance coverage referenced in Section 19.03. A copy of the Construction Safety and Health Guidelines is attached hereto as Exhibit D and incorporated herein by reference.

Section 19.03.  Contractor Provided Insurance Coverage. During the Term of this Agreement, Contractor shall comply with the insurance requirements set forth in Exhibit C (“Insurance Requirements”).

Section 19.04.  Survival. The insurance provisions of this Article 19 shall survive any termination of this Contract.

ARTICLE 20

SURETY BONDS

Section 20.01.  Surety Bonds Required. The Contractor shall furnish and keep in force throughout the performance of the Work a separate performance bond and separate labor and material payment bond, each in the amount of the total of the Lump Sum Price (as the same may be modified from time to time) conditioned upon the faithful performance of the Work by the Contractor and payment of all obligations arising in connection with the Work by the Contractor. The bonds shall also guarantee to the Owner that the Work shall be free of all liens. The bonds shall name the Owner as obligee and shall be in such form and with such sureties as the Owner may approve prior to commencement of the Work.

ARTICLE 21

INDEMNIFICATION

Section 21.01.  Indemnification of the Contractor.

(a) Without limiting any insurance required herein and to the fullest extent permitted by law, Contractor, on behalf of itself, its subcontractors, their agents, their employees or any entity or person for which the Contractor is or may be responsible (hereinafter collectively referred to as “Indemnitors”), shall fully defend, indemnify, save and hold the Owner, the Board of Commissioners of the Owner, the Program Manager, the Engineer, their agents, employees, officers, directors, partners and related entities (hereinafter collectively referred to as “Indemnitees”) harmless from and against
all liability, damages, loss, claims, demands, actions and expenses of any nature whatsoever, including, but not limited to reasonable attorney’s fees which arise out or are connected with: (1) any negligent act, error or omission by any Indemnitee, or (2) the failure of the Indemnitee to comply with any applicable laws, statutes, ordinances, rules or regulations of any governmental or quasi-governmental authority, or (3) the material breach of any term or condition of this Contract by any of the Indemnitors.

(b) Without limiting the generality of the foregoing, the indemnity set forth in this Article 21 shall include all liability, damages, loss, claims, demands and actions on account of personal injury, death or property loss to any third party, any Indemnitees, any of the Indemnitees’ employees, agents, licensees or invitees relating to the Project and which results from the negligent act, error or omission of Contractor.

(c) The indemnity set forth in this Article 21 shall survive any termination of this Contract.

Section 21.02. Labor Indemnity. The Contractor shall indemnify, demand and hold harmless the Owner, the Board of Commissioners of the Owner, the Program Manager, and the Engineer, their agents, employees, officers, directors, partners and related entities, from any and all administrative and judicial actions (including reasonable attorney’s fees related to any such action), incurred by the Owner, the Program Manager, or the Engineer in connection with any labor related activity arising from the wrongful acts or omissions of the Contractor or its subcontractors in the performance of the Work of the Contractor. As used in this Contract, “labor related activity” includes, but is not limited to, strikes, walk-outs, informational or organizational picketing, use of placards, or distribution of hand-outs or leaflets at or in the vicinity of any facility where the Owner conducts business. The Owner shall advise the Contractor if any labor related activity occurs and the Contractor shall arrange for the legal representation necessary to protect the Owner, the Program Manager, and the Engineer provided such representation is previously approved by Owner.

Section 21.03. Royalties and Patents. The Contractor shall pay all royalties and license fees in anyway relating to the Work, shall defend all suits or claims for infringement of any patent or copyrights, and shall indemnify and hold the Owner, the Board of Commissioners of the Owner, their agents, officers, directors, partners and related entities, harmless from loss on account of such suit or claim.

Section 21.04. Attorney’s Fees. In the event it becomes necessary for Owner to employ an attorney to enforce any provision of this Contract or to defend against any claim or litigation initiated by the Contractor, then the Contractor shall be liable for all attorney’s fees and litigation expenses of Owner.

ARTICLE 22

RIGHT TO OCCUPY BY OWNER

Section 22.01. Early Occupancy by Owner. The Owner has the right to occupy or use ahead of schedule, at no additional cost nor obligation to Owner, all or any substantially completed or partially completed portion of the Work when such occupancy and use are in its best interest, notwithstanding the time of completion for all of the Work. Maintenance of occupied portion will remain the Contractor’s responsibility.

Section 22.02. Corrections after Occupancy. After the Owner has taken occupancy of all or any portion of the Work, the Contractor shall not disrupt the use and occupancy of the Owner to make corrections in the Work.

ARTICLE 23

DEFAULT: RIGHT TO TERMINATE BY OWNER

Section 23.01. Breach of Contract Terms. (Required by FAA) Any violation or breach of terms of this contract on the part of the contractor or its subcontractors may result in the suspension or termination of this contract or such other action that may be necessary to enforce the rights of the parties of this agreement.

Owner will provide Contractor written notice that describes the nature of the breach and corrective actions the Contractor must undertake in order to avoid termination of the contract. Owner reserves the right to withhold payments to Contractor until such time the Contractor corrects the breach or the Owner elects to terminate the contract. The Owner’s notice will identify a specific date by which the Contractor must correct the breach. Owner may proceed with termination of the contract if the Contractor fails to correct the breach by deadline indicated in the Owner’s notice.
The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder are in addition to, and not a limitation of, any duties, obligations, rights and remedies otherwise imposed or available by law.

Section 23.02. Default and Termination by Owner. (Required by FAA)

(a) The Contractor shall be considered in default of his or her Contract and such default will be considered as cause for the Owner to terminate the Contract for any of the following reasons if the Contractor:

(1) Fails to begin the Work under the Contract within the time specified in the Notice to Proceed, or

(2) Fails to perform the Work or fails to provide sufficient workers, equipment and/or materials to assure completion of Work in accordance with the terms of the Contract, or

(3) Performs the Work unsuitably or neglects or refuses to remove materials or to perform anew such Work as may be rejected as unacceptable and unsuitable, or

(4) Discontinues the execution of the Work, or

(5) Fails to resume Work which has been discontinued within a reasonable time after notice to do so, or

(6) Becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or

(7) Allows any final judgment to stand against the Contractor unsatisfied for a period of 10 days, or

(8) Makes an assignment for the benefit of creditors, or

(9) For any other cause whatsoever, fails to carry on the Work in an acceptable manner.

Should the Engineer consider the Contractor in default of the Contract for any reason above, the Engineer shall immediately give written notice to the Contractor and the Contractor’s surety as to the reasons for considering the Contractor in default and the Owner’s intentions to terminate the Contract.

(b) If the Contractor or surety, within a period of 10 days after such notice, does not proceed in accordance therewith, then the Owner will, upon written notification from the Engineer of the facts of such delay, neglect or default and the Contractor’s failure to comply with such notice, have full power and authority without violating the Contract, to take the execution of the Work out of the hands of the Contractor. The Owner may appropriate or use any or all materials and equipment that have been mobilized for use in the Work and are acceptable and may enter into an agreement for the completion of said Contract according to the terms and provisions thereof, or use such other methods as in the opinion of the Engineer will be required for the completion of said Contract in an acceptable manner.

(c) All costs and charges incurred by the Owner, together with the cost of completing the Work under contract, will be deducted from any monies due or which may become due the Contractor. If such expense exceeds the sum which would have been payable under the Contract, then the Contractor and the surety shall be liable and shall pay to the Owner the amount of such excess.

Section 23.03. Termination for Convenience by Owner. (Required by FAA) The Owner may terminate this Contract without cause at any time by providing fifteen (15) days prior written notice to Contractor. Upon receipt of a written notice of termination, except as explicitly directed by the Owner, the Contractor shall immediately proceed with the following obligations regardless of any delay in determining or adjusting amounts due under this clause:

(a) Contractor must immediately discontinue work as specified in the written notice;

(b) Terminate all subcontracts to the extent they relate to the work terminated under the notice;

(c) Discontinue orders for materials and services except as directed by the written notice;
(d) Deliver to the Owner all fabricated and partially fabricated parts, completed and partially completed Work, supplies, equipment and materials acquired prior to termination of the Work and as directed in the written notice;

(e) Complete performance of the Work not terminated by the notice; and

(f) Take action as directed by the Owner to protect and preserve property and work related to this Contract that Owner will take possession.

Owner agrees to pay Contractor for:

(1) Completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination;

(2) Documented expenses sustained prior to the effective date of termination in performing Work and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work;

(3) Reasonable and substantiated claims, costs and damages incurred in settlement of terminated contracts with Subcontractors and Suppliers; and

(4) Reasonable and substantiated expenses to the Contractor directly attributable to Owner’s termination action.

Owner will not pay Contractor for loss of anticipated profits or revenue or other economic loss arising out of or resulting from the Owner’s termination action.

The rights and remedies this clause provides are in addition to any other rights and remedies provided by law or under this Contract.

Section 23.04. Suspension by the Owner.

(a) The Owner may order the Contractor in writing to suspend, delay, or interrupt the Work in whole or in part for such period of time as the Owner may determine (hereinafter referred to as “Suspension”).

(b) Provided the Suspension lasts for more than ninety (90) days, an adjustment to the Lump Sum Price (“Adjustment”) shall be made as set forth in paragraph (c) of this Section 23.02. The Substantial Completion Date shall be extended by written Contract Amendment to the extent that substantial completion is actually delayed by this Suspension. No Adjustment shall be made to the extent:

(1) That performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is in full or in part responsible; or

(2) That an equitable adjustment is made or denied under another provision of this Contract.

(c) The amount of the Contractor’s compensation for a Suspension pursuant to this Section 23.02 shall be limited to any properly documented costs of maintaining personnel and equipment in the field provided such costs are pre-approved by the Owner in writing. The Owner shall not be liable at any time for home office overhead or consequential damages. At the Owner’s option, the Contractor may be ordered to demobilize its forces because the Project is suspended. In such event, the Owner will reimburse the Contractor for the reasonable cost of demobilization and remobilization.

Section 23.05. Assignment of Subcontracts. In the event of termination by the Owner pursuant to this Article 23 or Exhibit E to this Contract, the Owner may require the Contractor to promptly assign to it all or some of the subcontracts, materials, tools, and equipment to be installed under this Contract, or rental agreements, and any other commitments which the Owner, in its sole discretion, chooses to take by assignment. In such event, the Contractor shall promptly execute and deliver to the Owner written assignments of such commitments.
ARTICLE 24
HAZARDOUS MATERIALS

Section 24.01. Hazardous Materials Covenants.

(a) Contractor hereby represents and warrants to and for the benefit of Owner that the Project or Work Site will not be used or operated in any manner that will result in the storage, use, treatment, manufacture or disposal of any Hazardous Materials (hereinafter defined) upon the Project or Work Site or any portion thereof or which will result in Hazardous Materials Contamination (hereinafter defined). For purposes of this Article 24, the term “Hazardous Materials” shall mean and refer to: (1) any “hazardous waste” as defined by the Resource Conservation and Recovery Act of 1976 (42 U.S.C. § 6901 et seq.), as amended from time to time, and regulations promulgated thereunder; (2) any “hazardous substance” as defined by the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (42 U.S.C. § 9601 et seq.) (“CERCLA”), as amended from time to time, and regulations promulgated thereunder; (3) asbestos; (4) polychlorinated biphenyls; (5) urea formaldehyde; (6) any substance the presence of which on the premises is prohibited by any applicable environmental laws or regulations (“Laws”) or by any other legal requirements affecting the Project or Work Site; (7) petroleum based materials (with the exception of tires affixed to vehicles); and, (8) any other substance which is defined as hazardous, toxic, infectious or radioactive by any Laws or by any other legal requirements affecting the Project or Project site. For purposes of this Article 24, the term “Hazardous Materials Contamination” shall mean and refer to the contamination of the Project or Project site, soil, surface water, ground water, air, or other elements on, or of, the buildings, facilities, soil, surface water, ground water, air, or other elements on or of any other property as a result of Hazardous Materials at any time emanating from the Project or Work Site.

(b) In addition to and without limiting the generality of any other provision of this Contract, Contractor shall and hereby does indemnify and hold Owner, the Board of Commissioners of the Owner, the Program Manager, the Engineer, their agents, employees, officers, directors, partners and related entities harmless from and against any and all losses, damages, expenses, fees, claims, demands, causes of action, judgments, costs and liabilities, including, but not limited to, attorney’s fees and costs of litigation, and costs and expenses of response, remedial and corrective work and other cleanup activities, arising out of or in any manner connected with: (1) the “release” or “threatened release” (as those terms are defined in CERCLA and the rules and regulations promulgated thereunder, as from time to time amended) by Contractor or Contractor’s employees, agents, delegates, invitees, licensees, concessionaires, subcontractors or representatives, of any Hazardous Materials; or (2) any occurrence of Hazardous Materials Contamination affecting the Project or Work Site caused by or resulting from, in whole or in part, the operations of the Contractor or Contractor’s employees, agents, delegates, invitees, licensees, concessionaires, subcontractors or representatives. The provisions of this paragraph shall survive any payment or satisfaction of this Contract and such provisions shall remain in full force and effect.

(c) When use or storage of hazardous materials or equipment or unusual methods of construction are necessary, the Contractor shall obtain prior written approval from the Owner. The use of explosives is strictly prohibited provided, however, powder activated fasteners are permitted.

(d) If Contractor encounters on the Work Site any substance or material reasonably believed by Contractor to be hazardous, Contractor immediately shall (i) stop work in the area affected, (ii) take measures appropriate to the condition to keep people away from the suspected Hazardous Material and, (iii) report the condition to Owner in writing. If the Work is so stopped and Hazardous Material is found, the Work in the affected area shall not thereafter be resumed except by the issuance of a Construction Change Directive pursuant to Section 9.02 of this Contract. Any such Construction Change Directive shall be limited to, an adjustment to the Substantial Completion Date appropriate. If no Hazardous Material is found after the Work is stopped, no Construction Change Directive is required to resume the Work in the affected area.

ARTICLE 25
MISCELLANEOUS

Section 25.01. No Waiver. No consent or waiver, express or implied, by either party to this Contract or of any breach or default by the other in the performance of any of its obligations hereunder shall be deemed or construed to be a consent or waiver to or of any other breach or default by such party. Failure on the part of the Owner to complain of any act or failure to act of the Contractor or to declare the Contractor in default, irrespective of how long such failure continues, shall not constitute a waiver of the rights of Owner.
Section 25.02. Assignment. This Contract shall not be assigned, delegated or transferred in whole or in part by the Contractor nor shall the Contractor assign any monies due or to become due to it without the prior written consent of the Owner.

Section 25.03. Governing Law. This Contract is entered into in Tennessee and shall be governed by and construed according to the laws of Tennessee. Any and all disputes arising out of this Contract, and/or the Project shall be decided by a state or federal court of competent jurisdiction in Memphis, Shelby County, Tennessee.

Section 25.04. Execution of Contract. The parties hereby agree and express their intent to execute this Contract electronically if Owner has a designated information processing system. The parties also hereby agree that this Contract may be executed in counterparts, each of which shall be deemed to be an original, but all of which, taken together, shall constitute one and the same agreement.

Section 25.05. Article and Section headings. Article and section headings contained in this Contract are for ease of reference only and shall not affect the interpretation or meaning of this Contract.

Section 25.06. Parties in Interest. This Contract shall inure to the benefit of and be binding upon the Parties and their respective successors, assigns and legal representatives. It is specifically agreed between the Owner and the Contractor that the Parties do not intend to create any third party beneficiary rights by the execution of this Contract.

Section 25.07. Severability. If any one or more of the provisions contained in this Contract shall for any reason be held invalid, illegal or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect any other provision of this Contract, but it shall be construed as if such invalid, illegal or unenforceable provision had never been contained herein.

Section 25.08. Written Notices. Whenever by the terms of this Contract notice shall be given either to Owner or to Contractor, such notice shall be in writing and shall be sent by regular United States Postal Service, by hand-delivery, by registered or certified mail, by a nationally recognized overnight delivery service or by electronic mail with a delivery receipt. Notice intended for Owner shall be addressed to the Vice President of Operations as follows with a copy to Owner's General Counsel at the address for regular mail:

If to the Owner, address to:

Regular Mail or Hand Delivery
Vice President of Operations
Memphis-Shelby County Airport Authority
2491 Winchester Rd., Suite 113
Memphis, Tennessee 38116-3856

Certified Mail or Overnight Delivery
3505 Tchulahoma Road
Memphis, TN 38118
(901) 922-8000

If to the Contractor, address to:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Either Party, from time to time, may change its address by giving written notice to the other Party.

Section 25.09. Exhibits. All exhibits described in this Contract shall be deemed to be incorporated into and made a part of this Contract. If there is any inconsistency between this Contract and the provisions of any exhibits, the provisions of this Contract shall control to the extent of the inconsistency.

Section 25.10. Entire Contract. This Contract, together with the exhibits and the other Contract Documents, constitutes the entire agreement between the Owner and the Contractor and supersedes all prior written or oral agreements, understandings, representations, negotiations and correspondence between the Parties. This Contract shall not be supplemented, amended or modified by any course of dealing, course of performance or usage of trade and may only be amended or modified by a written instrument duly executed by officers of both Parties.
Section 25.11. Non-Federally Assisted Projects. Regardless of the funding source for the Project, Contractor hereby agrees to comply with all nondiscrimination provisions of this Contract.


(a) The Project is subject to the requirements of Owner’s Business Diversity Development Program (BDDP) and Small Business Participation Program (SBPP). It is the responsibility of the Contractor to see that all requirements of the BDDP and SBPP are met. The Disadvantaged Business Enterprise (DBE) participation goal for the Project is Twenty-Two Percent (22%). This percentage is defined as the dollar value of subcontracts awarded to certified DBEs divided by the base bid or alternate amount. To qualify, a firm must be included on the Owner’s list of certified DBE firms.

(b) Proposed changes to the designated participating DBEs during performance of the Work must be submitted to the Owner. Contractors must make every effort to replace a DBE subcontractor with another certified DBE, based on said DBEs’ availability. All substitutes for DBE subcontractors or joint ventures require prior approval of the Owner, such approval not to be unreasonably withheld; and said approval may be granted for reasons including, but not limited to, the following: (1) subcontractor requests that its subcontract or joint venture agreement with the prime contractor be voided; (2) subcontractor is unable to perform the Work; and/or (3) subcontractor has consistently performed unacceptable work.

(c) A determination by the Owner that the Contractor has either failed to comply with this Section 25.12, to timely submit to Owner requested documentation related hereto, to cooperate with Owner, or to answer inquiries truthfully shall subject the Contractor to any or all of the following penalties:

(1) Withholding from the Contractor all future payments under this Contract until the Contractor is in compliance; and/or

(2) Cancellation, termination or suspension of this Contract, in whole or in part; and/or

(3) Payment by the Contractor to the Owner of an amount equal to the difference in the DBE dollar value achieved in documented DBE participation or any lesser amount or penalty as deemed appropriate by the Owner, which dollar value shall be considered liquidated damages for failure to perform the requirements of this Contract and for which the Contractor and all of its subcontractors agree to be bound.

(d) A violation of this provision shall be considered a material breach of this Contract. If, in the opinion of the Owner, the Contractor has made significant deviations from the DBE program commitments, such deviations shall be considered a breach of this Contract.

Section 25.13. No Financial Benefit. Contractor understands and agrees that no Owner employee or member of the Board of Commissioners, Memphis City Council or Shelby County Commission shall receive any financial benefit arising out of this Contract, either directly or indirectly. Further, any fees paid to any person or entity by Contractor for assistance in obtaining this Contract with Owner must be fully disclosed to Owner. Notwithstanding any term, condition, obligation or provision in this Contract, any other writing, any other agreement, any oral understanding or agreement, or any conduct or failure to act by the Owner, Contractor stipulates and agrees conclusively that Contractor has against the Owner no right, entitlement or claim for any payment, compensation, cost or remuneration of any type other than pursuant to the terms of this Contract.

ARTICLE 26

FEDERAL AVIATION ADMINISTRATION (FAA) REQUIRED CONTRACT PROVISIONS

Section 26.01. FAA Required Provisions. Federal laws and regulations require that specific contract provisions be included in certain contracts and subcontracts. All such provisions are set forth in Exhibit E, which is attached hereto and incorporated herein by reference. Contractor hereby agrees to insert these provisions in each contract and subcontract (to the extent applicable) related to the performance of this Contract and to require each of its subcontractors to do the same. Contractor also hereby agrees to incorporate these provisions by reference for work done under any purchase order, rental agreement or other agreement for supplies or services related to the performance of this Contract. Contractor further agrees to be responsible for compliance with these provisions by any subcontractor, lower-tier subcontractor or service provider. Contractor acknowledges that the FAA prevents any modification to these
provisions that creates a conflict with federal laws and regulations or changes the intent of the required provision.

IN WITNESS WHEREOF, the Parties have made and executed this Contract as of the day and year first above written.

The remainder of this page intentionally left blank.

[Signature page to follow.]
MEMPHIS-SHELBY COUNTY
AIRPORT AUTHORITY

CONTRACTOR

By: _______________________________  By: _______________________________

Title: __President and CEO______________  Title: __Vice President______________

Approved as to Content:

By: _______________________________

Title: __Vice President of Operations______________

Approved as to Form and Legality:

By: _______________________________

Title: __General Counsel______________

Reviewed and Approved:

By: _______________________________

Title: __Director of Development______________
EXHIBIT A
TO
LUMP SUM CONSTRUCTION CONTRACT
FOR
AIRFIELD MAINTENANCE TEMPORARY FACILITY - CONSTRUCTION

BY AND BETWEEN
THE MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY
AND
(CONTRACTOR NAME)

SCOPE OF WORK

This project generally consists of retrofitting the former bus barn to serve as the airfield maintenance heavy vehicle maintenance facility, renovating the former PSI building, improving the 2 metal buildings south of the bus barn for off-season snow equipment storage, and adding a fuel dispensing system outside of the bus barn. Larger vehicle doors will be added to the bus barn and an entire structural bay will be widened to include new footings, upsized roof purlins, steel beams, and strengthening of existing structure. Other work efforts include, but are not necessarily limited to, gravel placement, concrete foundation and pad improvements, metal building renovations, lighting enhancements, trench drain additions, site/building utilities (including electrical, gas, water, sanitary sewer, and radiant heating), demolition of interior stud walls, sheetrock and door installation, and other efforts as required.

END OF EXHIBIT A
EXHIBIT B
TO
LUMP SUM CONSTRUCTION CONTRACT
FOR
AIRFIELD MAINTENANCE TEMPORARY FACILITY - CONSTRUCTION

BY AND BETWEEN
THE MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY
AND
(CONTRACTOR NAME)

CONTRACT DOCUMENTS

NON-TECHNICAL SPECIFICATIONS

DIVISION 0
00001 Project Title Page
00007 Professional Seals
00010 Table of Contents
00015 List of Drawings
00100 Legal Notice to Bidders
00200 Instructions to Bidders/Proposers
00405 Proposal
00410 Proposal Guarantee
00445 Disadvantaged Business Enterprise (DBE) Requirements
00490 Addenda and Modifications
00500 Construction Contract
00605 Certificate of Secretary
00610 Performance Bond & Labor and Material Payment Bond
00630 Application for Payment
00640 Business Diversity Monthly Compliance Report
00765 Supplemental Provisions
00801 Airport Construction Safety Requirements
00802 Airport Security Requirements

General Provisions
Section 10 Definition of Terms
Section 20 Proposal Requirements and Conditions
Section 30 Award and Execution of Contract
Section 40 Scope of Work
Section 50 Control of Work
Section 60 Control of Materials
Section 70 Legal Regulations and Responsibility to Public
Section 80 Execution and Progress
Section 90 Measurement and Payment
Section 105 Mobilization
Section 150 FAA General Provisions Addendum

DIVISION 1
01100 Summary of Work, Sequence of Construction & Liquidated Damages
01210 Allowances
01230 Alternates
01250 Amendment Procedure
<table>
<thead>
<tr>
<th>Division/Section Code</th>
<th>Section Title</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DIVISION 1 (continued)</strong></td>
<td></td>
</tr>
<tr>
<td>01310</td>
<td>Preconstruction Conference &amp; Progress Meetings</td>
</tr>
<tr>
<td>01320</td>
<td>Schedules and Reports</td>
</tr>
<tr>
<td>01321</td>
<td>Construction Surveying</td>
</tr>
<tr>
<td>01325</td>
<td>Delays and Extension of Time</td>
</tr>
<tr>
<td>01330</td>
<td>Submittals</td>
</tr>
<tr>
<td>01351</td>
<td>Storage and Protection</td>
</tr>
<tr>
<td>01352</td>
<td>Nuclear Gages</td>
</tr>
<tr>
<td>01455</td>
<td>Quality Control and Quality Assurance Testing Programs</td>
</tr>
<tr>
<td>01500</td>
<td>Construction Facilities and Temporary Controls</td>
</tr>
<tr>
<td>01600</td>
<td>Product Requirements</td>
</tr>
<tr>
<td>01630</td>
<td>Product Substitution Procedures</td>
</tr>
<tr>
<td>01700</td>
<td>Field Engineering</td>
</tr>
<tr>
<td>01720</td>
<td>Project Record Documents</td>
</tr>
<tr>
<td>01741</td>
<td>Cleaning</td>
</tr>
<tr>
<td>01770</td>
<td>Close-Out Procedures</td>
</tr>
<tr>
<td>01771</td>
<td>Affidavit of Contractor</td>
</tr>
<tr>
<td>01772</td>
<td>Final Waiver and Release of Lien: PRIME</td>
</tr>
<tr>
<td>01773</td>
<td>Final Waiver &amp; Release of Lien: SUBCONTRACTOR</td>
</tr>
<tr>
<td>01774</td>
<td>Contractor Warranty Form</td>
</tr>
<tr>
<td>01775</td>
<td>Consent of Surety Company to Final Payment</td>
</tr>
<tr>
<td>01783</td>
<td>Electrical Characteristics, Capacities, and Wiring Diagrams</td>
</tr>
<tr>
<td>01784</td>
<td>Manufacturer's Supervision</td>
</tr>
</tbody>
</table>

**TECHNICAL SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Division/Section Code</th>
<th>Section Title</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DIVISION 02</strong></td>
<td><strong>EXISTING CONDITIONS</strong></td>
</tr>
<tr>
<td>02 40 00</td>
<td>Demolition</td>
</tr>
<tr>
<td><strong>DIVISION 03</strong></td>
<td><strong>CONCRETE</strong></td>
</tr>
<tr>
<td>03 30 10</td>
<td>Reinforced Concrete</td>
</tr>
<tr>
<td><strong>DIVISION 05</strong></td>
<td><strong>METALS</strong></td>
</tr>
<tr>
<td>05 12 00</td>
<td>Structural Steel</td>
</tr>
<tr>
<td>05 50 00</td>
<td>Metal Fabrication</td>
</tr>
<tr>
<td><strong>DIVISION 08</strong></td>
<td><strong>OPENINGS</strong></td>
</tr>
<tr>
<td>08 11 13</td>
<td>Steel Doors and Frames</td>
</tr>
<tr>
<td>08 71 00</td>
<td>Finish Hardware and Schedule</td>
</tr>
<tr>
<td>08 80 00</td>
<td>Glazing</td>
</tr>
<tr>
<td><strong>DIVISION 09</strong></td>
<td><strong>FINISHES</strong></td>
</tr>
<tr>
<td>09 21 16</td>
<td>Gypsum Board Assemblies</td>
</tr>
<tr>
<td>09 90 00</td>
<td>Painting and Coating</td>
</tr>
<tr>
<td><strong>DIVISION 10</strong></td>
<td><strong>SPECIALTIES</strong></td>
</tr>
<tr>
<td>10 44 00</td>
<td>Fire Protection Specialties</td>
</tr>
<tr>
<td><strong>DIVISION 22</strong></td>
<td><strong>PLUMBING</strong></td>
</tr>
<tr>
<td>22 05 13</td>
<td>Common Motor Requirements for Plumbing Equipment</td>
</tr>
<tr>
<td>22 05 17</td>
<td>Sleeves and Sleeve Seals for Plumbing Piping</td>
</tr>
<tr>
<td>22 05 19</td>
<td>Meters and Gages for Plumbing Piping</td>
</tr>
<tr>
<td>22 05 23</td>
<td>General-Duty Valves for Plumbing Piping</td>
</tr>
</tbody>
</table>

Contract: Contractor Name  
Airfield Maintenance Temporary Facility - Construction  
MSCAA Project No. 14-1379-10-01
<table>
<thead>
<tr>
<th>Division/Section Code</th>
<th>Section Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIVISION 22 (continued)</td>
<td>Hangers and Supports for Plumbing Piping and Equipment</td>
</tr>
<tr>
<td>22 05 29</td>
<td>Domestic Water Piping</td>
</tr>
<tr>
<td>22 05 53</td>
<td>Domestic Water Piping Specialties</td>
</tr>
<tr>
<td>22 07 19</td>
<td>Sanitary Waste and Vent Piping</td>
</tr>
<tr>
<td>22 11 16</td>
<td>Sanitary Waste Piping Specialties</td>
</tr>
<tr>
<td>22 11 19</td>
<td>General-Service Compressed-Air Piping</td>
</tr>
<tr>
<td>22 13 16</td>
<td>General-Service Packaged Air Compressors and Receivers</td>
</tr>
<tr>
<td>22 40 00</td>
<td>Plumbing Fixtures</td>
</tr>
<tr>
<td>22 45 00</td>
<td>Emergency Plumbing Fixtures</td>
</tr>
<tr>
<td>DIVISION 23</td>
<td>HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)</td>
</tr>
<tr>
<td>23 05 13</td>
<td>Common Motor Requirements for HVAC Equipment</td>
</tr>
<tr>
<td>23 05 29</td>
<td>Hangers and Supports for HVAC Piping and Equipment</td>
</tr>
<tr>
<td>23 05 48</td>
<td>Vibration and Seismic Controls for HVAC Piping and Equipment</td>
</tr>
<tr>
<td>23 05 53</td>
<td>Identification for HVAC Piping and Equipment</td>
</tr>
<tr>
<td>23 07 13</td>
<td>Testing, Adjusting, and Balancing for HVAC</td>
</tr>
<tr>
<td>23 11 23</td>
<td>Duct Insulation</td>
</tr>
<tr>
<td>23 13 13</td>
<td>Facility Natural-Gas Piping</td>
</tr>
<tr>
<td>23 31 13</td>
<td>Metal Ducts</td>
</tr>
<tr>
<td>23 33 00</td>
<td>Air Duct Accessories</td>
</tr>
<tr>
<td>23 34 23</td>
<td>HVAC Power Ventilators</td>
</tr>
<tr>
<td>23 54 00</td>
<td>Furnaces</td>
</tr>
<tr>
<td>23 55 23</td>
<td>Gas-Fired Radiant Heaters</td>
</tr>
<tr>
<td>23 73 33</td>
<td>Indoor Indirect-Fired Heating and Ventilating Units</td>
</tr>
<tr>
<td>23 81 26</td>
<td>Split-System Air Conditioners</td>
</tr>
<tr>
<td>DIVISION 26</td>
<td>ELECTRICAL</td>
</tr>
<tr>
<td>26 05 00</td>
<td>Common Work Results for Electrical</td>
</tr>
<tr>
<td>26 05 23</td>
<td>Control-voltage Electrical Power Cables</td>
</tr>
<tr>
<td>26 05 26</td>
<td>Grounding and Bonding for Electrical Systems</td>
</tr>
<tr>
<td>26 05 29</td>
<td>Hangers and Supports for Electrical Systems</td>
</tr>
<tr>
<td>26 05 33</td>
<td>Raceways and Boxes for Electrical Systems</td>
</tr>
<tr>
<td>26 05 53</td>
<td>Identifications for Electrical Systems</td>
</tr>
<tr>
<td>26 09 23</td>
<td>Lighting Control Devices</td>
</tr>
<tr>
<td>26 09 43</td>
<td>Network Lighting Controls</td>
</tr>
<tr>
<td>26 24 16</td>
<td>Panelboards</td>
</tr>
<tr>
<td>26 27 26</td>
<td>Wiring Devices</td>
</tr>
<tr>
<td>26 32 13</td>
<td>Engine Generators</td>
</tr>
<tr>
<td>26 36 00</td>
<td>Transfer Switches</td>
</tr>
<tr>
<td>26 51 00</td>
<td>Interior Lighting</td>
</tr>
<tr>
<td>26 56 00</td>
<td>Exterior Lighting</td>
</tr>
<tr>
<td>DIVISION 31</td>
<td>EARTH WORK</td>
</tr>
<tr>
<td>31 26 00</td>
<td>Steel Helical Piers</td>
</tr>
<tr>
<td>DIVISION 32</td>
<td>EXTERIOR IMPROVEMENTS</td>
</tr>
<tr>
<td>32 11 00</td>
<td>Unbounded Base Courses and Ballasts</td>
</tr>
<tr>
<td>32 31 10</td>
<td>Slide Gate Operator</td>
</tr>
</tbody>
</table>

Appendices

Appendix A  MSCAA Design Guide – Construction Standards
LIST OF DRAWINGS

DRAWINGS, Entitled Airfield Maintenance Temporary Facility – Construction, Issued for Bid, dated 11/29/16, with revisions, as noted on the drawing sheets:

<table>
<thead>
<tr>
<th>SHEET NO.</th>
<th>INDEX OF SHEETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>G000</td>
<td>COVER SHEET</td>
</tr>
<tr>
<td>A001</td>
<td>ARCHITECTURAL SITE PLAN AND PROJECT NOTES</td>
</tr>
<tr>
<td>A002</td>
<td>SITE PLAN - HANGAR ROAD</td>
</tr>
<tr>
<td>A003</td>
<td>SITE PLAN - RUNWAY ROAD</td>
</tr>
<tr>
<td>A011</td>
<td>EQUIPMENT SCHEDULE AND PHOTOGRAPHS</td>
</tr>
<tr>
<td>A102</td>
<td>DEMOLITION PLAN - 2836 HANGAR ROAD</td>
</tr>
<tr>
<td>A201</td>
<td>1ST FLOOR PLAN - 2836 HANGAR ROAD</td>
</tr>
<tr>
<td>A202</td>
<td>1ST FLOOR PLAN - 4000 RUNWAY ROAD</td>
</tr>
<tr>
<td>A203</td>
<td>FLOOR AND DEMOLITION PLANS - 2845 &amp; 2855 HANGAR ROAD</td>
</tr>
<tr>
<td>A411</td>
<td>WALL TYPES AND EXTERIOR DETAILS</td>
</tr>
<tr>
<td>A601</td>
<td>SCHEDULES</td>
</tr>
<tr>
<td>S001</td>
<td>GENERAL &amp; QUALITY ASSURANCE NOTES</td>
</tr>
<tr>
<td>S101</td>
<td>FOUNDATION PLAN &amp; DETAILS</td>
</tr>
<tr>
<td>S102</td>
<td>FRAMING PLAN &amp; ELEVATIONS</td>
</tr>
<tr>
<td>S201</td>
<td>FOUNDATION SECTIONS AND DETAILS</td>
</tr>
<tr>
<td>S202</td>
<td>ROOF FRAMING SECTIONS AND DETAILS</td>
</tr>
<tr>
<td>M000</td>
<td>HVAC LEGEND, GENERAL PROJECT NOTES &amp; SCHEDULES</td>
</tr>
<tr>
<td>MD101</td>
<td>HVAC FIRST FLOOR DEMOLITION - 2836 HANGAR ROAD - NORTH</td>
</tr>
<tr>
<td>MD102</td>
<td>HVAC FIRST FLOOR DEMOLITION - 2836 HANGAR ROAD - SOUTH</td>
</tr>
<tr>
<td>M201</td>
<td>HVAC FIRST FLOOR PLAN NEW &amp; DEMO WORK - 4000 RUNWAY ROAD</td>
</tr>
<tr>
<td>M202</td>
<td>HVAC SECOND FLOOR NEW &amp; DEMO WORK - 4000 RUNWAY ROAD</td>
</tr>
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<td>M203</td>
<td>HVAC FIRST FLOOR NEW WORK - 2836 HANGAR ROAD - NORTH</td>
</tr>
<tr>
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<td>HVAC FIRST FLOOR NEW WORK - 2836 HANGAR ROAD - SOUTH</td>
</tr>
<tr>
<td>M301</td>
<td>HVAC DETAILS</td>
</tr>
<tr>
<td>M302</td>
<td>HVAC DETAILS</td>
</tr>
<tr>
<td>M401</td>
<td>HVAC CONTROLS</td>
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<td>P000</td>
<td>PLUMBING GENERAL NOTES, LEGEND, SCHEDULES AND DETAILS</td>
</tr>
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<td>PD101</td>
<td>PLUMBING FIRST FLOOR DEMO PLAN 4000 RUNWAY RD</td>
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<td>PD103</td>
<td>PLUMBING FIRST FLOOR DEMO PLAN 2836 HANGAR RD</td>
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<td>PLUMBING FIRST FLOOR DEMO PLAN 2836 HANGAR RD</td>
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<td>P100</td>
<td>PLUMBING SITE PLAN 4000 RUNWAY RD</td>
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<td>P201</td>
<td>PLUMBING FIRST FLOOR NEW WORK PLAN 4000 RUNWAY RD</td>
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<td>P202</td>
<td>PLUMBING SECOND FLOOR NEW WORK PLAN 4000 RUNWAY RD</td>
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<td>P203</td>
<td>PLUMBING FIRST FLOOR NEW WORK PLAN 2836 HANGAR RD</td>
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<tr>
<td>P204</td>
<td>PLUMBING FIRST &amp; SECOND FLOOR NEW WORK PLAN 2836 HANGAR RD</td>
</tr>
<tr>
<td>P301</td>
<td>PLUMBING DETAILS</td>
</tr>
<tr>
<td>P401</td>
<td>PLUMBING ISOMETRIC PLANS</td>
</tr>
<tr>
<td>E000</td>
<td>ELECTRICAL GENERAL NOTES AND SCHEDULES</td>
</tr>
<tr>
<td>ED101</td>
<td>ELECTRICAL FIRST FLOOR DEMO PLAN 4000 RUNWAY ROAD</td>
</tr>
<tr>
<td>ED102</td>
<td>ELECTRICAL FIRST FLOOR DEMO PLAN 2836 HANGAR ROAD - NORTH</td>
</tr>
<tr>
<td>ED103</td>
<td>ELECTRICAL FIRST FLOOR DEMO PLAN 2836 HANGAR ROAD - SOUTH</td>
</tr>
<tr>
<td>ED104</td>
<td>ELECTRICAL DEMO PLAN 2845 &amp; 2855 HANGAR ROAD</td>
</tr>
<tr>
<td>E100</td>
<td>ELECTRICAL SITE PLAN 4000 RUNWAY ROAD</td>
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<td>SHEET NO.</td>
<td>INDEX OF SHEETS (continued)</td>
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<tr>
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<tr>
<td>E200</td>
<td>ELECTRICAL SITE PLAN 2836 HANGER ROAD</td>
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<tr>
<td>E201</td>
<td>ELECTRICAL FIRST FLOOR NEW WORK PLAN 4000 RUNWAY ROAD - LIGHTING</td>
</tr>
<tr>
<td>E202</td>
<td>ELECTRICAL FIRST FLOOR NEW WORK PLAN 4000 RUNWAY ROAD - POWER</td>
</tr>
<tr>
<td>E203</td>
<td>ELECTRICAL FIRST FLOOR NEW WORK PLAN 2836 HANGAR ROAD - LIGHTING NORTH</td>
</tr>
<tr>
<td>E204</td>
<td>ELECTRICAL FIRST FLOOR NEW WORK PLAN 2836 HANGAR ROAD - LIGHTING SOUTH</td>
</tr>
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<td>E205</td>
<td>ELECTRICAL FIRST FLOOR NEW WORK PLAN 2836 HANGAR ROAD - POWER NORTH</td>
</tr>
<tr>
<td>E206</td>
<td>ELECTRICAL FIRST FLOOR NEW WORK PLAN 2836 HANGAR ROAD - POWER SOUTH</td>
</tr>
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<td>E207</td>
<td>ELECTRICAL NEW WORK PLAN 2845 HANGAR ROAD</td>
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<tr>
<td>E208</td>
<td>ELECTRICAL NEW WORK PLAN 2855 HANGAR ROAD</td>
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<tr>
<td>E301</td>
<td>ELECTRICAL DETAILS</td>
</tr>
<tr>
<td>E401</td>
<td>ELECTRICAL RISER DIAGRAMS</td>
</tr>
<tr>
<td>E402</td>
<td>ELECTRICAL RISER DIAGRAMS</td>
</tr>
<tr>
<td>E403</td>
<td>ELECTRICAL PANEL SCHEDULES</td>
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<td>ELECTRICAL PANEL SCHEDULES</td>
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END OF EXHIBIT B
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<th>SHEET NO.</th>
<th>INDEX OF SHEETS (continued)</th>
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<tbody>
<tr>
<td>E201</td>
<td>ELECTRICAL FIRST FLOOR NEW WORK PLAN 4000 RUNWAY ROAD - LIGHTING</td>
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<tr>
<td>E202</td>
<td>ELECTRICAL FIRST FLOOR NEW WORK PLAN 4000 RUNWAY ROAD - POWER</td>
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<td>ELECTRICAL FIRST FLOOR NEW WORK PLAN 2836 HANGAR ROAD - LIGHTING</td>
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<td>ELECTRICAL FIRST FLOOR NEW WORK PLAN 2836 HANGAR ROAD - POWER</td>
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<td>E206</td>
<td>ELECTRICAL FIRST FLOOR NEW WORK PLAN 2845 HANGAR ROAD</td>
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<td>ELECTRICAL RISER DIAGRAMS</td>
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<td>ELECTRICAL PANEL SCHEDULES</td>
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<td>ELECTRICAL PANEL SCHEDULES</td>
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C.1. Owner Controlled Insurance Program
The Owner, has elected to implement an Owner Controlled Insurance Program (OCIP) that will provide Workers’ Compensation, Employers’ Liability, Commercial General Liability, Excess Liability and Builders’ Risk insurance for Contractors and Subcontractors of every tier who have been properly enrolled and are providing direct labor to the Project. A general summary of coverage provided by the OCIP is included in the MSCAA OCIP Manual, (hereinafter called the Manual), a copy of which is attached hereto and made a part of this Agreement, and should be attached to and incorporated in every subcontract. All terms and conditions of Exhibit C will apply during the term of the contract. The Owner agrees to pay all premiums associated with the OCIP.

While the OCIP provides uniform coverages and reasonable limits, the OCIP is not intended to meet all the insurance needs of the Contractor and eligible Subcontractors who have been properly enrolled. In addition to any insurance provided by Owner, the Contractor and all Subcontractors working on the Project will be responsible for providing certain insurance as specified in paragraph C.2. Contractors and eligible Subcontractors should discuss the OCIP with their insurance agent or consultant to assure that other proper coverages are maintained. Contractor and eligible Subcontractors enrolled in the OCIP agree that the insurance company policy limits of liability, coverage terms and conditions shall determine the scope of coverage provided by the OCIP.

C.1.1. Applicability of the OCIP
Participation in the OCIP by the Contractor and all eligible Subcontractors is mandatory but not automatic. The Contractor and each eligible Subcontractor (as defined below) must follow the enrollment procedures shown in the Manual. The Contractor shall comply with all requirements of the OCIP as outlined in the OCIP Manual and shall require all eligible Subcontractors to comply with requirements of the OCIP manual. The Manual may be updated and revised during the course of construction to reflect any changes in State Law, Rules and/or Regulations or Procedures that may be necessary or appropriate, and said revisions will replace all previous versions. Copies of any revised Manual will be distributed by the OCIP Administrator.

- If the Contractor or any eligible Subcontractor fails to enroll any of its eligible Subcontractors of any tier, it will be subject to a penalty charge of the full and complete deduct as shown in C.1.2.c or 3% of the subcontract cost, whichever is greater. Note: Collection of the penalty charge of any non-enrolled contractor(s) of any tier does not provide automatic coverage in the program.

- If any Contractor or any eligible Subcontractor enrolls in the OCIP more than 30 days after its start date, it will have to provide a No Known Loss Letter to the Carrier along with the enrollment documentation.

Eligible Subcontractor includes all Subcontractors providing or subcontracting for direct labor on any Designated Project (see definition of ineligible Subcontractors below).
Ineligible Subcontractor includes (but is not limited to) subcontractors performing any type of environmental remediation work (example: asbestos or underground tank removal), consultants, suppliers (that do not perform or subcontract installation), vendors, materials dealers, guard services, janitorial services, truckers (including trucking to any Designated Project where delivery is the only scope of work performed), employee leasing companies, temporary labor services and other temporary project services. However, such Employee leasing and temporary labor service companies can be insured by the OCIP but must be submitted for review to the OCIP administrator prior to acceptance.
A Designated Project is a project designated and approved by the Owner as a Designated Project and, enrolled by the OCIP Manager with the insurance company. This project is a Designated Project. A Designated Project includes operations necessary or incidental to the Work. The Contractor’s/Subcontractor’s regularly established workplace, plant, factory, office, shop, warehouse, yard or other property even if such operations are for fabrications of materials to be used at the job site or training of apprentices will be considered off-site and not covered by the OCIP.

Unless otherwise directed by the Owner, the Contractor, eligible Subcontractors and all Subcontractors not enrolled in the OCIP, will be required to maintain at least the insurance coverages set forth in paragraph C.2 and are required to participate in the MSCAA OCIP Safety Program. Contractor will promptly furnish the Owner, or their designated representative, certificates of
insurance giving evidence that all required insurance is in force.

C.1.2. Contractor Insurance Cost Identification
The Contractor and eligible Subcontractors will exclude their cost for all insurance coverages to be provided by the Owner for the work at any Designated Project from their bid.

C.1.3. Change Order Pricing
Contractor and all enrolled Subcontractors will price each change order to exclude the cost of insurance.

C.1.4. Assignment of Return Premiums
The Owner will be responsible for the payment of all premiums associated solely with the OCIP and will be the sole recipient of any dividend(s) and/or return premium(s) generated by the OCIP. In consideration of the Owner’s provision of said coverages under the OCIP program, the Contractor and eligible Subcontractors agree to:
1) Exclude all applicable insurance costs for coverage provided by the Owner associated with their contract work and excluded from their bid; and cooperate with the OCIP Administrator in the administration of the OCIP.
2) Irrevocably assign to and for the benefit of the Owner, all return premiums, premium refunds, premium discounts, dividends, retentions, credits, and any other monies in connection with the OCIP insurance. Contractor agrees to evidence such assignment by executing and delivering the Form-2. Contractor further agrees to require each eligible Subcontractor to execute the assignment on the Form-2, for the benefit of the Owner.

C.1.5 Audit of Contractor and/or Subcontractor Payroll
For insurance purposes, the Contractor and all tiers of Subcontractors agree to keep and maintain accurate and classified records of their payroll for operations at any Designated Project. Contractor and all eligible Subcontractors agree to furnish a copy of the Monthly Payroll Reporting Form, Form 5, to the OCIP Program Administrator by the 20th of each month and attach a copy of the Form-5, to their monthly pay application. If this report (Form-5) is not attached to the monthly pay application, payment may be held until the report is received.

The Contractor and all eligible Subcontractors will permit the Owner and its representative to examine and/or audit its books and records pertaining to any Designated Project. Contractor and eligible Subcontractor will also provide any additional information to the Owner or its appointed representatives as may be required. At the end of each contract, an audit may be performed of the reported payroll by the OCIP Carrier.

Upon Final Completion of each contract, the Contractor and eligible Subcontractors will furnish a completed and signed Form-4 - Notice of Anticipated Completion Form (a copy of which is attached hereto as “Form-4”) to the OCIP Administrator, together with all required documentation. Demobilization payments will not be released until all closeout documentation has been received and approved.

C.1.6. OCIP Deductibles
General Liability:
If a claim arises under the Owner provided Commercial General Liability OCIP policy from the partial or sole negligence of a Contractor or Subcontractor, or for violation of any OCIP Safety Requirements, such Contractor or Subcontractor shall be responsible for reimbursing the Owner’s deductible to the extent of their respective negligence, as determined solely by owner, up to a maximum of $10,000 per occurrence per Contractor.

 Builders Risk:
The Contractor shall be responsible for a deductible of $25,000 for each and every loss.

C.1.7. Termination/Modification of the OCIP
The Owner reserves the right to terminate or to modify the OCIP or any portion thereof. To exercise this right, the Owner will provide thirty (30) days advance written notice of termination or material modification to the Contractor and all eligible Subcontractors covered by the OCIP. In such event, the Contractor will promptly obtain appropriate replacement insurance coverage acceptable to the Owner. Written evidence of such insurance will be provided to the Owner prior to the effective date of the termination or modification of the OCIP coverages. The reasonable cost of such replacement insurance will be reimbursed by the Owner to the Contractor.

SPECIAL NOTE:
The Contractor and eligible Subcontractors who have completed their work at any Designated Project and whose insurance as provided by MSCAA OCIP has been terminated, and who returns to the site to perform warranty work does so under its own insurance coverages and not under those provided by MSCAA OCIP.

C.2 Contractor Provided Coverages
All insurance obtained by the Contractor pursuant to this Agreement shall be written by insurance companies licensed to do business in Tennessee and acceptable to Owner.
Prior to the commencement of any operations by or on behalf of the Contractor relating to the Project, and with respect to any and all such operations, the Contractor shall procure and provide to Owner and the Program Manager.

1) Evidence of Contractor’s Commercial Automobile Liability Insurance. A certificate of insurance and copy of endorsement shall be provided as evidence of:
   a) Coverage for Owner, their officers, directors and employees as additional insureds.
   b) Coverage to apply to all liability arising out of the ownership or use of all vehicles owned by, hired by, or used on behalf of the Contractor.
   c) Waiver of Subrogation to be provided in favor of the Owner, the Design Professional, the Program Manager and their officers, directors, and employees.
   d) If hazardous materials or waste are to be transported, the policy will be endorsed with the MCS-90 endorsement in accordance with the applicable legal requirements.

   This insurance shall be for an amount not less than $1,000,000 combined single limit liability.

2) Evidence of Contractor’s Workers’ Compensation and Employer’s Liability Insurance. A certificate of insurance or, at Owner’s request, a certified policy copy shall be provided as evidence of:
   a) Coverage for claims for damages arising out of bodily injury, occupational sickness or disease or death of Contractor’s employees under any applicable workers’ compensation statute or any other applicable employers’ liability law. Certificate of insurance or policy must clearly identify that coverage applies in the state of Tennessee.
   b) A waiver of subrogation by the insurer against the Owner the Design Professional, the Program Manager and their officers, directors and employees.
   c) This insurance shall include employers’ liability limits of not less than $1,000,000 bodily injury each accident, $1,000,000 bodily injury by disease each employee and $1,000,000 bodily injury by disease in the aggregate.
   d) All Enrolled Contractors must provide Workers’ Compensation and Employer’s Liability insurance covering all employees for injuries that occur AWAY from the Project Site or after OCIP termination, expiration, or cancellation.
   e) Ineligible subcontractors or subcontractors not enrolled must provide coverage for ALL operations.

3) Evidence of Contractor’s Commercial General Liability Insurance. Certificate of insurance and copies of endorsements to Contractor’s primary commercial general liability policy and shall be provided as evidence of:
   a) Coverage for Owner and the Design Professional, Program Manager, their officers, directors and employees as additional insureds as respects claims or liabilities arising from or connected with Contractor’s work, operations and completed operations. The additional insured endorsements shall be at least as broad as the current editions of CG 2010 (1001) during the course of construction and CG2037 (1001) until the expiration of the statute of repose, or its carrier equivalent.
   b) Coverage shall be primary and non-contributing with any coverage Owner maintains in its own name and on its own behalf.
   c) Coverage shall be written on an occurrence coverage form, with coverage at least as broad as that provided under the current edition of the ISO Commercial General Liability coverage form, CG 0001. Other than standard exclusions applicable to pollution, asbestos, mold, employment practices, ERISA and professional liability, there shall be no limitations or exclusions beyond those contained in the standard policy forms which apply to property damage, products and completed operations, contractual liability or construction defects. In addition to procuring and maintaining this insurance during the duration of the contract, contractor agrees to continue to procure and maintain products and completed operations liability insurance coverage for a minimum of six (6) year(s) after the date the contract is completed or terminated or in accordance with the applicable statute of limitations under state law, whichever is longer.
   d) Waivers of subrogation by insurers against Owner, Design Professional, Program Manager and their officers, directors and employees.
e) Contractual Liability Insurance applicable to the indemnification agreement contained in Section 21.01 of this Agreement.

f) The required amounts of primary Commercial General Liability Coverage in the amount of:
   - $1,000,000 Bodily Injury and Property Damage Limit for each occurrence
   - $1,000,000 Personal & Advertising Injury
   - $2,000,000 General Aggregate (Annual)
   - $2,000,000 Products/Completed Operations Aggregate (annual)
   The general aggregate limit shall apply separately to each project.

   g) All Enrolled Contractors must provide General Liability insurance covering third-party losses that occur AWAY from the Project Site (including products liability for any product manufactured, assembled or otherwise worked upon away from the Project Site) or after OCIP termination, expiration or cancellation. Ineligible contractors or subcontractors not enrolled must provide coverage for ALL operations.

h) The policy will be endorsed to exclude any “Designated Project” for onsite coverage only, if you are a participant in the OCIP.

4) Evidence of Contractor’s Excess or Umbrella Liability Insurance. Certificate of insurance and copies of endorsements to Contractor’s Excess or Umbrella liability policy and shall be provided as evidence of this excess liability or umbrella insurance with an annual an aggregate amount of not less than $25,000,000 for the Contractor and $1,000,000 limits required of subcontractors unless otherwise stated in the Contract Documents, and shall be excess and follow form over primary coverages included herein. Such coverage will be excess of Commercial Auto Liability, Employers Liability and the Primary Liability policies.

5) Evidence of Professional Liability Insurance (Not Applicable):
   Per Claim and in the Aggregate:
   All professional services firms must provide professional liability insurance appropriate for their profession. Architectural and engineering firms must provide coverage for liability arising out of design errors and omissions. The policies shall provide a three (3) year extended reporting period.

6) Evidence of Contractors Pollution Liability Insurance (Not Applicable):
   Each Occurrence Limit and in the Aggregate:
   Coverage applies to third-party bodily injury and property damage claims (including natural resource damage), and clean-up costs, caused by pollution conditions which result from covered operations performed by, or on behalf of, contractors and subcontractors of all tiers at the Project Site. Coverage shall apply to claims for mold and fungus damage that result from the work as well as gradual and sudden and accidental pollution incidents arising from activities of the contractors working at the project site.

   Coverage must be evidenced for on-site and off-site transportation which may result in a pollution incident/event and non-owned disposal site coverage (if applicable to the project). The policy shall be endorsed to provide a Waiver of Subrogation in favor of the Owner, Design Professional and Program Manager. In addition, the Owner, their officers, directors and employees shall be included as Additional Insureds.

7) Evidence of Contractor’s Equipment Insurance:
   The Contractor is responsible for their tools and equipment including, but not limited to, construction trailers and their contents and temporary scaffolding at the project site, whether owned, leased, rented or borrowed. Contractor acknowledges and agrees that the Owner will not be responsible for any loss or damage to their tools and equipment. If insured, the Contractor’s insurance policies covering tools and equipment will include a waiver of subrogation and any other rights of recovery in favor of the Owner. If uninsured, the Contractor will hold harmless the Owner, Program Manager and Design Professional for loss or damage to their tools and equipment.

8) Aircraft/Aviation Liability Insurance (Not Applicable):
   Each Occurrence Limit and in the Aggregate (including passenger liability):
   The operator of an aircraft of any kind must maintain liability insurance covering bodily injury and property damage on a Combined Single Limit basis. If non-employee passengers are carried, there cannot be a per-passenger sublimit.

   Prior to commencing operations, the operator must provide the Owner with a certificate of insurance naming the Owner, their officers, directors and employees as additional insureds on a primary and non-contributory basis. Operator and their insurer(s) must hold the Owner harmless and waive subrogation with respect to damage to the aircraft. If aircraft is to be used to perform lifts at the Project Site, a “slung cargo” endorsement must be included to cover the full replacement value...
of any equipment being lifted.

NOTE: If the Contractor and / or eligible Subcontractor participating in the OCIP choose(s) to have the policy endorsed to include any “Designated Project” site during the construction period, coverage should be Excess and/or Difference in Conditions (DIC) of the OCIP and this cost should not be passed back to the Owner. Inclusion of any “Designated Project” Site on such insurance policies shall not replace the OCIP coverage or otherwise affect the cost identification requirement in paragraph C.1.2.

C.2.2. Contractor’s Insurance Primary.
Any coverage applicable to Owner under Contractor’s insurance policies shall be primary and non-contributing with any insurance maintained by Owner in its own name and on its own behalf. Copies of endorsements to Contractor’s policies shall be provided to Owner.

C.2.3. Cancellation.
All such insurance shall be in form and substance satisfactory to the Owner and shall provide that not less than thirty (30) days’ notice of cancellation or non-renewal, other than non-payment of premium which shall be ten (10) days’ notice, be provided to Owner. If unavailable, Contractor must provide Owner with thirty (30) days’ advance written notice of cancellation, other than non-payment of premium, which shall be ten (10) days’ notice. Contractor must notify Owner of any material change or reduction in coverage to the Contractor’s insurance policies.

C.2.4. Certificates of Insurance - Contractor Provided Insurance Coverage Requirements
As shown in Section C.2

Description of Operations for contractors participating in the OCIP shall read:
Workers’ Compensation and Commercial General Liability coverages shown above do not apply to any Designated Project at the Memphis International Airport.

Additional Insured Wording for Contractors shall read:
Memphis-Shelby County Airport Authority, Program Manager, Design Professional and their officers, commissioners, agents and employees as now or hereafter exist as respect to the services / work to be performed under this Agreement, for coverages as required by contract. MSCAA Project # 14-1379-10-01.

Additional Insured Wording for Subcontractors shall read:
For Subcontractors participating in the OCIP
The Memphis-Shelby County Airport Authority, Program Manager, Design Professional and their officers, commissioners, representatives, agents and employees ATIMA are additional insureds for coverages as required by contract.
For Subcontractors not participating in the OCIP
The Memphis-Shelby County Airport Authority, Program Manager, Design Professional and their officers, commissioners, representatives, agents and employees ATIMA and Awarding Contractor are additional insureds as respect to the services / work to be performed under this Agreement for coverages as required by contract.

Filing of Certificates
Certificates of insurance acceptable to the Owner shall be filed with the Owner by furnishing to the OCIP Administrator, prior to commencement of the Work. If any of the foregoing insurance coverages are required to remain in force after final payment and are reasonably available, an additional certificate evidencing continuation of such coverage shall be submitted with the final Application for Payment.
A sample is provided of a certificate of insurance is provided in the OCIP Manual.

MSCAA OCIP
c/o Willis Towers Watson National Project Insurance Practice.
Attn: OCIP Administrator
15305 North Dallas Parkway, Suite 1100
Addison, TX 75001

C.2.5. The Right of the Owner to Maintain Insurance.
In the event the Contractor fails to furnish and maintain the required insurance or to furnish certificates of insurance, the Owner shall have the right, at its option, to terminate this Agreement or to take out and maintain such insurance, and hold the Contractor liable for the cost. Compliance by the Contractor with the requirements of this Article shall in no way relieve the Contractor from liability under any provision of this Agreement or the Contract Documents.

C.2.6. Other Insurance
Any type of insurance or any increase of limits of liability not described in this section which the Contractor or any Subcontractor requires for their own protection or on account of any statute will be their own responsibility and their own expense. Any type of
insurance or any increases of limits of liability not described herein that the Contractor or any Subcontractor requires for its own protection or on account of statute shall be its own responsibility and its own expense. If the Contractor or the Subcontractors maintain any insurance policies covering owned, leased or borrowed, equipment, such policies shall contain a waiver of subrogation against the Owner. Each item must be shown as a line item and approved by the Owner.

C.2.7. Deductibles
The Contractor shall be responsible for the payment of the deductible amounts for any insurance in force pursuant to this Agreement whether such insurance is furnished by the Owner or the Contractor.

C.2.8. Insurance for Project Property While outside the United States and Canada.
If any project property is in transit or is located outside the continental United States or Canada for any reason, Contractor shall arrange to insure such property for its full replacement value separate from the other insurance described herein.

All Subcontractors are subject to the same insurance requirements as Contractor. Contractor shall cause each Subcontractor employed by Contractor to purchase and maintain such insurance and upon request, must promptly furnish Owner with copies of certificates of insurance evidencing coverage for each Subcontractor.

C.2.10. No Representation of Coverage Adequacy.
In specifying minimum Contractor insurance requirements, Owner does not represent that such insurance is adequate to protect Contractor for loss, damage or liability arising from its work. Contractor is solely responsible to inform itself of the types or amounts of insurance it may need beyond these requirements to protect itself. The insurance requirements set forth in minimum amounts shall not be construed to relieve Contractor for liability in excess of such coverage, nor shall it preclude Owner from taking such other actions as is available to it under any other provision of the contract.

C.2.11. Contractor Responsibilities
The Contractor will cooperate with and will require all eligible Subcontractors to cooperate with The Owner and/or the OCIP Administrator with regards to the administration and operation of the OCIP. The Contractor and eligible Subcontractors responsibilities will include, but not be limited to:
1) Compliance with all rules and regulations of the applicable State Insurance Bureau/Board; failure to meet state requirements may result in fines being assessed, and, if this occurs, the Owner shall deduct from monies due or to become due under the provisions of this contract for any applicable fines that are assessed against the Owner, the Contractor or any eligible Subcontractor;
2) Compliance with applicable Construction Safety Program;
3) Provision of necessary contract, operations and insurance information, including verification of current Worker’s Compensation Experience Modifier;
4) Cooperation with any insurance company or OCIP Administrator with respect to requests for claims, payroll or other information required under the program;
5) The Contractor and all eligible Subcontractors shall adhere to and perform all reporting requirements as set forth in the Claims Procedures portion of the OCIP Program Manual.

The Contractor will include this exhibit and the Manual with the bid documentation. The Contractor will require that all eligible Subcontractors participate in the OCIP and comply with all rules and procedures as outlined in MSCAA Enrollment Process Summary. It will be the Contractor’s responsibility to submit to The Owner and its designated representative all bid documentation for approval. If Contractor fails to comply with this section and any eligible Subcontractors do not enroll in the program, the Owner has the right to retain the 3% of subcontracted work as a penalty from the awarding Contractor/Subcontractor as set out in C.1.2.c.

C.2.13. Approval of Forms and Companies
All insurance described in this Section will be written by an insurance company or companies satisfactory to the Owner and licensed to do business in Tennessee and will be in a form and content satisfactory to the Owner. No party subject to the provisions of this contract will violate or knowingly permit to be violated any of the provisions of the policies of insurance described herein.

C.2.14. Coverage to be provided by Contractor during Warranty Period
During the period following the final acceptance date and prior to expiration of the warranty period hereunder, Contractor will maintain in full force and effect all insurance as specified in paragraph C.2 covering all Work performed during such period.

C.3. Waiver of Subrogation and Waiver of Rights of Recovery Owner Controlled Insurance Program
Except as respects any deductibles identified above, Owner waives all rights of subrogation and recovery against the Contractor and all Subcontractors of all tiers to the extent of any loss or damage, which is insured under the OCIP. Except as respects the
Contractor waives all rights of subrogation and recovery against the Owner, Design Professional and Program Manager, to the extent loss or damage is insured under the Contractor’s policies. The Contractor and each Subcontractor will require all Subcontractors to similarly waive their rights of subrogation and recovery in each of their respective construction contracts with respect to their work on any Designated Project.

**Contractor Provided Coverages**

Contractor waives all rights of subrogation and recovery against the Owner, Design Professional and Program Manager, to the extent of any loss or damage, which is insured under the OCIP. The Contractor and each Subcontractor will require all Subcontractors to similarly waive their rights of subrogation and recovery in each of their respective construction contracts with respect to their work on any Designated Project.

**C.4. Project Safety Administration**

It is the responsibility of the Contractor to maintain total control of safety to ensure that its employees and the general public will be provided an environment free of recognized hazards during construction activities. In carrying out this policy it is clear the only accepted level of performance is to be “Incident Free” on this project each and every day.

**C.5. Project Safety Manual**

The safety requirements of any Designated Project Safety Manual are a supplementary document to all Government rules, codes and regulations. It is understood that the ultimate responsibility for providing a safe place to work rests with each individual Contractor. All Contractors are responsible for full compliance with the requirements and standards referenced in the manual.

**C.6. New Employee Orientation**

Each new Contractor or Subcontractor employee will be required to attend an orientation program. This orientation is designed to communicate all project specific safety policies, procedures, and expectations of “the Safety Team” in regard to the construction of any Designated Project.

**C.7. Contractor Safety Program Review**

To proactively monitor the safety, health and environmental performance of Contractors and Subcontractors the Owner and/or his Representative, will be conducting a periodic review of Contractor or Subcontractor safety programs. This will be a formal process, which will be done with or without advanced notice. Upon completion of the Safety Program Review, a list of recommendations will be provided to the Contractor or Subcontractor. There will be a timeline developed and agreed upon for the purpose of abating any deficiencies in the Contractor or Subcontractor safety program.

**C.8. No Release**

The provision of the OCIP by The Owner will in no way be interpreted as relieving the Contractor or any Subcontractor of any other responsibility or liability under this agreement or any applicable law, statute, regulation or order.
MSCAA OCIP III

An Owner Controlled Insurance Program Manual for Construction Projects

<table>
<thead>
<tr>
<th>Revision</th>
<th>Revision Summary</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Updated Manual for OCIP III</td>
<td>11/30/2012</td>
</tr>
<tr>
<td>2</td>
<td>Accommodate change in policy end dates to 10/25/2018. Update Team Members</td>
<td>06/08/2016</td>
</tr>
</tbody>
</table>
### MSCAA OCIP – ENROLLMENT SUMMARY

#### Contract Bid – All Contractors/Subcontractors

Bid package will be furnished to bidders.
1) All eligible contractors/Subcontractors of every tier will exclude their cost of insurance for coverage provided by the Owner from their bid.
2) Workers’ Compensation – Tennessee Payroll Rules are applicable to WC payroll. First dollar coverage is given to all Contractors on WC.
3) General Liability – Mandatory deductible not to exceed $10,000 will apply to any loss as described in the OCIP manual. 5% credit will be applied to Contractor’s premium for this deductible

#### Contract Award

Once notification of contract award has been received, all eligible contractors/subcontractors of every tier will complete and submit Form 2 with the required certificate of insurance. Any Contractors or Subcontractors who enroll in the OCIP 30 days after their start date will have to provide a No Known Loss Letter to the Carrier along with the enrollment documentation. The OCIP Administrator will:
1) Assign a location code for this contract, forward the Form 2 to the insurance carrier for enrollment into program
2) Issue a certificate of insurance which will reflect all OCIP coverages. The original copy will be sent to the enrolled contractor/Subcontractor with a copy to their awarding contractor.

#### Change Order

Contractor and all enrolled Subcontractors will price each change order to exclude the cost of insurance provided by the Owner.

#### Monthly Payroll Reporting

Submission of Monthly Payroll Reporting Form - Form 5 – to be completed with proper Workers’ Compensation Classification Codes – one copy attached and turned in with pay application, one copy submitted to the OCIP Administrator by the 20th of the month.

#### If Contractor/Subcontract receives additional contracts

Once the contractor/Subcontractor has enrolled in the OCIP, all additional contract bids must also exclude the Contractor’s cost of insurance for coverage provided by the Owner. Form 2 must be submitted to the OCIP Administrator to receive confirmation of enrollment in the OCIP for the additional contract. (Contact the OCIP Administrator if you have questions). The OCIP Administrator will:
1) Assign a location code for this contract, forward the Form 2 to the insurance carrier for enrollment into program
2) Issue a certificate of insurance which will reflect all OCIP coverages. The original copy will be sent to the enrolled contractor/Subcontractor, a copy to their awarding contractor.

#### When Contractor/Subcontract reaches Substantial Completion

Notice of Anticipated Completion - Form 4 – Prior to completion of all work being performed under the contract. This will initiate Closeout Procedures. Payroll and Receipts may be audited.

#### When Contractor/Subcontractor has completed the Work

Contractor should notify their insurance agent/broker to remove any exclusion for this designated project from their primary policies.

#### Claims

All Contractors/Subcontractors must follow claims rules and procedures outlined in the MSCAA OCIP Manual.

#### Safety

All Contractors/Subcontractors must follow safety rules and procedures outlined in the MSCAA OCIP Site Specific Safety Plan.

#### Notice to All Contractors/Subcontractors

Failure to follow the Enrollment or Claims procedures outlined in MSCAA OCIP Manual may result in fines being assessed by the State Bureau/NCCI, State’s Workers’ Compensation Commission or the Owner against the Contractor or Subcontractor. If the Owner or Carrier is assessed fines due to Contractor’s or Subcontract’s failure to follow State rules or regulations, the Owner will deduct from monies due or to become due for any applicable fines.

**CHANGES TO ANY OCIP REQUIREMENT OR PROCEDURE MUST BE APPROVED BY THE OWNER AND OCIP ADMINISTRATOR. NO CONTRACTOR OR SUBCONTRACTOR HAS THE AUTHORITY TO AMEND THE OCIP REQUIREMENTS.**
INTRODUCTION
This manual identifies, defines, and assigns responsibilities related to the administration of the Memphis-Shelby County Airport Authority (MSCAA) Owner Controlled Insurance Program (OCIP).

This manual:
• Describes the OCIP and details the insurance-related responsibilities of the various parties involved.

• Provides a basic description of the OCIP structure and operation, with an overview of coverage provided by the OCIP and guidelines for carrying out specific administrative and audit procedures.

Provides answers to questions that are likely to arise during the course of the project. Because it is impossible to anticipate every question or situation that may arise, the directory lists those involved in the administration of the OCIP and their areas of expertise. Please feel free to call with any questions.

This Manual will be updated as changes dictate during the course of this project.

NOTE
• This Manual does not, and is not intended to, provide coverage interpretations or complete information about coverages.

• The terms and conditions of the insurance policies govern how coverage is applied.

• The information herein is not intended to alter any provisions of the actual contract documents of the Contractors, and if any such conflict occurs, the contract documents will govern.

CHANGES TO ANY OCIP REQUIREMENT OR PROCEDURE MUST BE APPROVED BY THE SPONSOR AND OCIP ADMINISTRATOR. NO CONTRACTOR OR SUBCONTRACTOR HAS THE AUTHORITY TO AMEND THE OCIP REQUIREMENTS.
**ADMINISTRATION**

**Program Management**

**OCIP Program Coordinator**
Willis Towers Watson

**John Shorten**
8285 Tournament Drive, Suite 130
Memphis, TN 38125

Phone: (901) 248-3102
Fax: (901) 248-3101
E-mail: john.shorten@willistowerswatson.com

**OCIP Program Unit Manager**
Willis Towers Watson National Project Insurance Practice

**Becky Hubert**
15305 North Dallas Parkway, Suite 1100
Addison, TX 75001

Phone: (972) 715-6239
Fax: (972) 386-5561
E-mail: becky.hubert@willistowerswatson.com

**OCIP Administration**
Willis Towers Watson National Project Insurance Practice

**Rebecca Trejo**
15305 North Dallas Parkway, Suite 1100
Addison, TX 75001

Phone: (972) 715-6219
Fax: (972) 386-5561
E-mail: rebecca.trejo@willistowerswatson.com

**On-Site Safety**
Willis Towers Watson

**Wes Shelby**
4225 Airways Blvd.
Memphis, TN 38116

Phone: (901) 344-1659
Fax: (901) 345-6636
Cell: (901) 604-2136
E-Mail: wes.shelby@willis.com

**Claims Management**

**Zurich North America**
PO Box 968077
Schaumburg, IL 60196-8077

**FAX NUMBER FOR REPORTING CLAIMS:** (877) 967-2567
**GENERAL CLAIMS FAX NUMBER:** (615) 872-1303
**GENERAL PHONE NUMBER:** (800) 366-8366

**Workers Compensation Claims**

Team Manager: Veatrice Storey (615) 872-1241 veatrice.storey@zurichna.com
WC Claim Handler: Dawn Parshall (615) 872-1281 dawn.parshall@zurichna.com
WC Claim Handler: Joy Collier (615) 872-1313 joy.collier@zurichna.com
WC Claim Handler: Sandra Aaron (615) 391-7510 sandra.aaron@zurichna.com

**Commercial General Liability Claims**

Team Manager: Christopher Dwyer (404) 851-3517 christopher.dwyer@zurichna.com
Claim Handler: Tom Finch (615) 872-1222 tom.finchi@zurichna.com
Insurance Policy References

Workers Compensation
Insurance Company: Zurich American Insurance Company
Master Policy Number: WC 9409456-00
Each Contractor and/or Subcontractor will be issued their own Workers’ Compensation Policy

Commercial General Liability
Insurance Company: Zurich American Insurance Company
Master Policy Number: GLO 9409457-00

Umbrella Liability
Insurance Company: Westchester Fire Insurance Company
Master Policy Number: G2427536A 001
Limits: $10,000,000 excess of primary

Excess Liability – Layer 1
Insurance Company: Allied World National Assurance Company (AWAC)
Master Policy Number: 0307-4969
Limits: $15,000,000 excess of $10,000,000

Excess Liability – Layer 2
Insurance Company: RSUI Indemnity Company
Master Policy Number: NHA059734
Limits: $25,000,000 excess of $25,000,000
Program Definitions

Owner Controlled Insurance Program (OCIP)
The Insurance Program under which Workers’ Compensation, Employer’s Liability, Commercial General Liability and Excess Liability are procured or provided on a project “wrap-up” basis for Contractors/Subcontractors(s) of any tier, who have been properly enrolled, while performing operations on a designated Project Site for Memphis-Shelby County Airport Authority.

Insured
The Memphis-Shelby County Airport Authority, Contractors(s) and Subcontractors of any tier who are enrolled in the OCIP and who have been named in a policy, certificate of insurance, or advice of insurance.

Insurer
Insurance Company, as identified in the Insurance Policy Reference section.

OCIP Coordinator and Administrator
The firms responsible for the insurance broker and administration of the OCIP.

OCIP Safety Consultants
These representatives are employees of the Insurer and Willis Towers Watson who will provide safety consulting services to MSCAA and its contractors enrolled in the OCIP.

Project Description
All Designated Projects identified and approved by the Owner and on file with the Insurance Company.

On-Site Activities
Those activities at the Designated Project or emanating there from such as adjacent sidewalks, streets, and contiguous areas, storage areas, work sites, temporary construction yards, staging areas, and/or any location or area in which work or storage related to a designated project is conducted.

The OCIP does not provide insurance coverage for permanent yards or other locations of any Contractors/Subcontractors, except as specifically requested by Contractors and endorsed by owner.

Eligible Contractors
Insured by the OCIP:
Eligible Contractors include all contractors providing direct labor on the Designated Project (see definition of ineligible contractors below). Temporary labor services and leasing companies are to be treated as subcontractors.

Ineligible Contractors
Not insured by the OCIP:
Includes (but is not limited to) contractors performing any type of environmental remediation work (example: asbestos or underground tank removal), consultants, suppliers (that do not perform or subcontract installation), vendors, materials dealers, guard services, janitorial services, truckers (including trucking to any Designated Project where delivery is the only scope of work performed), employee leasing companies, temporary labor services and other temporary project services. However, such Employee leasing and temporary labor service companies can be insured by the OCIP but must be submitted for review to the OCIP administrator prior to acceptance.

Certificate of Insurance
Written evidence of the existence of coverage terms of a particular insurance policy.
**COVERAGE SUMMARY**

The OCIP coverage applies only to work performed under the Agreement at any Designated Project Site for eligible contractors. Contractor and Subcontractors must provide their own insurance as detailed in the contract.

Through a combination of insured and self-insured insurance programs the Owner, at its sole expense, will provide and maintain in force the types of insurance listed in subsection (1) through (5) below as a part of the OCIP for Contractor and eligible Subcontractors who have been enrolled. Contractor and eligible Subcontractors enrolled in the OCIP agree that the insurance company policy limits of liability, coverage terms and conditions shall determine the scope of coverage provided by the OCIP.

This section provides a brief description of the coverages provided under the OCIP. The Contractor shall refer to the actual policies for details concerning coverages, exclusions and limitations. Policies are available for review upon request.

While the OCIP is intended to provide uniform coverages and reasonable limits, the OCIP is not intended to meet all the insurance needs of the Contractor and all eligible Subcontractors who have been properly enrolled. Contractor and eligible Subcontractors enrolled in the OCIP agree that the will discuss the OCIP with their insurance agent or consultant to ensure that proper coverages are maintained. It is the contractors’ responsibility to notify their agent that the work performed on-site will be insured under an OCIP.

1) **Workers’ Compensation and Employers’ Liability Insurance** (Off-site operations are excluded unless locations are scheduled & approved by the Owner and OCIP insurance carriers) with Statutory Limits with All States Endorsement and minimum Employer’s Liability Limits will be provided as follows:
   a) $1,000,000 Bodily Injury with Accident - Each Accident;
   b) $1,000,000 Bodily Injury by Disease - Policy Limit
   c) $1,000,000 Bodily Injury by Disease - Each Employee; and

   Each Enrolled Contractor will be issued a separate Workers’ Compensation policy. The premium and loss experience on the Project Site will be reported to the appropriate rating authorities in the normal manner for use in calculating Enrolled Contractors’ future experience modifiers. OCIP loss experience will impact Contractor’s future insurance costs and, therefore, compliance with the project safety guidelines will directly benefit all Contractors.

2) **Commercial General Liability Insurance**, (Off-site operations are excluded unless locations are scheduled & approved by the Owner and OCIP insurance carriers) will be provided on an “occurrence” form under a master liability policy. Certificates of insurance will be provided to the Contractor and all tiers of eligible Subcontractors reflecting the following Limits of Liability, Coversages, and Terms:
   a) Limit of Liability: Limits of Liability Shared by all Enrolled Contractors
      i) $2,000,000 Bodily Injury and Property Damage Liability Each Occurrence
      ii) $4,000,000 General Aggregate
      iii) $4,000,000 Products and Completed Operations Aggregate
      iv) $2,000,000 Fire Damage
      v) $2,000,000 Personal Injury Advertising

   b) Coverage and Terms:
      i) Occurrence Basis;
      ii) Products;
      iii) Contractual Liability specifically designating the indemnity provision of this agreement as an insured contract;
      iv) Completed Operations (Six Year Term);
      v) Independent Contractor/Subcontractor’s Liability;
      vi) Personal Injury; Explosion, Collapse, and Underground (X, C, U) exclusion deleted; and
      vii) Coverage limited to any Designated Project
      viii) Policy Exclusions include (but are not limited to) asbestos, pollution, mold, professional liability, employment practices, EIFS, impaired property and work or operations performed away from any Designated Project Site.

   c) If a claim arises under the Owner provided Commercial General Liability OCIP policy from the partial or sole negligence of a Contractor or Subcontractor, or for violation of any OCIP Safety Requirements, such Contractor or Subcontractor

---

Contract: Contractor Name
Airfield Maintance Temporary Facility - Construction
MSCAA Project No. 14-1379-10-01
shall be responsible for reimbursing the Owner’s deductible to the extent of their respective negligence, as determined solely by owner, up to a maximum of $10,000 per occurrence per Contractor.

d) The limits of liability detailed under 2) a) apply to construction operations within the property boundary of the applicable Airport under the management of MSCAA.

3) **Umbrella and Excess Liability Insurance** (Off-site operations are excluded)
   a) Limits of Liability Shared by all Enrolled Contractors
      i) $50,000,000 per Occurrence
      ii) $50,000,000 Aggregate
      iii) $50,000,000 Products / Completed Operations Aggregate

4) **Builder's Risk Insurance** will be provided on “All-Risk” coverage on a replacement cost basis, subject to the limits of the insurance policy. This insurance will include the interests of the Owner the Contractor and all tiers of Subcontractors in the Work. The Builders Risk policy will not provide coverage against loss by theft or disappearance of any materials (unless the materials are to be incorporated into the Project), tools, or equipment of the Contractor or any tier of Subcontractor, or any other person furnishing labor or materials for the Work. The Contractor shall be responsible for a deductible of $25,000 for each and every loss.

**ACCIDENT REPORTING AND CLAIMS PROCEDURES**

When accidents happen, everyone needs to work together. Even though the Contractors and each Subcontractor has instituted tough safety measures, work-related accidents are bound to occur. When they do, the OCIP Insurers stand ready to serve the Contractors and Subcontractors, but they need help if they are to perform this service in the most effective and efficient manner.

Each Contractor/Subcontractor should have the claims procedures and emergency numbers posted on the jobsite and in all vehicles.

The Insurer will have a claims adjuster available to handle all Commercial General Liability and Workers’ Compensation claims.

The Insurer will arrange for legal counsel to handle all lawsuits emanating from the project.

Never discuss any accident or claim with anyone except authorized representatives of MSCAA, Contractor, the Insurer(s), and the Owners Insurance Broker or Law Enforcement agencies.

**MSCAA Emergency Procedures (Serious Injuries)**

1. Contact MSCAA Emergency Dispatch at (901) 922-8333 (DO NOT call 911). Specific directions should be given to the accident scene. If the accident occurred in the SIDA area, give location in relation to an active taxiway/runway. If outside the SIDA, give location relative to a street or construction gate. Explain the extent of injuries.

2. Notify the on-site OCIP Safety Coordinator, Wes Shelby, (901) 604-2136 (cell).

3. Methodist South Hospital Emergency Room, 1300 Wesley Drive, Memphis, TN, will be used (901) 516-3700, the decision on the treating medical facility will be made by the EMT, in serious cases, the Med Trauma Center may be used.

4. Contractors must have currently qualified First Aid personnel on site at all times. First Aid supplies must be readily available and maintained, including rubber gloves to protect First Aid personnel against blood borne pathogens, etc.

5. After the call for emergency unit is made to MSCAA, the contractor should send escorts to all locations where the emergency unit could enter the site.

6. If the injured employee does not speak English, send a good interpreter to the treating medical facility.
7. The Contractor should provide the Medical Facility with a completed Authorization For Treatment form (sample provided in the OCIP Manual).

A. Workers' Compensation Claims

1. Seek immediate medical attention for the injured person(s).

2. Immediately notify your supervisor and project manager of the situation.

3. Notify the on-site OCIP Safety Coordinator, Wes Shelby, (901) 604-2136 (cell). If you cannot reach Wes, please leave a voice mail message.

4. Complete a First Report of Injury form and the Claim Reporting Cover Sheet (include appropriate Location Code) and forward to Zurich Insurance Company via fax 877-967-2567 or email usz_carecenter@zurichna.com immediately. If not possible, then send before the end of the business day.

5. MSCAA the Contractor’s safety representative or designated person will transport the injured worker to

   Concentra Medical Center
   2831 Airways Boulevard
   Suite 102
   Memphis, TN 38132
   Phone: (901) 348-0200
   Hours: 8a.m. to 8p.m. (Mon. – Fri.)

   If accident occurs and Concentra Medical Center is not open:

   Methodist South Hospital
   1300 Wesley Drive
   Memphis, TN 38116
   Phone: (901) 516-3700
   24 Hours, 7 days per week

   Or

   Baptist Memorial Hospital DeSoto
   7601 Southcrest Parkway
   Southaven, MS 38671
   Phone: (662) 349-4000
   24 Hours, 7 days per week

6. Complete the Accident Investigation Form and forward it along with the Claim Reporting Cover Sheet to Wes Shelby, OCIP Safety Coordinator (e-mail: Wes.Shelby@willis.com, fax: (901) 345-6636, or mail: 4225 Airways Blvd., Memphis, TN 38116 before the end of the day.

7. Receipt of Acknowledgement of Claim and claim number from Zurich Insurance Company will be sent to the contact person provided on the Claim Reporting Cover Sheet and to Wes Shelby, OCIP Safety Coordinator. The claim number should be used for future reference.

8. All medical bills, hospital bills, etc. should be forwarded to Zurich Insurance Company identifying the injured employee and claim number.

After Hours / Close of Business Claims Reporting

1. Call Zurich Insurance Company at (800) 987-3373.
2. Tell the Zurich representative that an injury just occurred and that you need to be routed to the on call specialist to authorize treatment.

3. You will either be placed directly in touch with the on-call person or the on-call person will be paged and will return your call within two hours.

4. If hospital needs to speak with Zurich directly, the contractor will have to supply the hospital name and phone number to Zurich and they will call the hospital directly.

B. Commercial General Liability Claims
Any occurrence involving Bodily Injury or Property Damage to members of the public that is NOT caused by an automobile accident.
1. Seek immediate medical attention for any injured person(s).
2. Immediately notify your supervisor and project manager of the situation.
3. Notify the on-site OCIP Safety Coordinator, Wes Shelby, (901) 604-2136 (cell). If you cannot reach, please leave a voice mail message.
4. Complete the Claim Reporting Cover Sheet (include appropriate Location Code) and forward to Zurich Insurance Company via fax (866) 691-7068 or email usz_carecenter@zurichna.com immediately. If not possible, then send before the end of the business day.
5. Complete the Accident Investigation Form and Claim Reporting Cover Sheet (include appropriate Location Code) and forward to Wes Shelby, OCIP Safety Coordinator, (e-mail: wes.shelby@willis.com, fax: (901) 345-6636, or mail: 4225 Airways Blvd., Memphis, TN 38116.
6. Receipt of Acknowledgement of Claim and claim number from Zurich Insurance Company will be sent to the contact person provided on the Claim Reporting Cover Sheet and to Wes Shelby, OCIP Safety Coordinator. The claim number should be used for future reference.
7. All investigation reports, pictures, medical bills, hospital bills, etc should be forwarded to Zurich Insurance Company identifying the injured individual, claimant and claim number.

C. Duties in the event of a claim or suit
1. Follow the claims reporting procedures above.
2. You must see to it that the OCIP Safety Coordinator, Wes Shelby, is notified promptly of an “occurrence” which may result in a claim. Notice should include:
   a. How, when and where the “occurrence” took place, and;
   b. The names and addresses of any injured persons and witnesses.
3. If a claim is made or “lawsuit” is brought against any insured, you provide written notice of the claim or “lawsuit”.
4. You and any other involved insured must:
   a. Cooperate with the Insurer in their investigation, settlement or defense of the claims or “suit”; and
   b. Assist the Insurer, upon their request, in the enforcement of any right against any person or organization which may be liable to the insured because of injury or damage to which this insurance may also apply.
5. No Insureds will, except at their own cost, voluntarily make a payment, assume any obligation or incur any expense, other than for first aid, without Insurer’s consent.
D. Automobile Claims
Even though no Automobile Liability or Physical Damage coverage is provided under the OCIP, the Contractor/Subcontractor must notify Wes Shelby, OCIP Safety Coordinator, in writing of any automobile accident which could be related to the project. This should be done as soon as possible following the accident.

E. Contractor’s Equipment Claims
Even though no coverage is provided under the OCIP for loss of or damage to Contractor’s or Subcontractor’s owned equipment the Contractor/Subcontractors must notify Wes Shelby, OCIP Safety Coordinator, in writing, of any loss or damage to their equipment at the project. This should be done as soon as possible, following first knowledge of loss or damage.

F. Miscellaneous Claims Notes
1. Any incident that involved injury to persons or property is to be reported to Wes Shelby, OCIP Safety Coordinator’s office immediately.

2. Any claims adjuster representing a Contractor/Subcontractor’s normal insurer who seeks to come onto Any Designated Project site must obtain written authorization from Wes Shelby, OCIP Safety Coordinator, prior to coming on the site. There will be no exceptions to this stipulation.
FORMS

Zurich Claim Reporting Cover Sheet

Incident Investigation Report

Workers’ Compensation Referral Slip for Injured Employees

Authorization to Treat

Form 1 – Notice of Sub-contract Award

Form 2 – Enrollment Form

Form 4 – Notice of Anticipated Completion

Form 5 – Project Site Payroll Reporting

Certificate of Insurance
ZURICH CLAIM REPORTING COVER SHEET

Email to: USZ_CARECENTER@ZURICHNA.COM

OR

Fax to: (866) 691-7068

Account Name: Memphis Shelby County Airport OCIP III

Master WC policy #: WC 9409456-00
Master GL Policy #: GLO 9409457-00

Project Location:__________________________________________________________

Subcontractor/Employer:____________________________________________________

Subcontractor/Employer Policy Number:_______________________________________

Contact Name:_____________________________________________________________

Contact Phone Number:_______________________________________________________

Contact Fax Number: ________________________________________________________

Location Code:_____________________________________________________________

Injured Worker:________________________________________________________________

Attention Zurich Representative – Please fax the receipt and claim number immediately to the contact above.
### Incident Investigation Report

(To be completed within 24 hours by Supervisor at time of incident)

#### INJURED EMPLOYEE INFORMATION

<table>
<thead>
<tr>
<th>Employee Name</th>
<th>Male</th>
<th>Female</th>
<th>Date of Birth</th>
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<th>Wt.</th>
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<tbody>
<tr>
<td>Staff Name</td>
<td></td>
<td></td>
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</table>

**Employee Address**

- Street
- City
- State
- Zip Code
- Home Phone

<table>
<thead>
<tr>
<th>Employer Name</th>
<th>Address</th>
<th>Date of Incident</th>
<th>Time</th>
<th>AM/PM</th>
<th>Jobsite/Area</th>
<th>Employee Job Title</th>
<th>Length of Employment</th>
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</thead>
<tbody>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

**Weather Condition**

- Shift
- Supervisor

#### UNSAFE ACTS

<table>
<thead>
<tr>
<th>What actions caused or contributed to the incident?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating equipment without authority</td>
</tr>
<tr>
<td>Failure to warn/signal</td>
</tr>
<tr>
<td>Failure to secure/lock out/tag out</td>
</tr>
<tr>
<td>Reaching into/servicing equipment in operation</td>
</tr>
<tr>
<td>Making safety devices inoperable</td>
</tr>
<tr>
<td>Used defective equipment</td>
</tr>
<tr>
<td>Took unsafe/improper position</td>
</tr>
<tr>
<td>Horseplay, disruptive actions</td>
</tr>
<tr>
<td>Improper lifting or movement</td>
</tr>
<tr>
<td>Other: _________________________________</td>
</tr>
<tr>
<td>No unsafe action</td>
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</table>

#### UNSAFE CONDITIONS

<table>
<thead>
<tr>
<th>What conditions of tools, equipment, or environment contributed to incident?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate guard/barrier/safety device</td>
</tr>
<tr>
<td>Inadequate/improper protective equipment</td>
</tr>
<tr>
<td>Inadequate warning system</td>
</tr>
<tr>
<td>Defective or work tools/equipment materials</td>
</tr>
<tr>
<td>Congestion or restricted area</td>
</tr>
<tr>
<td>Fire or explosion hazard</td>
</tr>
<tr>
<td>Hazardous storage method</td>
</tr>
<tr>
<td>Unsecured against movement</td>
</tr>
<tr>
<td>Lighting/noise/visual obstruction</td>
</tr>
<tr>
<td>Environmental/atmospheric conditions</td>
</tr>
<tr>
<td>Other:</td>
</tr>
<tr>
<td>No unsafe condition</td>
</tr>
</tbody>
</table>

#### INJURY/ILLNESS DATA

- Describe the nature and extent of injury/illness (body part affected, type of injury, etc.)

#### INJURY/ILLNESS EVALUATION

- How did the incident occur? Describe in detail the task the employee was doing when injured or became ill. Include specifics such as equipment, structure tools, materials, objects (size, shape, and weight), people involved in the task, positions, distances, rate of movement, sequence of events, etc.

#### OTHER:

- Unknown

---

Contract: Contractor Name
Airfield Maintenance Temporary Facility - Construction
MSCAA Project No. 14-1379-10-01
Incident Investigation Report

Incident/Illness Evaluation (continued)

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<thead>
<tr>
<th>Type of exertion/body motion during injury:</th>
<th>Pull</th>
<th>Lift</th>
<th>Bend</th>
<th>Reach</th>
<th>Twist</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was this the employee’s regular job?</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much experience does this employee have on this job?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was the employee trained in this job or task?</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>When was last training on this task?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was this the employee’s first job-related injury or illness?</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If no, briefly describe previous injuries (date, nature, extent, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hours of overtime worked in last 24 hours</th>
<th>Did this possibly contribute to incident?</th>
<th>If so, describe</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Does a safety rule or policy apply to this task?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>If yes, describe rule and how employee followed or violated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Does a specific procedure for task exist?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>If yes, describe procedure briefly and if it was followed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Is protective equipment required for this task?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>If yes, describe equipment, if it was used, if it was adequate/functioned properly, and if the employee(s) were trained on it.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Is there possibly any third party which contributed to the incident? (Other contractors, employee, etc.)</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>If yes, describe.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Did any unsafe physical/environmental conditions exist?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>If yes, describe conditions (physical, mechanical, electrical, etc.) which contributed to the incident</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Is material handling equipment required for this task?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>If yes, was it used and did it function properly?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Possible actions to be taken to prevent reoccurrence

- [ ] Reinstatement of employee(s) involved
- [ ] Preventative instruction of others who do job
- [ ] Training of employee(s)
- [ ] Action to improve enforcement
- [ ] Reprimand/discipline of employee(s) involved

- [ ] Do/revise Job Safety Analysis
- [ ] Revise/establish safety rule
- [ ] Reassign employee to another job
- [ ] Require/replace protective equipment
- [ ] Install safety guard device

- [ ] Repair/replace/modify equipment
- [ ] Improve clean-up procedure
- [ ] Improve inspection procedure
- [ ] Eliminate/reduce congestion
- [ ] Improve design/construction
- [ ] Improve environmental conditions

CORRECTIVE ACTION(S) TAKEN OR PLANNED

<table>
<thead>
<tr>
<th>What was/will be done</th>
<th>By Whom</th>
<th>Estimated Completion Date</th>
<th>Completion Confirmed Date</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incident discussed with employee to prevent reoccurrence?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>If yes, describe what type.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Any disciplinary action taken?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>If yes, describe</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FOLLOW UP COMMUNICATION

- [ ] YES | NO | Incident site reviewed by supervisor with employee (and safety coordinator if applicable.)
- [ ] YES | NO | Incident review meeting conducted. Attended by
- [ ] YES | NO | Employee or supervisor reviewed incident with work group.
- [ ] YES | NO | Employee reviewed injury with safety committee
- [ ] YES | NO | Project Safety informed of incident

Date of Report ___________________________ Prepared by ___________________________ Title ___________________________ Signature ___________________________
ON-SITE EMT: (901) 922-8333

Authorized Clinic: Concentra Medical Center
2831 Airways Boulevard
Suite 102
Memphis, TN 38132
(901) 348-0200 (Phone)
(901) 348-0046 (Fax)

Clinic Hours: 8 a.m. to 8 p.m. (Mon. – Fri.)

Authorized After-Hours Clinics: Methodist South Hospital
1300 Wesley Drive
Memphis, TN 38116
(901) 516-3700

Baptist Memorial Hospital DeSoto
7601 Southcrest Parkway
Southaven, MS 38671
(662) 349-4000

Employee Name: ____________________________
Date: _________________________________

Employer: _______________________________
Employer Policy Number: ________
_____________________________________

Location Code (if known): __________________ Claim Number (if known): ________
_____________________________________

Account Name: Memphis Shelby County Airport Authority OCIP III
Insurer: Zurich
Master Policy Number: WC 9409456-00

Instructions for medical facility:
The person listed above has been injured on the job. Please provide the employee with medical treatment per OCIP protocol.
MSCAA OCIP III
Authorization to Treat

Local Office Information
Company Name:

Designated Representative:

Address:

Phone: ___________ Fax: ___________ E-mail: ___________

Billing Information for Drug Screens

Company Name: Zurich North America
Address: PO Box 968077
Schaumberg, IL 60196-8077
Phone: (800) 366-8366    Fax: (615) 872-1303

Insurance Information for Work Comp Carrier

Company Name: Zurich American Insurance Company
Master Policy Number: 9409456-00
Address: PO Box 968077
Schaumberg, IL 60196-8077
Phone: (877) 928-4531    Fax: (866) 691-7068

Services Required

Worker’s Comp Injuries

Drug Screen Required For (employer to check necessary testing):

___ Pre-Employment    ___ Random
___ Probable Cause    ___ Post Accident
___ Urine (collection only)    ___ Breath Alcohol
___ Test Cup (Cocaine, PCP, etc.)

Treating Medical Center: Please be advised if negative, DO NOT send out. Be sure to mark on the Chain of Custody (COC) the information for the employer:

Employer: ___________________________ Fax:

Special Instructions: Use TEST CUP. Do NOT send out unless the test reads positive.
Fax results to designated employer listed above.

__________________________________________  __________________________
Company Authorized Signature:               Date:

MSCAA OCIP III
Notice of Subcontract Award and Request For Insurance

Willis Towers Watson National Project Insurance Practice
Rebecca Trejo                                          Phone:    (972) 715-6219
15305 North Dallas Parkway, Suite 1100            Fax:      (972) 386-5561
Addison, TX 75001                                e-mail:  rebecca.trejo@willistowerswatson.com
                                                  Cc: becky.hubert@willistowerswatson.com

RE: Project Name: ____________________________________________

This is to inform you that we have awarded the following subcontract to the following Subcontractor:

Name of Firm: ____________________________________________
Address: ___________________________ City: _________ State: _____ Zip: _________
Phone: (_____)________________________ Fax: (_____)________________________
Office Contact: ___________________________ E-Mail: ___________________________
Type of Work: ___________________________ Job #: ______________
Contract Value: $_________________________________________
Award Date: ______________ Estimated Start Date: _______________
Awarding Contractor: ______________________________________
By: ________________________________________________
Title: ________________________________________________
Date: ________________________________________________
Prime Contractor (if different) ______________________________

DO NOT complete this form for your own company.
A Form-1 should be completed on each of your Subcontractors.
• Award Date – date Notice to Proceed was given (Verbally or in Writing)
• Start date is mandatory – date shown will be the effective date of coverage.

Any Contractors or Subcontractors who enroll in the OCIP 30 days after their start date will have to provide a No Known Loss Letter to the Carrier along with the enrollment documentation.

MSCAA OCIP III ENROLLMENT FORM

CONTRACTOR’S INFORMATION
Contractor: _______________ Indv _____ Ptshp _____ Corp _____ J/V _______
Address: ___________________ FEIN: ___________________
Office Contact: _______________ Phone: _______________ Fax: _______________ Email: _______________
Site Contact: _______________ Phone: _______________ Fax: _______________ Email: _______________
Safety Contact: _______________ Phone: _______________ Fax: _______________ Email: _______________
Insurance Contact: _______________ Phone: _______________ Fax: _______________ Email: _______________
Payroll Contact: _______________ Phone: _______________ Fax: _______________ Email: _______________
Address (if different): ___________________

CONTRACT INFORMATION
Contract Value: $ ___________________
Job Name/Description: ___________________
Awarding Contractors: ___________________ Prime Contractors: ___________________
Award Date: _______________ Start Date: _______________ Est Completion Date: _______________ Self Performed %, $ _______________
Subcontracted %; $ _______________ Est. # of Subcontractors _______________ Est. Man hours _______________ DBE/MBE/WBE: _______________

CURRENT INSURANCE INFORMATION:
Contractors’ Insurance Broker or Agent: PLEASE PRINT
Company Name: ___________________
Contact: ___________________
City/State/Zip: ___________________
Phone: (_______) _______________

WORKERS’ COMPENSATION
Current Experience Modifier: _____ (Provide documentation confirming)

<table>
<thead>
<tr>
<th>W.C. Classification</th>
<th>W.C. Class Codes</th>
<th>Estimated Payroll</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
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<tr>
<td>2.</td>
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<tr>
<td>3.</td>
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<tr>
<td>4.</td>
<td></td>
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</tr>
</tbody>
</table>

It is each Contractor's responsibility to notify its own insurance carrier to exclude all work to be done under this contract from your current insurance program. Any Contractors or Subcontractors who enroll in the OCIP 30 days after their start date will have to provide a No Known Loss Letter to the Carrier along with the enrollment documentation.

Contractor warrants that the insurance costs for coverages provided by the Owner, have been removed from the bid. The OWNER, or their Agent, is granted permission by Contractors to inspect the insurance and payroll records. At completion of the Work, Owner’s Agent shall have the right to audit the project payroll records of Contractors. Any and all returns of premiums, dividends, discounts or other adjustments to any OCIP policy is assigned, transferred
and set over absolutely to OWNER. This assignment is valid for insurance policies whose premiums have been paid by
the OWNER on behalf of such Contractors.

Signed ____________________________ Title __________________________ Date __________

Send this Form to:

Willis Towers Watson National Project Insurance Practice
Rebecca Trejo
15305 North Dallas Parkway, Suite 1100
Addison, TX 75001

Phone: (972) 715-6219
Fax: (972) 386-5561
E-Mail: rebecca.trejo@willistowerswatson.com
cc: becky.hubert@willistowerswatson.com
MSCAA OCIP III

NOTICE OF ANTICIPATED COMPLETION
(to be submitted with Final Pay Request)

Willis Towers Watson National Project Insurance Practice  Phone:    (972) 715-6219
Rebecca Trejo  Fax:      (972) 386-5561
15305 North Dallas Parkway, Suite 1100  E-Mail:  rebecca.trejo@willistowerswatson.com
Addison, TX 75001  cc:  becky.hubert@willistowerswatson.com

Please be advised, we, _____________________________________________________ are scheduled to complete our work for:

Awarding Contractor:_____________________________ Prime Contractor:_____________________________
Project Description:__________________________ Actual Start Date:___________ Completion Date: ___________
Reported Contract Value:______________________________ Final Contract Value: _________________________
Self Performed Work:_________________________________ Subcontracted Work: _________________________
Estimated WC On Site Payroll: ________________________________ Final WC On Site Payroll:  ______________

We used the following enrolled subcontractors, who will also complete their work on the date shown above:

<table>
<thead>
<tr>
<th>Subcontractors</th>
<th>Reported Contract Value</th>
<th>Final Contract Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

This is our contract:   YES ☐  NO ☐

We are still working on the following contracts:

<table>
<thead>
<tr>
<th>Location Code</th>
<th>Awarding Contractor</th>
<th>Prime Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

Your Company's Name: _______________________________ Date: __________________
By: _______________________________ Title _______________________________

Final insurance audits may be made under the applicable policies. Please show who in your office (or another location if applicable) is responsible for this information:

Name: _______________________________ Phone: ____________ Fax: _____________ E-Mail: ________________
Address: _______________________________ City: _________________ State: ______ Zip __________
MSCAA OCIP III

PROJECT SITE PAYROLL REPORTING FORM

Contractor: ____________________________ City: ______________________ State: __________
Address: _______________________________ Phone: __________________________ Fax: _________
Zip: _______________ Awarding Contractor: ____________________________ Construction Manager: ____________

Please indicate Project Site payroll and forward with pay requests. Please retain a copy for your files.

If this is your first payroll report, when did you start on site? ______________
Is this your final payroll report for this contract? ____________________________
LOCATION CODE (For this Contract): ______________ MONTH ENDING: ____________________

<table>
<thead>
<tr>
<th>WC Classification Description</th>
<th>Man hours</th>
<th>WC Code</th>
<th>Actual Payroll</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
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<tr>
<td>2.</td>
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<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Monthly Receipts (Amount on Monthly Pay Application) $

- It is extremely important to accurately estimate payrolls anticipated for this contract. Payroll should be raw wages without burden, overtime wages or fringes; but should include sick, vacation, holiday pay, and imputed income. Payroll for overtime should be included only at straight time hourly rates.

- Overtime means those hours in excess of 8 hours worked each day, 40 hours in any week or on Saturdays, Sundays, or holidays, when there is an increase in the hourly rate to work such hours. Overtime hours should be added to straight time hours.

- Tennessee State rules for Workers’ Compensation will apply.

- If no work is performed at the Project Site during the required reporting period, a report must still be submitted showing “Zero Payroll”.

The above is a true and complete statement of the entire remuneration of services rendered by employees of the company shown above.

Signature: ____________________________ Title: ____________________________ Date ____________

By the 20th of the Month Send this form to:

Willis Towers Watson National Project Insurance Practice
Rebecca Trejo
15305 North Dallas Parkway, Suite 1100
Addison, TX 75001

Phone: (972) 715-6219
Fax: (972) 386-5561
E-Mail: rebecca.trejo@willistowerswatson.com
cc: becky.hubert@willistowerswatson.com
CERTIFICATE OF LIABILITY INSURANCE

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFER NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
Agent Company Name
Address
City, State ZIP
Attn:

CONTACT
NAME:
PHONE
(A/C, No. Ext):
FAX
(A/C, No):
E-MAIL
ADDRESS:

INSURER(S) AFFORDING COVERAGE
NAIC#

INSURED
OCIP Enrolled Contractor

INSURER A : AM BEST Rating A- VII or better
INSURER B :
INSURER C :
INSURER D :
INSURER E :
INSURER F:

COVERAGES:

COVERAGE NUMBER: 
REVOLUTION NUMBER:

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

<table>
<thead>
<tr>
<th>INSR LTR</th>
<th>TYPE OF INSURANCE</th>
<th>ADDL INSR</th>
<th>SUBR WVD</th>
<th>POLICY NUMBER</th>
<th>POLICY EFF (MM/DD/YYYY)</th>
<th>POLICY EXP (MM/DD/YYYY)</th>
<th>LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GENERAL LIABILITY</td>
<td>CLAIMS-MADE</td>
<td>OCCUR</td>
<td></td>
<td></td>
<td></td>
<td>EACH OCCURRENCE $1,000,000</td>
</tr>
<tr>
<td></td>
<td>COMMERICAL GENERAL LIABILITY</td>
<td>CLAIMS-MADE</td>
<td>OCCUR</td>
<td></td>
<td></td>
<td></td>
<td>DAMAGES TO RENTED PREMISES (Ea occurrence) $</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MED EXP (Any one person) $</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>PERSONAL &amp; ADV INJURY $1,000,000</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>GENERAL AGGREGATE $2,000,000</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>PRODUCTS-COMP/OPT AGG $2,000,000</td>
</tr>
<tr>
<td></td>
<td>AUTOMOBILE LIABILITY</td>
<td>ANY AUTO</td>
<td>COMBINED SINGLE LIMIT (Ea accident) $1,000,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ANY AUTO</td>
<td>ALL OWNED AUTOS</td>
<td>BODILY INJURY (Per person) $</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hired AUTOS</td>
<td>SCHEDULED AUTOS</td>
<td>BODILY INJURY (Per accident) $</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NON-OWNED AUTOS</td>
<td>PROPERTY DAMAGE (Per accident) $</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>UMBRELLA LIABILITY</td>
<td>OCCUR</td>
<td>EXCESS LIABILITY</td>
<td>CLAIMS-MADE</td>
<td>EACH OCCURRENCE $1,000,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

Workers’ Compensation and Commercial General Liability coverages shown above do not apply to any Designated Project at the Memphis International Airport. The Memphis-Shelby County Airport Authority, its officers, commissioners, representatives, agents and employees ATIMA and [AWARDING CONTRACTOR] are additional insureds applicable to the Auto Liability Insurance and off-site Commercial General Liability insurance policies.

CERTIFICATE HOLDER

MSCAA OCIP
C/o Willis Towers Watson National Project Insurance Practice.
Attn: Rebecca Trejo

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.
END OF EXHIBIT C
EXHIBIT D
TO
LUMP SUM CONSTRUCTION CONTRACT
FOR
AIRFIELD MAINTENANCE TEMPORARY FACILITY - CONSTRUCTION
BY AND BETWEEN
THE MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY
AND
(CONTRACTOR NAME)

OCIP CONSTRUCTION SAFETY AND HEALTH GUIDELINES

Memphis-Shelby County Airport Authority

Construction Safety and Health Guidelines

<table>
<thead>
<tr>
<th>Revision</th>
<th>Revision Summary</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Updated Safety Manual for OCIP III</td>
<td>11/30/2012</td>
</tr>
<tr>
<td>2</td>
<td>Accommodate change in policy end dates to 10/25/2018. Update Team Members</td>
<td>05/02/2016</td>
</tr>
</tbody>
</table>
Confirmation of these Project Safety & Health Guidelines

It is the responsibility of the Contractor to maintain total control of safety to ensure that employees and the general public are provided with an environment free of hazards during construction and renovation activities. This program does not relieve the Contractor of their responsibilities regarding the safety of their employees, the employees of their Subcontractors and sub-subcontractors, protection of the general public and the preservation of property.

Contractors shall develop their own written site-specific safety and health plans for the Memphis-Shelby County Airport Authority. At minimum, the safety and health plan shall meet the requirements of 29CFR1926 – Federal OSHA Construction regulations and the requirements established in the Memphis-Shelby County Airport Authority Construction Safety Guidelines. In short, as required by law, each Contractor is responsible for protecting the health and safety of its employees and the employees of each subcontractor and sub-subcontractor while ensuring they have a safe and healthful place to work. The site-specific safety and health program shall be submitted for approval within fifteen (15) days after the Notice to Proceed for approval to the Project Safety Manager, Wes Shelby, 4225 Airways Blvd., Memphis, TN.

The Safety Requirements of these safety guidelines are a supplementary document to all Government rules, codes and regulations. It does not negate, abrogate, alter or otherwise change any provisions of these rules, codes and/or regulations, and is intended to supplement and enforce the individual program of each contractor and the overall safety effort. It is understood that the ultimate responsibility for providing a safe place to work rests with each individual Contractor.

In the event of a conflict between the provisions of these guidelines and applicable local, State or Federal safety and health laws, regulations and/or standards, contract documents or the Contractor's Safety Plan the more stringent shall apply.

By Signature, each individual confirms their understanding of the contents of this manual and shall conform to the standards of safety outlined in this manual.

______________________________     ________________________________
Contractor – Project Manager   Contractor – Field Supervisor

______________________________     ________________________________
Date       Date
POLICY STATEMENT .......................................................................................................................... 70
Definitions ........................................................................................................................................ 70
PREFAE ................................................................................................................................................. 71
INTRODUCTION ................................................................................................................................... 73
Construction Safety and Health Guidelines, Purpose and Scope .............................................................. 73
RESPONSIBILITIES ............................................................................................................................ 73
General .................................................................................................................................................. 73
Contractors .......................................................................................................................................... 73
Workplace Substance Abuse Policy ........................................................................................................ 74
INSTRUCTION AND TRAINING .......................................................................................................... 75
Safety Orientation Program .................................................................................................................. 75
PROTECTION OF THE PUBLIC ............................................................................................................. 75
Group Tours and Site Visitors ................................................................................................................ 75
Harassment-Free Work Policy .............................................................................................................. 76
Employee Harassment .......................................................................................................................... 76
Sexual Harassment ............................................................................................................................... 76
Reporting of Harassment ....................................................................................................................... 76
REPORTING, ACCIDENT INVESTIGATION, AND RECORDKEEPING ................................................... 77
Reporting .............................................................................................................................................. 77
Record-Keeping and Files .................................................................................................................... 77
Accident Investigation .......................................................................................................................... 77
Return-To-Work .................................................................................................................................. 78
WORK PRACTICE CONTROL .............................................................................................................. 78
Overview ............................................................................................................................................ 78
Hazard Communication Program ......................................................................................................... 78
Record-Keeping and Files .................................................................................................................... 79
Job Safety Analysis (JSA) ...................................................................................................................... 80
SPECIFIC PROJECT SAFETY REQUIREMENTS .................................................................................. 80
Controls for possible conflicts between construction operations and aircraft ...................................... 80
Scaffolds, Stair Towers and Work Platforms .......................................................................................... 81
Tagging .................................................................................................................................................. 81
Walking and Working Surfaces ........................................................................................................... 81
Barrier Identification Tape ................................................................................................................... 81
Fall Protection ...................................................................................................................................... 81
Confined Space Entry .......................................................................................................................... 82
Employee Ground Transportation ....................................................................................................... 82
Housekeeping - MUST BE A CONTINUING PROCESS .................................................................. 83
Project Electrical Requirements .......................................................................................................... 84
Crane and Hoisting Equipment ............................................................................................................ 84
Rigging .................................................................................................................................................. 85
Excavation (Any process which disturbs soil) ....................................................................................... 85
Earthmoving Equipment and Trucks ................................................................................................. 86
Welding & Cutting .............................................................................................................................. 86
Personal Protective Equipment ............................................................................................................ 87
Eye and Face Protection ...................................................................................................................... 87
Head Protection .................................................................................................................................. 87
Hearing Protection ............................................................................................................................... 87
Respiratory Protection .......................................................................................................................... 87
Foot Protection ..................................................................................................................................... 87
Clothing .............................................................................................................................................. 87
Appendix A - Safety Orientation ....................................................................................................... 88
Appendix B - Employee Disciplinary Guideline .................................................................................... 90
Appendix C - Critical Lift Checklist .................................................................................................... 91
Appendix D - Substance Abuse ............................................................................................................ 92
Appendix E - Supervisor's Report of Bodily Injury ............................................................................... 96
Appendix F - Report of Damage to Equipment or Property .................................................................. 97
POLICY STATEMENT

Memphis-Shelby County Airport Authority is committed that all construction workers have the best possible working environment while working on this project. It shall be the responsibility of each Contractor/Subcontractor to abide by the Safety and Health Provisions listed in OSHA 29 CFR 1926.

In addition, each Contractor, Subcontractor and Sub-Subcontractor shall abide by Memphis-Shelby County Airport Authority Construction Safety Guidelines, Federal Regulations, State laws and regulations, local and county laws and regulations which are applicable.

The primary goal established for the Memphis-Shelby County Airport Authority is to safely perform work with “ZERO ACCIDENTS”; totally free from lost time injuries for the mutual benefit of the worker, environment, and community.

The safety goals and objectives established for the Project can only be achieved when everyone commits to perform their tasks safely and efficiently. This commitment to achieve these goals will result in both increased productivity and the PREVENTION of job related injuries and illnesses. This will be considered as safe construction.

Definitions

OCIP Team – Means the Owner Memphis-Shelby County Airport Authority, Willis Towers Watson and all applicable insurance carrier representatives or the representative of defined such agencies and firms working together to implement the OCIP insurance program.

Construction Managers – Means the Management Group or General Contractor that has direct contract with the Owner Memphis-Shelby County Airport Authority to provide the overall control of the construction at the project.

General Contractor – Means the Contractor that has direct contract with the owner or Construction Managers as bid for the project. The General Contractor is also the controlling contractor on the construction site when a Construction Manager is not present.

Subcontractor – Means the contractor and or contractors that carry contracts with the General Contractor or Construction Managers. Subcontractors bid portions of the scope of work to be completed.

Sub-Subcontractors – Means any subcontractors of a subcontractors working or contracted to do work on the project.

Critical Lift – A lift that exceeds 75% of the rated capacity of the crane or requires the use of more than one crane. Also, relates to the installation of equipment and or materials that are critical to the completion of the project and damage to such equipment and/or material could result in delays to the project.

The General Public – Is defined as all persons not employed by or under contract, subcontract or sub-subcontract to the Memphis-Shelby County Airport Authority.
PREFACE

From the inception of Memphis-Shelby County Airport Authority there has been a determination and commitment to provide a safe environment for all workers and for the public from hazards associated with the construction of the Project.

All Contractors shall implement measures that will create safety awareness, promote safe work practices at the job site and pursue the contract objectives in the safest possible manner. Each Contractor shall bear sole and exclusive responsibility for safety in all phases of their work. Nothing contained herein shall relieve such responsibility.

Each Contractor shall be responsible for all its subcontractor’s and sub-subcontractor’s compliance with the project safety requirements.

Contractors shall develop their own written site-specific safety and health plan for the MSCAA OCIP. At minimum, the safety and health plan shall conform to the requirements addressed in the Occupational Safety and Health Act of 1970 and all additions and revisions thereto, and the requirements established in the Memphis-Shelby County Airport Authority Construction Safety Guidelines. In short, as required by law, each Contractor is responsible for protecting the health and safety of its employees while ensuring they have a safe and healthful place to work.

Contractor developed plans/program(s).
Programs will be reviewed and approved by OCIP Team. Example(s) of such OSHA mandated plans/programs are shown below.

<table>
<thead>
<tr>
<th>Plan/Program</th>
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<tbody>
<tr>
<td>Site Traffic Control Plan</td>
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<tr>
<td>Fire Protection Plan</td>
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<td>Respiratory Protection Plan</td>
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<tr>
<td>Confined Space Entry</td>
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<td>Hearing Conservation Program</td>
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<td>Dust Control Plan</td>
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<td>Fall Protection Plan</td>
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<td>Trench Safety Plan</td>
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<td>Hazard Communication Program</td>
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<td>Scaffold Safety Program</td>
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<td>Ladder Safety Training</td>
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Emergency Procedures shall be made part of the Contractor’s Safety Program. The following provisions shall be included in the emergency plan:

a. Highest ranking supervisor automatically becomes responsible for the handling any emergency that occurs during his working hours; they may call upon the assistance of any available worker. A responsible supervisor must be designated for each shift.

b. On a regular basis, at both supervisory and “weekly tool box meetings” instruct and update all employees in any course of action for emergencies.

c. Establish teams to handle each of the various emergencies.

d. Following an emergency, ranking personnel shall secure the area as expediently as possible and provide access and an account of the emergency to authorized representative(s) of MSCAA. Questions from the media should be referred to MSCAA.

Emergency procedures that may occur during any 24 hour period in the following categories must be established by each contractor:

a. Fire
b. Employee injury
c. Pedestrian injury due to work activity of any kind
d. Property damage and damage to above ground and buried utilities
e. Public demonstrations
f. Bomb threats

On a regular basis, the Contractor shall review and, when necessary, update Emergency Procedures for maximum effectiveness. The contractor should provide MSCAA, the Construction manager, and the on site safety rep a telephone list of key management personnel, for after hours emergency contact.

Should a serious accident or emergency occur, the contractor shall contact the Construction Manager immediately. If an emergency requires the presence of an ambulance or the Fire Department, including nights, weekends and holidays, the contractor shall call MSCAA emergency dispatch at (901)922-8333. Non injury accidents need to be
Contract:   Contractor Name  
Airfield Maintenance Temporary Facility - Construction  
MSCAA Project No. 14-1379-10-01  

reported to the airport police at (901)922-8298. DO NOT USE 911.

Site Access

1. Use only designated haul routes/crossings.  
2. Stay in assigned work area as identified on plans and as defined by fences and barricades. Barricades/fences must not be crossed.  
3. Instructions from guards and escort personnel must be obeyed.

Contractors, Subcontractors, and Sub-Subcontractors will be monitored for implementation and application of their respective safety programs at the work site. Members of the OCIP Team shall have the authority to stop work when either site conditions and/or work practices present an imminent danger until those conditions and/or practices are corrected. Contractors will be notified of any non-compliance and corrective action required. This notice, when delivered to the contractor or their representative at the site of the work, shall be deemed sufficient notice of non-compliance and corrective action required. After receiving the notice, the contractor shall immediately take corrective action. If the contractor fails or refuses to take corrective action promptly, a stop work order may be issued. The cost to bring the work activity into compliance shall be incurred by the Contractor, Subcontractor or Sub-subcontractor. The Contractor, Subcontractor or Sub-Subcontractor shall not submit a request for extension of time or increased costs as a result of any such stop work order. Members of the OCIP Team shall not be liable for any damages experienced by the Contractor due to the work stoppage. Progress payments may also cease until the Contractor and/or its Subcontractor and Sub-Subcontractors is in full compliance with all applicable safety and health rules, standards and regulations.

Each Contractor and their subcontractors and sub-subcontractors shall establish and enforce an effective disciplinary program (Appendix B). Contractors shall discipline and/or dismiss employees who violate established rules and regulations. This includes immediate termination for serious violations, repeated violations, or the refusal to follow safety and health rules.

OCIP Team members shall have the authority to effectively remove from the site, any person (employees including supervisors and management of any contractor) who is regarded as a frequent violator of safe work practices, or who fails to ensure persons working under their supervision or in a work place they control are not exposed to serious work hazards. Any Competent Person assigned to identify existing and predictable hazards and authorized to eliminate them, which fails to perform this duty for any reason shall be replaced by the employer.

The Contractor shall not receive additional payment or reimbursement for safety items and procedures which have been identified as required by the Project Safety and Health Guidelines.

Failure to comply with the contract safety requirements will be considered as non-compliance with the contract and may result in remedial action including withholding of progress payments due the Contractor and/or termination of the Contractor from the site.

In the event the work or any portion thereof is shut down by either an outside agency or because of an unsafe condition as determined by the OCIP Team, the responsible Contractor shall bear the total cost caused by that shut down.

In no case shall the Contractor be relieved of overall responsibility for compliance with the requirements of federal, state and local safety and health laws for all work to be performed under the contract.

For any construction equipment working near operating right of way and in aircraft safety areas that could encroach into MSCAA’s operating right of way and air craft safety areas shall submit to MSCAA (and obtain approval from the MSCAA) a plan describing the use of such equipment, and the necessary precautions to be taken to preclude any accidental encroachment unto the right of way or aircraft safety area.
INTRODUCTION

Construction Safety and Health Guidelines, Purpose and Scope

These guidelines are established to aid in the prevention of job-related accidents and health problems during the construction of the Memphis-Shelby County Airport Authority. These guidelines set forth elements which all Contractors, subcontractors and sub-subcontractors shall include in their safety plan. This manual is not all-inclusive. Other elements may be added, or conveyed individually to Contractors to whom they expressly apply. There are other essentials which some Contractors, by nature of the specific type of work being performed, must integrate within their own safety plan.

These guidelines set forth basic rules and regulations for all personnel involved in the construction of the Project. The intent of these guidelines is to enhance and supplement the safety and health standards which are required by law, in contract documents, and are applicable to the construction projects for which it is applied. These guidelines do not cover the full spectrum of published safety and health standards mandated by law, and Contractors shall not assume that they are responsible only for those which are referenced in this manual, nor that they are current and quoted as published. It is the responsibility of the Contractor and its employees to ensure that they are in compliance and their safety plan is in compliance with all safety directives required by law.

In the event of a conflict between the provisions of these guidelines and applicable local, State or Federal safety and health laws, regulations and/or standards, contract documents or the Contractor's Safety Plan the more stringent shall apply.

RESPONSIBILITIES

General

Each participant involved in the construction of the Project is individually responsible for conducting their activities to ensure compliance with all applicable safety and health requirements. Construction activities of the Contractor and their Subcontractors and sub-subcontractors will be monitored for compliance with FAA, MSCAA, Federal, State, County, and local safety and health regulations and contract safety and health requirements.

Contractors

The Contractor shall be responsible for the safety and health of employees, subcontractors, sub-subcontractors, visitors, and vendors in accordance with State, Local and Federal regulations, and the Contract Documents. Each Contractor shall establish and submit for review a written Safety and Health Plan which includes details commensurate with the work to be performed. The Contractor’s Safety and Health Plan shall clearly describe the contractor’s commitments for meeting its obligations to provide a safe and healthful work environment for its employees and subcontractor employees, to protect vendors, visitors, and members of the general public. The Contractor's Safety and Health Plan shall reference Federal OSHA standards, and any other rules or regulations applicable to construction activities.

Each Contractor shall designate an on-site Safety Representative who is charged with the responsibility of on-site safety management. The Safety Representative’s sole duty shall be safety management and shall not have other collateral duties. At minimum the safety representative shall meet the requirements of a “competent person” as defined by OSHA for all phases of construction and have a minimum of three (3) years construction safety experience. A resume shall be provided that outlines such items as: work experience, education, training completed and professional organizations, etc. The safety representative shall remain on the Project until contract acceptance (full-term of contract). Safety representative must be knowledgeable on SC-230, SC-240, and other safety requirements as outlined in GP-200, the safety plan and site safety manual. The safety representative shall be interview by the OCIP Team.

As a condition of this contract, a safety improvement team shall be established for this project. The following guidelines (Appendix H) shall be followed.

As a condition of their contract, all Contractors shall submit to the Project Safety Manager or designee:

- A site-specific safety plan within fifteen (15) days after receipt of Notice to proceed and prior to start of any construction activities.
- The name and qualifications (resume) of designated on-site safety person;
- An immediate copy of all citations and/or warning of safety violations received from any state or federal jurisdiction,
agency, insurance company, or by any of its subtier contractor.

The Contractor shall:

- Ensure that all employees, subcontractor’s and sub-subcontractor’s employees are given a comprehensive Safety and Health orientation. This orientation shall include general Safety and Health procedures and policies as well as the project specific rules, regulations and specific hazards. Employees shall be advised that disregard for these rules, or any other applicable Safety and Health regulations shall be subject to company disciplinary action and/or removal from the project. All workers shall complete an acknowledgment that indicates the worker has read, understood, and will abide by the rules and regulations. The following information shall be obtained from all employees: worker’s name, date of orientation, Contractor’s name and project name (Appendix A).
- Investigate all accidents and incidents that result in personal injury or illness to workers, damage to buildings or equipment and any incident with the general public.
- Conduct daily job inspections, identify unsafe conditions or work practices and assure they are corrected, and maintain documentation.
- Conduct weekly, documented, safety meetings with Contractor supervisory personnel.
- Attend monthly Safety committee meetings and participate.
- Assure that employees acting in a supervisory capacity understand and enforce all safe work practices. Foreman and supervisors are required to have completed a 10-hour OSHA Outreach hazard recognition course within Two (2) years prior to directing work on the project. Documentation must be made available for review.
- Assure that employees acting in a supervisory capacity understand and enforce all safe work practices. Foreman and supervisors are required to have completed a 10-hour OSHA Outreach hazard recognition course within Two (2) years prior to directing work on the project. Documentation must be made available for review.
- Assure a Competent Person is provided at work locations where required by OSHA.
- Assure that all Personal Protective Equipment (PPE) is available and being used as required.
- Assure all construction equipment and motor vehicles certification, inspection, repair and controls are in compliance with the safety requirements of the project and OSHA. Annual crane certification shall be available for review for each to a crane on the project.
- Prior to making critical crane lift, detailed lift plans shall be submitted. (See Appendix C, “Critical Lift Checklist”)
- Assure that all hand and power tools are in safe working order.
- Assure that all work areas are kept clear of debris and trash and that adequate trash barrels are placed throughout the work area and emptied frequently.
- Provide the appropriate number and types of sanitary facilities for employees.
- Assure that fall protection equipment is provided and used. Inspections of this equipment shall be documented and on file for review.
- Assure that all perimeter cables, barricades, or any other safety-related items are installed correctly and maintained. If another Contractor must remove a safety item, coordinate this activity with the Contractor who installed the device and other Contractors who may be exposed. Safety devices shall be replaced by the Contractor removing them. Warning signs, tags, or barricades shall be installed if other safety devices are removed.
- Assure that employees receive adequate training as required by the Project and OSHA. Additional training for foreman and safety representative may be required based on unique hazards involved in a task.

WORKPLACE SUBSTANCE ABUSE POLICY

The contractor shall submit as a part of their overall Safety and Health Plan a copy of their company Workplace Substance Abuse policy. This policy shall at minimum comply with Appendix D, “Substance Abuse”.

The Contractor shall ensure that all subcontractors and sub-subcontractors are in compliance. The Contractor shall submit a monthly notarized letter stating they and their subcontractors are in compliance with the Project’s Substance Abuse Policy.

Contractors should contact the State of Tennessee, at 1-800-332-2667, if there are questions concerning the Tennessee Drug Free Workplace Program. Contractors should also consult their own legal counsel.
INSTRUCTION AND TRAINING

Safety Orientation Program
Newly employed, promoted, and/or transferred personnel shall receive an orientation regarding the general safety and health rules and regulations as well as the site specific policies and hazards prior to starting work on the construction site. The Contractor shall be responsible for the orientation of their employees, Subcontractors and sub-subcontractors, and visitors. Documentation of this orientation shall be maintained on file for review (Appendix A). Hard hat stickers (provided by the Project) are to be issued to an employee following their orientation, and then documented on training Log Sheet. It is the responsibility of the contractor to ensure that non-English speaking employees receive these same instructions in a language they understand. Safety orientation of all personnel shall include at a minimum the following topics Safety orientation of all personnel shall include at a minimum the following topics:

- Unique hazards of the project
- Employer/personnel responsibilities under OSHA Standards – location of required posters
- Personal protective equipment, including appropriate work attire
- Confined space entry
- 6-Foot fall rule - 100% continuous fall protection (including steel erection and scaffolds)
- 100% eye protection, 100% hard hat protection
- Appropriate guarding and other warning devices
- Housekeeping
- Fire protection
- Accident reporting procedures - First-aid facilities - Emergency procedures
- Crane and lifting hazards
- Scaffolding tagging requirements
- Hazard communication/ Right-to-Know, location of MSDS's
- Substance abuse policy
- Disciplinary procedures
- Trenching & excavation
- Electrical hazards

PROTECTION OF THE PUBLIC
All necessary precautions to prevent injury to the public or damage to property of others shall be taken. The “Public” is defined as all persons not employed by or under contractor or subcontractor to Memphis-Shelby County Airport Authority. Installation of temporary barriers and/or fencing designated to protect the Public shall be reviewed and approved by the Owner and/or their representative. Precautions shall include but not be limited to the following:

1. Work shall not be performed in any area occupied by the Public unless specifically permitted according to the terms of the contract or in writing.
2. When necessary to maintain public use of work areas involving vehicular roadways, etc., the contractor shall protect the Public in accordance with the applicable regulations.
3. Appropriate warnings, signs and instructional safety signs shall be conspicuously posted where necessary. In addition, a signal person shall control the moving of motorized equipment in areas where the public might be endangered. All signage warnings and traffic control shall comply with the particular agency that takes judicial precedence.
4. Each project work area shall be protected by a fence constructed and erected per MSCAA requirements.
5. Barricades for the general public or public roadways shall be secured against accidental displacement and in place at all times, except when temporary removal is required. As such times, a flag person shall be assigned to control the unprotected area. Barricades used on the airfield will be reconstructed erected and maintained per MSCAA/FAA requirements.
6. Required signs and symbols shall be visible at all times when work is being performed and shall be removed or covered promptly when the hazards no longer exist.

Group Tours and Site Visitors
It is particularly important that a high degree of protection be afforded to all persons on the authorized tours of construction work-sites. The following instructions shall be complied with, as applicable, by the Contractor and those responsible for
arranging such tours. The following procedures shall be followed:

a) Group tours shall be cleared through the site Memphis-Shelby County Airport Authority office, allowing maximum advance notice.

b) If visitors to the site will be on foot or out of the vehicle/bus, the individual or organization requesting the tour shall ensure that:
   - In all cases, the Construction Manager, MSCAA and the contractor shall be advised of any tour in a timely manner prior to the tour taking place.
   - Release and Hold Harmless Agreement – Each visitor shall be required to sign a release and hold harmless agreement prior to the commencement of the tour.
   - MSCAA will coordinate the tour arrangements and ensure notification to the Construction Manager.
   - Tour groups are limited to no more than (25) twenty-five persons.
   - Visitors are required to wear appropriate clothing and shoes.
   - Children under 18 years of age are not permitted on the Project tours.
   - All visitors shall comply with Contractor safety requirements.
   - Site Memphis-Shelby County Airport Authority or designee personnel will escort Tours.

HARASSMENT-FREE WORK POLICY

Employee Harassment

It is the policy of Memphis-Shelby County Airport Authority to provide a workplace free from employee harassment on the basis of race, color, religion, sex, national origin, age, handicap, disability, etc. Improper interference with the ability of an employee to perform their work activities will not be tolerated. Harassment can appear in many forms, including derogatory comments, jokes, slurs, unwanted physical contact, derogatory drawings or threats.

Sexual Harassment

Unwanted sexual advances, requests for sexual favors and other verbal physical conduct of a sexual nature will not be tolerated. Sexual harassing conduct includes, but is not limited to:

- Unwelcome sexual flirtation, touching, advances or propositions
- Verbal abuse of a sexual nature, including graphic or suggestive comments about an individual’s dress or degrading words used to describe and individual
- The display in the workplace of sexually suggestive objects or pictures, including nude photographs
- Other verbal or physical conduct of a sexual nature can affect an employee’s work performance

Reporting of Harassment

It is the policy of Memphis-Shelby County Airport Authority to actively investigate any alleged incidence of harassment. Anyone who believes they have been harassed should contact the project manager. Any allegation or complaint will be held in the strictest confidence.

Any employee who commits a wrongful act of harassment shall be subject to disciplinary action, up to and including termination.
REPORTING, ACCIDENT INVESTIGATION, AND RECORDKEEPING

Contractors shall provide an American Red Cross and CPR Certified First Aid representative and designate an appropriate area for the first aid and medical care to treat injured employees at the job site. A copy of the First Aid Representative’s qualifications shall be submitted to the Project Safety Manager.

The contractor must designate an individual to coordinate injury treatment with the workers’ compensation carrier. The contractors’ designated representative should also coordinate return to work and availability of modified work.

To coordinate medical services, the contractor will complete “Employee Medical Data Sheet” and “Company Drug Screen Request: forms.

Reporting
All accidents resulting in employee injury, property damage, or involving the general public shall be reported immediately to the designated project representative and the Project Safety Manager.

The Contractor and their subcontractors and sub-subcontractors shall complete a Supervisor’s Incident Report Form (See Appendix E) and submit the report to the Project Safety Manager for all job-related accidents involving any of the following:

1. Any employee injury of the contractor, any subcontractor or sub-subcontractor.
2. Any injury and/or incident with the general public (including any alleged injuries reported by a member of the general public).
3. Equipment
4. Property

A formal accident investigation report and “First Report of Injury” shall be submitted within 24 hours. Pertinent facts that are not available within the above time shall be submitted as soon as available in a supplemental report.

A drug and alcohol test shall be administered to employee(s) injured and/or any employees in a work crew involved in an accident involving bodily injury.

Record-Keeping and Files
The Contractor and all Subcontractors and sub-subcontractors shall maintain a master or central file for safety and health related documentation on the jobsite. Files shall be maintained in such a manner that distinguishes each contractor and their subcontractors from other subcontractors and sub-subcontractors.

See Insurance manual for claim reporting procedures.

Accident Investigation
All accident/incidents shall be investigated by the contractor’s safety supervisor and/or their safety designee. An accident investigation report must be submitted to the Designated Project Representative, OCIP Administrator/Willis Towers Watson and OCIP Insurance Carrier within twenty-four (24) hours of the occurrence.

The accident investigation should generate appropriate recommendations for corrective actions to prevent recurrence of similar accidents. Depending upon severity of the accident, the foreman of the injured worker may be requested to appear at the job safety and coordination meeting to:

1. Describe the cause of accident.
2. Report as to what corrective action has been initiated to avoid future accidents.

The Contractor and all Subcontractors shall maintain a current OSHA 300 log. The log shall be available for review by any OCIP team member at any time.

The Contractor and all Subcontractors and Sub-Subcontractors shall submit on a monthly basis a monthly summary of accident/incidents for the project. The summary shall follow the format contained within (Appendix G).
Under the direction of MSCAA AD HOC Committee may be appointed for investigation of serious accidents that result in loss of life, injury to several workers on pedestrians or major property loss. The committee will submit a report to MSCAA at the conclusion of the investigation.

RETURN-TO-WORK

Under the OCIP Program, every effort shall be made to return employees to work as soon as possible after an accident and under the direction of the physician. The insurance carrier will be in contact with the physician to determine the employee’s physical demands and limitations.

A return-to-work program shall be developed and implemented by each Contractor to assist workers who are temporarily disabled due to an injury or illness. The Contractor and all subcontractors shall participate in the return-to-work program.

The Contractor, Subcontractor or Sub-subcontractor shall agree that their injured employees shall be treated by an authorized medical treating facility. The medical facility shall be utilized for initial treatment and evaluation of all injured employees. Follow-up care will be provided in accordance with applicable Workers’ Compensation statutes.

When employees report a work related illness or injury, they shall be taken to the approved medical facility for examination and/or treatment. If the doctor determines that the employee qualifies for "Return to Work" ("light-duty"), the doctor will complete appropriate forms indicating the restrictions and conditions for transitional work.

The Contractor, Subcontractor or Sub-subcontractor shall provide modified work until the employee is able to resume regular duties. All modified work is temporary in nature and is designed to facilitate a return to regular duties as soon as possible. Modified duty positions may be offered at any location of the project or on any shift. Modified work can also be provided at other work locations of the Contractor with approval from the OCIP Team.

In no case shall an injured employee be laid-off or terminated from a "alternative work" position, unless first discussed with the Owner and it's representatives.

WORK PRACTICE CONTROL

Overview

The primary focus of these Safety and Health Guidelines is to provide guidance for Contractors. Each Contractor shall have on site and available for employee review a written safety and health plan. This plan shall cover work exposures the contractors work operations. It is a project requirement that each and every employee conduct their operations in accordance with OSHA and all other applicable standards for all project operations

Memphis-Shelby County Airport Authority prohibits the use, possession, concealment, transportation, promotion or sale of the following controlled items:

a. Firearms, weapons, and ammunition – except when authorized for security reasons.  
b. Switchblades.  
c. Unauthorized explosives, including fireworks.  
d. Stolen or contraband.

Hazard Communication Program

The Contractor shall develop a written Hazard Communication Program that contains at minimum the following elements:

➢ The name of the program coordinator.
➢ A list of hazardous substances present within the Contractor’s workplace.
➢ A written system that ensures MSDS’s are obtained and made readily accessible to all employees, including lower tier subcontractor personnel, on each shift. In the event of an emergency, MSDS’s shall be made available on an immediate basis.
➢ A labeling program that ensures that containers of hazardous substances in the workplace are properly labeled with the name of the substance and any applicable hazard warnings.
➢ A training program regarding hazards of substances that are used in the workplace and the protective measures that must be taken by the employee or any other persons potentially exposed to the hazardous substances.
The Contractor shall ensure that each employee, prior to working with, or being potentially exposed to hazardous substances, receives initial training on the Hazard Communication Program and the safe use of the hazardous substances. Additional training shall be provided to employees whenever new substances are introduced to the workplace.

Permanent records shall be maintained by the Contractor, describing all Hazard Communication Program training.

**Record-Keeping and Files**

The Contractor and all Subcontractors and sub-subcontractors shall maintain a master or central file for safety and health related documentation on the jobsite. Files shall be maintained in such a manner that distinguishes each contractor and their subcontractors from other subcontractors and sub-subcontractors.

Contractors shall submit and/or have available on site:

<table>
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<tr>
<th>REPORT NAME</th>
<th>Annual</th>
<th>Immediately</th>
<th>24 Hr.</th>
<th>Weekly¹</th>
<th>Monthly²</th>
<th>Per Occurrence</th>
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¹ Weekly – Weekly reports are due the following Tuesday morning
² Monthly – Monthly reports are due by the 6th of the following month.
³ Safety Action Plan or JSA – As required by contract or specification

The Owner and it’s Representatives shall have the right to review all documentation at any time upon request. The Contractor shall give full cooperation during these reviews. The following documentation shall be in the safety files:

- A written project site specific Safety & Health Plan
- Hazard Communication Program, including current MSDS’s. A project specific MSDS file shall be maintained on-site for employee review
- Site emergency plans
- All required safety & health permits
- Weekly safety meeting reports - including meeting topic(s) and employee attendance sheets
- Specific job hazard worker training
- Daily jobsite safety inspection reports - including documentation of corrective measures
- Equipment inspection reports
- Crane inspection reports - daily and monthly (annual certification reports required prior to equipment operation)
- Employee orientation training records
- Accident investigation reports, including near-misses
- Job hazard analysis

Contract: Contractor Name
Airfield Maintenance Temporary Facility - Construction
MSCAA Project No. 14-1379-10-01
Job Safety Analysis (JSA)

In order to provide Contractor employees with a safe workplace through pre-planning hazardous work, a Job Safety Analysis (JSA) shall be prepared. JSA’s shall be required when thorough pre-job planning, it is determined that the process, equipment or procedure indicates potential for serious injury and/or property damage. The Contractor shall also prepare a JSA upon request by an OCIP Team member. JSA’s will be done daily. JSA’s should be kept in the work area, possibly at the tool box and/or where they are readily available to the workers. JSA’s will be also be on file with the contractor.

The JSA shall be used by Contractors to analyze the jobs they perform, to identify the existing and potential hazards associated with each job step and establish controls for them. These JSA’s shall be used as a task specific training tool to instruct employees, inspectors, and visitors of potential hazards and required safety precautions. Each employee working on the project shall sign a training log indicating that they understand the hazards of the project as indicated on the JSA.

Examples of activities that may require a JSA:
- Potential for collapse, (work-in trenching, tunneling. This may include demolition, etc).
- Potential release of stored energy, (electrical, pressure, explosive, etc).
- Crane supported work plate form use.
- Critical crane lifts (two cranes used to lift one load).
- Unusual crane operation as defined by the CIP Team.
- Potential exposure to uncontrolled hazardous materials or wastes.
- Blasting operations
- Abrasive /Sandblasting, Hydro blasting, etc.
- Potential injury from burns, both chemical and thermal.
- Respirator use.
- Potential oxygen-deficient environments.
- Entry into confined space.
- Potential of entanglement in, on, or between objects.
- Work in public streets and highways.
- Lockout/Tagout.
- Operations involving fall exposure.
- Structural Steel Erection.
- Use of new or Hazardous Materials, procedures, equipment.
- Material Storage & Handling.
- Powder actuated tool use.
- Suspended scaffolds.
- Scaffold erection.
- Scaffold dismantlement
- Rock drilling.
- Work on live electrical systems.

SPECIFIC PROJECT SAFETY REQUIREMENTS

Controls for possible conflicts between construction operations and aircraft

1) Contractor must request that a notice to Airmen (NOTAM) be issued prior to start of any construction that might affect navigable airspace or surface movement.
2) Barricades and temporary lighting must be installed and maintained per specs.
3) Operators of equipment/vehicles must be instructed on routes and haul procedures.
4) All personnel must stay in defined work areas. Fences/barricades are not to be crossed.
5) No access to active taxiways/runways will be allowed without prior authorization and direction/escort by MSCAA personnel.
Scaffolds, Stair Towers and Work Platforms

The Project requires **100% continuous fall protection** during the erection and dismantling of scaffolds where employees may be exposed to a fall greater than (6) six feet. A competent person must be present during erection, dismantling or moving of scaffold. The Contractor/Subcontractor shall develop and use a scaffold tagging system similar to the following:

**Tagging**

The tagging procedure, at minimum, shall consist of three (3) tags. The appropriate tag will be placed on a scaffold approved by the competent person. Each tag must have at least the following information and be visible by all employees:

- Date tag was placed - date of the last inspection.
- Name of person inspecting. All tags must be weather resistant.

A **GREEN** tag means the scaffold complies with federal OSHA regulations and can be used by any person.

A **YELLOW** tag indicates the scaffold is complete but does not meet all federal OSHA specifications. This tag will be used only in special circumstances. Special precautions, such as wearing a safety harnesses may be required because any accessory, such as a handrail, could not be installed due to the location of the scaffold.

A **RED** tag shall be placed on a scaffold that is being erected, dismantled, damaged and/or defective. No employees except members of the erection/dismantling crew shall work from a red tagged scaffold.

Employees will be instructed to read tags before using scaffolds. If a tag is not attached to the scaffold, **DO NOT USE** the scaffold.

**Exceptions:** Single buck or Baker scaffolds need not be tagged.

**Walking and Working Surfaces**

**Barrier Identification Tape**

Barrier identification tape is strictly prohibited from being used for **any form of personnel fall protection**. Barricade tape around excavations can be used for short term (24-hours), after this period physical barriers are required.

- **YELLOW** barricade tape shall be used for **CAUTION/WARNING**
- **RED** barricade tape shall be used for **DANGER DO NOT ENTER**

Note: Once the area barricaded is free of the hazard(s) for which it was erected the tape will be removed and properly discarded.

**Fall Protection**

Employees shall not be exposed to fall hazards. When an employee observes a fall hazard, they will notify their supervisor of the hazard. The responsible Contractor will immediately correct the hazard. **100% continuous fall protection, for fall hazards greater than six (6') feet, shall be implemented on this Project - including steel erection and scaffold use, erection and dismantling.**

Each Contractor shall be responsible for meeting fall protection requirements in their overall safety and health program.

Each Contractor shall evaluate ALL fall exposure conditions or tasks and must develop a Fall Protection Plan which outlines what methods, procedures and/or devices will be used in their program.

Each Contractor shall be responsible for implementing the requirements to achieve fall protection in accordance with all Federal, State, local rules, regulations, and the OCIP Safety and Health Guideline.

All fall protection systems used on this project shall comply with OSHA regulations and the project safety guidelines. Fall protection shall provide a positive means of protection. **Controlled Access Zones and Safety Monitoring Systems are not considered positive means of fall protection and shall not be permitted.** Any employee exposed to a fall greater than six (6) feet shall use approved fall protection equipment or devices. Fall protection systems shall be designed and installed under the direction of a Registered Professional Engineer or Qualified Person. Fall protection is required, as a minimum, under the following examples:
- Formwork and reinforcing steel. Each employee on the face of formwork or reinforcing steel shall be protected from falling 6 feet or more to lower levels by Personal Fall Arrest Systems, safety net systems, or positioning device systems.
- When working from a telescoping, articulating, or rotating type lifts and scissors lifts, personnel shall wear a safety harness with shock absorbing lanyard, secured to an approved anchorage point.
- When working on a ladder higher than six (6) feet from a solid surface, if the employee’s torso extends past the side rails or if a vertical ladder extended a total of 20’ or greater.
- When working on a platform or other support not equipped with an adequate guardrail, which is higher than six (6) feet from a solid surface.
- When working from a crane-suspended work platform, a safety harness with shock absorbing lanyard is mandatory.
- When an employee may have to be lowered into or raised from a confined space, a personal fall arrest system will be worn. The employee will be supported by an approved platform or a boatswain’s chair, with certified hoisting device and fall arrest device.
- When working adjacent to an unguarded floor opening or sloped roof, a lifeline system is desirable for mobility. A positive means of fall protection must be provided unless it can be proven infeasible.
- When working adjacent to a deep excavation, pit or trench. Employees will be instructed on the proper wearing and use of personal Fall Protection Arresting Device Systems.
- **Barricade tape is not adequate fall protection.**

The Fall Protection Plan shall detail in writing when fall protection is required and exactly how this protection is to be provided. This written plan is required for any Contractor exposing workers to falls six (6) feet or greater.

The Contractor shall prepare a written training program to ensure that each employee who might be exposed to fall hazards is knowledgeable of the Fall Protection Plan requirements. The program shall enable each employee the ability to recognize the hazards of falling and shall train each employee in the procedures to be followed in order to eliminate or minimize these hazards.

The Contractor shall assure that each employee has been trained.

*Personnel, who have been trained, then re-trained and continue to violate the established fall protection plan/regulations shall be removed from the project IMMEDIATELY.*

**Confined Space Entry**

All employees required to enter a confined space shall be knowledgeable of the hazards involved with confined space entry. Prior to the start of such an entry the Contractor involved in the work will develop a Confined Space Entry Procedure. The Contractor shall train all personnel who will enter the confined space. No one shall enter a confined space area until properly instructed. Contractors shall identify all confined spaces within their work area with a sign identifying the area as a confined space.

A Confined Space Entry procedure shall be used to:
- Prevent inadvertent operation of equipment and/or work process while people are working in the confined space.
- Eliminate unexpected exposure to hazardous materials, oxygen deficient or inert/toxic gaseous atmosphere while working in confined spaces.
- Plan for a timely and effective response to an emergency during a confined space entry.

Confined Spaces are considered to be areas with limited entry and exit, or poor natural ventilation, and not intended for human occupancy. Examples of a confined space include: tanks, covered basins, vaults, columns, mixers, manholes, pipelines, sumps, ditches or excavations. All spaces shall be considered permit-required confined spaces until the pre-entry procedures demonstrate otherwise.

Safety considerations include but are not limited to: atmosphere testing for gaseous conditions/lack of oxygen, appropriate personal protective and emergency equipment, and additional personnel as needed to assure communications and assist
the individual conducting the entry.

A Permit Required Confined Space means confined space that has one or more of the following:

- May or may not potentially contain a hazardous atmosphere;
- Contains a material that has potential for engulfing entrant;
- Has internal configuration that could trap the entrant;
- Contains any other recognized serious health or safety hazard;

Contractors shall provide their own permit.

A Non-Permit Required Confined Space is a confined space that does not contain or with respect to atmospheric hazards, the potential of causing death or serious physical harm.

**Employee Ground Transportation**

The purpose of this section is to establish minimum acceptable guidelines for the safe transportation of all personnel traveling within the Project confines. Eliminate personal accidents and injuries resulting from improper equipment use.

Contractors are responsible for assuring that all personnel follow the requirements of this section and prohibit improper transportation of employees and visitors. Transporting employees in cargo beds of pick ups, vans, etc. is prohibited, unless approved seats and seat belts are provided and used.

- Operators must be qualified. Vehicle operators must have valid state operator’s license
- All equipment/vehicles must be identified (company logo) per specifications.
- Safe speed must be maintained and adjusted to site conditions.
- Use flashers/headlamps as directed.
- Mobile cranes, forklifts, winch trucks, front-end loaders, tractors and other materials handling equipment are not permitted to transport passengers.
- Trucks
  - A maximum of three passengers are permitted to ride inside of the truck cab unless the cab is specifically designed to accommodate additional passengers.
  - Passengers shall ride with all portions of their bodies inside the truck body or frame.
  - Passengers shall be in the seated position, with the seat belts secured and adjusted properly, before the vehicle is set in motion.
  - Riding on a vehicle’s bumper or tailgate is prohibited.
  - Tailgates will be closed and latched before the vehicle is operated.
  - Passengers are not permitted to ride in the body of a dump truck, in the bed of a pickup truck or in trailers.
  - Passengers are not permitted to ride on top of the load or to hold materials from shifting.
  - Vehicles must be designed to accommodate passenger transportation or the vehicle shall not be used for that purpose.
  - Drivers transporting passengers shall follow the posted speed limit and Project traffic rules.
  - The Contractor shall establish a designated employee parking area. Employee vehicles shall not be allowed on the construction project.

**Housekeeping - MUST BE A CONTINUING PROCESS**

The purpose of this section is to incorporate into the day-to-day work activity a good housekeeping action plan that will be followed by all Contractors working on the project.

- Contractors, through inspection and example, are responsible for assuring that trash and debris remain out of the work areas. Contractors are responsible for all of their work areas and the work areas of their subcontractors and sub-subcontractors. If poor housekeeping practices are observed, corrective action will be discussed with the appropriate Contractor to remind them that cluttered work areas will not be tolerated and that their work area(s) pose...
a hazard to his employees and other personnel.

- Should the Contractor fails to address and correct their poor housekeeping upon 24 hour written notification, the "owner" may at its option, cause the same to be removed and charge the expense of such removal to the appropriate Contractor.

- Specific attention is needed for operations to the Aircraft Operation Area (AOA).

- Contractors shall monitor their work areas daily or more frequently if needed to assure that all debris is removed to minimize hazards.

- Immediately available vacuum sweeper for cleaning taxiway/runway crossings.

- Personnel immediately available for taxiway and runway cleanup. (Provide brooms to supplement cleanup by sweeper.)

- Access to taxiway/runway crossings for cleanup only at the direction of MSCAA guard.

- Loading of haulage vehicles to minimize spillage.

- Maintenance of vehicles/equipment so that no fluids will leak.

- Provide waste containers at the direction of the Construction Manager.

**Project Electrical Requirements**

- The Contractor shall implement an electrical safety program. This safety program element shall include safe installation, work practices, maintenance, and special equipment considerations. All electrical installations, either temporary or permanent, shall be in conformance with the National Electrical Safety Code, NFPA-70, ANSI-C1, and low and high voltage electrical safety orders OSHA code requirements. Only qualified employees shall install electrical tools and equipment, defective and/or improperly installed equipment shall be repaired immediately.

- Only qualified electricians familiar with code requirements shall be allowed to perform electrical work.

- Extension cords used with portable electrical tools and appliances shall be heavy duty (minimum 12 AWG) and of the three-wire type. Cords shall be covered, elevated or otherwise protected from damage that would create a hazard to construction site personnel.

- Electrical cords and equipment shall be visually inspected before each shift for external defects. All damaged and defective cords shall be removed from service immediately (this includes cords with the ground prong missing). Cords shall be repaired with approved heat-shrink methods, electrical tape is not permitted.

- All temporary electrical tools, cords and equipment shall be properly protected by ground fault circuit interrupters (GFCI). All portable generators shall have properly functioning GFCI outlets. GFCI receptacles shall be tested monthly with a multi-range GFCI tester (the tests shall be documented) to insure the GFCI is properly functioning and protecting the worker.

- A "task-specific" lockout/tagout safety plan shall be established to ensure power sources to equipment and/or machinery are isolated and de-energized. This plan shall establish minimum steps necessary to disable equipment and machinery to prevent the unexpected release of potentially hazardous energy. Lockout/Tagout shall be performed in accordance with 29 CFR 1910.147.

**Cranes and Hoisting Equipment**

- Cranes and hoists shall not be used without a current annual certificate of examination and testing issued by an accredited crane examiner. **Annual inspection certificates shall be available when cranes arrive on-site. Operators manual shall be in the cab of each crane prior to crane operation.**

- Only qualified and designated personnel shall operate cranes or hoisting equipment. Crane operators must have current (Certified Crane Operator) CCO certification and/or local or state certification.

- Rated load capacities and recommended operating speeds, special hazard warnings, or instructions, shall be conspicuously posted on all equipment; they shall be visible to the operator from his/her control station, and an accessible fire extinguisher of 10:ABC rating, shall be available at all operator stations or cabs of equipment. Crane operations position shall be kept clear of loose tools or material.
Outrigger cribbing shall be used for all crane operations. The size of the cribbing shall be determined by taking the cranes capacity and dividing by 5 (example: 40 to crane divided by 5 = 8 sq. ft. per outrigger).

All cranes working over shafts or lifting personnel platforms shall have anti-two block devices installed and operating properly.

Radio or other positive means of communication shall be used to direct the operator when the point of operation is not in direct view of the operator.

The operator shall respond to signals from only one person. The operator shall not follow any signal which is not understood, but shall always obey a stop signal.

The operator shall be responsible for the operations and load under their control at all times. Whenever there are doubts about the safety of movement, the operator shall stop operations until safety is assured.

A warning signal, such as a horn, shall be sounded to alert personnel to proximity of moving loads. Loads should not be passed over personnel, and personnel should not be permitted to work in the area directly under a suspended load.

Concrete buckets - Employees shall be permitted to work under concrete buckets while the buckets are elevated.

Employees shall keep out from under suspended loads at all times.

Employees shall not ride on loads, slings, hooks, buckets or other load handling attachments.

All repairs, adjustments, modifications, rigging assembly or dismantling shall be conducted only by qualified and authorized personnel.

The swing radius shall be barricaded or other positive means shall be taken to prevent personnel from entering the area between the counter weight/swing radius and any stationary and/or outside obstructions.

A critical lift checklist will be completed and submitted anytime:
- 2 cranes are used to make a lift
- when a lift exceeds 75% of the load chart
- or any unusual conditions are encountered
(See Appendix C, “Critical Lift Checklist”)

Crane suspended work platforms shall only be used if there is no other safe means to reach the work area. The Contractor shall complete a JSA prior to the lift.

Any overhead wire shall be considered to be energized unless and until the person owning such line or operating officials of the electrical utility supplying the line assures that it is NOT ENERGIZED and it has been visibly grounded at the work site.

Taglines shall be used to control all loads

Daily inspection of all cranes shall be completed and documented prior to crane use

Rigging

Major rigging operations shall be planned and supervised by Competent Personnel to ensure that the best methods and most suitable equipment and tackle are employed. This should be the superintendent or foreman in charge.

Job site management shall ensure that:
- Proper rigging equipment is available.
- All rigging is inspected before use. Documented inspections are required.
- Correct load ratings are available for the material and equipment used for rigging.
- Rigging material and equipment are maintained in proper working condition.

The supervisor of the hoisting operation shall be responsible for:
- Proper rigging of the load.
- Supervision of the rigging crew.
- Ensuring that the rigging material and equipment have the necessary capacity for the job and are in safe condition.
- Ensuring correct assembly of rigging material or equipment as required during the operation, such as the
correct installation of lifting bolts.
• Safety of the rigging crew and other personnel as they are affected by the rigging operation.

**Excavation (Any process which disturbs soil)**

A. Contact MSCAA/FAA thru the Construction Manager at least 72 hours prior to proposed work for location of underground hazards (cables, ducts, fuel lines, etc.). A request form will be provided to the contractor.
B. The contractor must contact Tennessee one call at least 72 hours prior to proposed excavation for location of utilities. Contractor must make arrangements to have personnel at the site when utilities are located. Documentation of the control number must be maintained on site.
C. **Utilities must be located/marked prior to any process that disturbs the soil.**

**Earthmoving Equipment and Trucks**

- All earthmoving equipment shall be maintained in safe working condition and shall be appropriate and adequate for the intended use.
- Only authorized personnel shall operate equipment. Operators of equipment, machinery or vehicles shall be qualified and properly licensed for the operation involved.
- Equipment maintenance shall be performed only by qualified mechanics.
- Equipment operators and truck drivers shall make a documented pre-shift safety inspection of their equipment. Any conditions that effect safe operation will be corrected before use.
- Equipment shall not be operated unless all required safety devices are in place and functioning properly.
- Careless, reckless or otherwise unsafe operation or use of equipment shall result in discipline and may constitute grounds for dismissal.
- Before performing any service or repair work, all equipment shall be stopped and positively secured against movement or operation, locked and tagged out of service, unless it is designed to be serviced while running, following the manufacturer's instructions.
- When equipment is serviced or repaired, the operator shall dismount until the service or repair is completed and then make a complete walk-around safety check before remounting.
- All heavy equipment including: cranes, forklifts, dozers, end-loaders, skid-steers, etc., shall have a reverse signal/back-up alarm audible above surrounding background noise.
- All off-highway earthmoving equipment and trucks such as loaders, dozers, scrapers, motor graders, rock trucks, tractors, rollers and compactors shall be equipped with roll-over protective structures (ROPS) and seat belts.
- Seat belts shall be used and adjusted properly by operators of all heavy equipment.
- Mobile equipment shall not be left unattended unless parked securely to prevent movement, with all ground engaging tools lowered to the ground, brakes set and the engine off.
- Equipment parked at night shall be lighted, barricaded or otherwise clearly marked when exposed to traffic. Keys shall not be left in equipment overnight.
- Personnel shall not be transported or ride on equipment or vehicles that are not equipped with seats for passengers.
- When fueling equipment or vehicles with gasoline or liquefied petroleum gas (LPG) the engine shall be shut down.
- All equipment and vehicles shall be equipped with appropriate fire extinguisher or fire suppression system.
- Haul roads shall be designed, constructed and maintained for safe operation consistent with the type of haulage equipment in use. Standard traffic control signs shall be used where necessary.
- Elevated roadways shall have axle high beams or guards maintained on their outer banks.
- Equipment, tools, and materials hauled on pickups and flat bead trucks must be secured to prevent them from falling onto the road.

**Welding & Cutting**

- Welding leads and cutting hoses shall be kept clear of walkways and stairways.
- Flash arrestors shall be installed provided in both oxygen and acetylene hoses at the regulator connection.
- Welders shall wear approved eye and head protection when welding. Personnel assisting the welder shall also wear approved eye protection.
- Prior to welding or cutting a “20-ABC” rated fire extinguisher shall be within easy reach of the worker. A fire watch shall be stationed at all locations where sparks and/or flames may fall to a lower floor/work area or to another side of a wall.
- A suitable cylinder truck, with chain shall be used to keep cylinders from being knocked over while in use.
Spent welding rods shall be picked up and disposed of daily.
When practical all welding and cutting operations shall be shielded by non-combustible or flame-proof screens.
Oxygen and acetylene cylinders shall not be stored inside buildings.
Rubber boot protectors shall be provided on all welding leads were they make connections at the welding machine.

**Personal Protective Equipment**

**Eye and Face Protection**

All employees shall wear safety glasses 100% of the time while on the construction site. Minimum eye protection shall include approved safety glasses with side shields which meet the standards specified in ANSI Z-87.1-1989 (this shall also include prescription eye wear).

Additional eye and face protection in combination shall be worn when:
- Welding, burning or cutting with torches
- Using abrasive wheels, portable grinders or files
- Chipping concrete, stone or metal
- Working with any materials subject to scaling, flaking or chipping
- Drilling or working under dusty conditions
- Using explosive actuated fastening or nailing tools
- Working with compressed air or other gases

Only clear safety glasses shall be worn inside any building(s).

**Head Protection**

All construction workers shall wear hard hats which meet ANSI Z 89.1-1986, 100% of the time while on the construction site. Hard hats shall display the company decal where the employee works.

All delivery personnel, vendors and visitors shall wear approved hard hats while on the project.

**Hearing Protection**

Work areas shall be monitored to identify areas of high noise exposure (85 dBA and higher). All work areas identified as high noise exposure shall be properly posted to warn employees of the exposure.

Appropriate hearing protection shall be worn in work areas where noise levels are 85 dBA or greater.

**Respiratory Protection**

Contractors whose work activities warrants that employees wear respiratory protection, shall establish and implement a respiratory protection program. The program shall meet the requirements set forth in 29 CFR 1926.134.

**Foot Protection**

All personnel on the construction site shall wear leather hard-soled work boots. No one is permitted to wear sneakers (including ANSI approved), tennis shoes or athletic shoes of any type, sandals, high heels or thongs on the construction site.

**Clothing**

Suitable clothing for construction shall be worn on the construction site. Shirts with sleeves (at least t-shirt (4 inches) in length) and full length pants shall be required. Shorts, sweat pants or tank-tops are not allowed.
Appendix A - Safety Orientation

Check each box when completed - To be completed by all employees on the jobsite. To be completed by site supervision and employee prior to beginning work.

- Alcohol and/or drug use, fighting or horseplay are prohibited and will result in immediate termination
- 100 % eye protection and hard hats are required when on the construction project
- Review potential hazards on the project and the precautions to be taken to prevent injury
- Disciplinary Policy:
  Non-serious violation
  First violation - Verbal warning
  Second violation - Verbal & written warning
  Third violation - Verbal & written warning and three day suspension without pay
  Fourth violation - Employee discharge from company
  
  Serious violation - (see disciplinary policy)
  First violation - Verbal & written warning
  Second violation - Employee discharge from company
- Hazard Communication Program - location of MSDS’s and written program on the project
- All accidents, injuries and unsafe conditions shall be reported to supervisor immediately
- Medical treatment protocols for injuries requiring off-site medical treatment with a doctor
- Safety meetings are held on a weekly basis (attendance is mandatory)
- All employees shall dress properly while working. Minimum attire is long pants, shirt with at least 4 inch sleeves and sturdy above the ankle work boots
- Ground fault circuit interrupters (GFCI) are required on all tools. All extension cords and power tools shall be properly grounded. Notify supervision immediately if defective equipment exists.
- All employees exposed to a fall exposure of six or greater, shall be protected by the means of fall protection. Specific training is required for fall protection.
- Employee are not allowed to work in excavations 4 feet or more in depth, unless they are properly sloped or protected by shielding or shoring
- Lockout/tagout is required when working on equipment or tools where unexpected start-up may occur or the release of energy may result in injury
- Before any employee is allowed to wear a respirator (including paper masks) they must be medically approved by a doctor and fit-tested
- Scaffolds shall be inspected and tagged prior to use by any personnel. Red tag means DO NOT USE; Yellow Tag means section of scaffold does not meet OSHA standards and Green Tag means SAFE FOR USE.
- Other hazards discussed related to the construction project:

Equipment Issued

- Hardhat
- Safety Glasses
☐ Orange vest
☐ Fall Protection Harness & Lanyard
☐ Respirator
☐ Other  ______________________________________________________________

To be completed by supervisor in the field with the employee

☐ Show employee around the project and discuss potential hazards
☐ Introduce employee to crew members
☐ Assign new employee to experienced work crew
☐ Specify work duties
☐ Where to eat lunch

This is to acknowledge that I have completed new employee orientation and understand that failure to comply with the Safety Program may be grounds for dismissal.

Employee Print Name: _____________________________  Date: ______________
Emergency Contact: _____________________________________________
Employee Signature: _____________________________________________
Supervision Signature: _____________________________  Date: ______________
Appendix B – Employee Disciplinary Guideline

The discipline policy is intended to encourage compliance with the requirements of the Federal Occupational Safety and Health Act of 1970 (OSHA) and all additions and revisions thereto, as well as other applicable federal, state and local requirements and this Safety and Health Guideline. Workers performing work in an unsafe manner that would endanger the employee, other workers or the public shall be subject to discipline or termination.

The Project Representative in conjunction with the Project Manager and Project Foreman will determine the course of action best suited to the circumstances. The steps to be taken shall be progressive, except in the most egregious circumstances and shall include:

a) **Non-Serious** – Initial, isolated, or rare instances of violation, that does not result in danger to the employee, property, or others, should be corrected through non disciplinary discussion and instruction. Safety violations of a less serious nature will be handled as follows:

<table>
<thead>
<tr>
<th>Offense</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Offense</td>
<td>Verbal Warning</td>
</tr>
<tr>
<td>Second Offense</td>
<td>Written Warning</td>
</tr>
<tr>
<td>Third Offense</td>
<td>Employee given three-day suspension without pay</td>
</tr>
<tr>
<td>Fourth Offense</td>
<td>Employee Discharge</td>
</tr>
</tbody>
</table>

b) **Serious** – One which could result in serious injury or loss of life or serious loss of property, shall be subject to:

<table>
<thead>
<tr>
<th>Offense</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Offense</td>
<td>Employee given three-day suspension without pay</td>
</tr>
<tr>
<td>Second Offense</td>
<td>Employee Discharge</td>
</tr>
</tbody>
</table>

c) **Supervisor Accountability** – If two or more employees working for the same supervisor are found in serious violation as described above, that subcontractor supervisor is also subject to disciplinary action up to and including immediate discharge.

**Documentation** - Notice of safety violation (written) shall be given to the employee, and a copy sent to the Project Safety Representative.
Appendix C - Critical Lift Checklist

Project: _______________________  Date: __________________

Description of Lift: _____________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

Name of supervisor in charge of lift: ______________________________
Name of crane operator(s): ______________________________
Name of signal person(s): ______________________________

Crane Data:
Make and Model: _______________  Load Data:
Gross Load Weight: _______________
Gross Load Weight: _______________

Boom Length: _________________  Rigging Weight: _________________
Load block & line Weight: _________________
Max. Load Radius: _________________

Counterweight: _________________
Max. Boom Angle: _________________

Capacity: _________________
Min. Boom Angle: _________________

Pre-Lift Requirements:
_____ Load is within chart limits.
_____ Has the Center of Gravity of the Load been established and marked?
_____ Is rigging adequate and in good condition?
_____ Load chart utilized is for exact crane model; boom type, length, tip; counterweight.
_____ Competent person in charge of lift: Name
_____ Competent signal person identified: Name
_____ Pre-pick meeting held with crew
_____ Written crane inspection completed within 1 day of critical pick
_____ Swing path not over personnel
_____ Footing is sound and level (soil conditions/compaction, underground tunnel or utilities).
_____ Pre-planning for radio or hand signal communications.
_____ Minimum clearances from power lines can and will be maintained.
_____ The load radius has been measured with tape measure.
_____ Weather conditions have been checked, including wind speed.
_____ Load will not touch boom at any time.
_____ For dual crane lift – diagrams have been prepared.
_____ Pad blocking is adequate and substantial.
_____ Outriggers are fully extended.

Signed: ____________________________
Supervisor in Charge
Appendix D – Substance Abuse

Policy Statement

The Owner Memphis-Shelby County Airport Authority and the OCIP Team are committed to providing project employees with a drug-free and alcohol-free workplace. It is our goal to protect the health and safety of these employees and visitors to our job site, promote a productive workplace, and protect the reputation of our project.

Consistent with those goals, the use, possession, distribution or sale at project sites of drugs, drug paraphernalia or alcohol is prohibited. A program of drug and alcohol testing will be instituted to monitor compliance with this policy.

Contractors / Subcontractors refusing to comply with this Drug and Alcohol Policy will not be permitted to work on this OCIP project and will be noted as being in violation of their contract with the (Project Name) / or other contractors & subcontractors working on this project.

This Policy does not represent a contract between the Owner Memphis-Shelby County Airport Authority, Design and Development, the OCIP Team, Owners of project, Construction Managers, General Contractors, Subcontractors, employees or perspective employees of the project.

Policy Administration

It is our combined goal to protect the health and safety of personnel, craft workers, and visitors to our job site; to promote a productive workplace, and protect the reputation of this OCIP.

Prohibited Substances

1. Drugs or Drug is defined as any substance which may impair mental or motor function including but not limited to illegal drugs, controlled substances, designer drugs, synthetic drugs, look alike drugs, and under circumstances described in this policy -prescription drugs.

2. Alcohol is defined as any beverage or substance containing alcohol, ethyl alcohol or ethanol. “Alcohol Testing or Alcohol test means testing by certified breath-alcohol technician using a DOT approved initial screening device or urine alcohol testing conducted by a certified laboratory and confirmed by gas chromatography/mass spectroscopy (GC/MS)”. Test levels must not meet or exceed.04 grams per 210 liter of breath.

Pre-Project Testing

Prior to the beginning work on this Project, employers will be required to insure that all employees have met the requirements of this policy with a negative (passing) test result. Employers and employees not meeting the requirements will not be allowed to work on this OCIP job site.

Additional Testing of Employees

1. Post Accident: It is agreed that drug and alcohol testing of employees shall be required after each and every work related incident. This testing shall take place at the medical facility providing treatment for the injury. A work related accident is defined as an accident resulting in an injury requiring treatment by a physician to the employee or other employees injured and / or resulting in damage to property or equipment.
2. **Reasonable Suspicion**: Is defined as supervision having a reason to suspect employee drug or alcohol use. The employer will bear the cost of this test.

**Points of Understanding Regarding Substance Abuse Testing**

The employer, the medical facility and the testing laboratory agree that the results of the described tests are to be held in strictest **CONFIDENCE** between the employer, the OCIP Workers Compensation Carrier and the medical facility (MRO). This is an issue of employee – employer relationship (employment) and falls under the requirements within the employers program.

1. This statement is noted for the purpose of adjudicating a workers compensation claim. The OCIP Workers Compensation Carrier requires the employer to report all accident related drug and alcohol test results to them immediately.

**Testing Procedures**

1. At a minimum pre-project and post accident testing is required.
2. Testing shall include the following drugs at a minimum:
   - Marijuana, Cocaine, Opiates, Amphetamines, Phencyclidine, Barbiturates, Benzodiazepines, Methadone, Propoxyphene
3. For reasons of safety, any employee subject to a reasonable suspicion test shall be suspended until test results are available.

**Prescription Drugs**

The use of current valid prescription Drugs that may impair an Employee’s ability to safely perform his or her duties must be reported to the safety director, supervisor and management personnel.

**Alcoholic Beverages**

Under no circumstances are alcoholic beverages allowed on the project site.

**Disciplinary Action**

1. A positive pre-project or post accident test will result in worker dismissal from this project site
2. Employees found using, selling, possessing or manufacturing drugs shall be removed from this project and may be reported to local law enforcement.

**Confidentiality**

All actions taken under this policy will be in conformance with the Local Drug Testing Act

**Subcontractors and Vendors**

Subcontractors, sub-tiered contractors, vendors and their employees shall cooperate with this policy in achieving a drug-free and alcohol-free workplace.

**Amendments to Policy**

Amendments to this policy may be issued to comply with project owner requirements, state or local laws, or federal contract requirements.

Company Name _________________________________________________________________
DRUG AND ALCOHOL POLICY
ACKNOWLEDGMENT AND ACCEPTANCE STATEMENT

I certify that I have read and understand the statement and policy. I further understand that prior to employment and during employment, I am subject to drug and alcohol screening tests. I agree to provide the specimen appropriate to such drug or alcohol test(s) as may be required. I further understand that my property and I may be subject to search under the terms of this policy while I am on the Owner's premises. Failure to provide the appropriate specimen, or to permit a search, will subject me to removal from this site.

I also understand that I will not be allowed to go to work prior to the reporting of my pre-employment drug test results.

If I am an employee of a subcontractor company, an employee of an affiliate company assigned to the job site, or a contract staff, I understand that I am subject to pre-employment drug testing and all testing conditions of this Policy. Failure to provide the appropriate specimen or to permit a search or a positive test result will result in my immediate removal from this job site.

__________________________________   _____________________________
  Signature                      Date

__________________________________
  Print Name and Title

__________________________________
  Witness
## Guidelines for Reasonable Suspicion

### Observation Checklist

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
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<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Walking</td>
<td><strong>___</strong> Stumbling</td>
<td><strong>___</strong> Staggering</td>
<td><strong>___</strong> Falling</td>
<td><strong>___</strong> Unable to Walk</td>
<td><strong>___</strong> Swaying</td>
<td><strong>___</strong> Unsteady</td>
</tr>
<tr>
<td>2. Standing</td>
<td><strong>___</strong> Swaying</td>
<td><strong>___</strong> Staggering</td>
<td><strong>___</strong> Unable to Stand</td>
<td><strong>___</strong> Rigid</td>
<td><strong>___</strong> Sagging at Knees</td>
<td><strong>___</strong> Feet Wide Apart</td>
</tr>
<tr>
<td>3. Speech</td>
<td><strong>___</strong> Shouting</td>
<td><strong>___</strong> Silent</td>
<td><strong>___</strong> Whispering</td>
<td><strong>___</strong> Slow</td>
<td><strong>___</strong> Rambling</td>
<td><strong>___</strong> Mute</td>
</tr>
<tr>
<td>4. Demeanor</td>
<td><strong>___</strong> Cooperative</td>
<td><strong>___</strong> Polite</td>
<td><strong>___</strong> Calm</td>
<td><strong>___</strong> Sleepy</td>
<td><strong>___</strong> Silent</td>
<td><strong>___</strong> Talkative</td>
</tr>
<tr>
<td>5. Actions</td>
<td><strong>___</strong> Resisting</td>
<td><strong>___</strong> Fighting</td>
<td><strong>___</strong> Threatening</td>
<td><strong>___</strong> Erratic</td>
<td><strong>___</strong> Drowsy</td>
<td><strong>___</strong> Profanity</td>
</tr>
<tr>
<td>6. Eyes</td>
<td><strong>___</strong> Bloodshot</td>
<td><strong>___</strong> Watery</td>
<td><strong>___</strong> Dilated</td>
<td><strong>___</strong> Glassy</td>
<td><strong>___</strong> Droopy</td>
<td><strong>___</strong> Closed</td>
</tr>
<tr>
<td>7. Face</td>
<td><strong>___</strong> Flushed</td>
<td><strong>___</strong> Pale</td>
<td><strong>___</strong> Sweaty</td>
<td><strong>___</strong> Normal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Appearance/</td>
<td><strong>___</strong> Unruly</td>
<td><strong>___</strong> Messy</td>
<td><strong>___</strong> Dirty</td>
<td><strong>___</strong> Neat</td>
<td><strong>___</strong> Normal</td>
<td></td>
</tr>
<tr>
<td>Clothing</td>
<td><strong>___</strong> Partially Dressed</td>
<td><strong>___</strong> Body</td>
<td><strong>___</strong> Stains</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excrement</td>
<td><strong>___</strong> Alcoholic</td>
<td><strong>___</strong> Faint Alcohol</td>
<td><strong>___</strong> No Odor</td>
<td><strong>___</strong> Odor</td>
<td><strong>___</strong> Normal</td>
<td></td>
</tr>
<tr>
<td>10. Movement</td>
<td><strong>___</strong> Fumbling</td>
<td><strong>___</strong> Jerky</td>
<td><strong>___</strong> Slow</td>
<td><strong>___</strong> Hyperactive</td>
<td><strong>___</strong> Nervous</td>
<td><strong>___</strong> Normal</td>
</tr>
<tr>
<td>11. Eating/</td>
<td><strong>___</strong> Gum</td>
<td><strong>___</strong> Candy</td>
<td><strong>___</strong> Mints</td>
<td><strong>___</strong> Other – identify</td>
<td>Chewing</td>
<td></td>
</tr>
<tr>
<td>12. Other observations: (Visible drug use, possession, sale, etc.: attendance; poor work performance or accident; tampering with drug test; credible reports, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

____________________________________________________________________

____________________________________________________________________

Observed by: ________________________  Observed by: _____________________

Date: ______  Time:  __________________  Location:  _______________________

---

**Contract:** Contractor Name  
Airfield Maintenance Temporary Facility - Construction  
MSCAA Project No. 14-1379-10-01
Appendix E - Supervisor's Report of Bodily Injury

Date of Accident __________________  Date Returned to Work:_____________________
Location of Accident __________________________ Time of Accident _____________ am/pm
Contractor/Subcontractor Involved __________________________________________________
First Aid: _______  Recordable _____  Lost Time _______   Fatality _____
Damage*: __________  Fire ___________  Property _____________
Equipment ___________________________________________________________________
Injured Person: ______________________________  SSN: ________________________
Address: ____________________________________  Occupation: _________________
___________________________________________  Home Phone:____________________
Male_____  Female ____  Age  ____
Nature of Injury: _______________________________________________________________
First Aid Administered By: _______________________________________________________
Hospital ___________________________________  Physician
Witnesses: ___________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
Equipment and/or Materials Involved: _____________________________________________
Cause of Accident:____________________________________________________________
____________________________________________________________________________
Superintendent's Corrective Action:______________________________________________
____________________________________________________________________________
____________________________________________________________________________
Employee’s Signature: ______________________ Supt. Signature_______________________
Date of report: ___________________________

*Attach a list of damaged property and/or equipment excluding motor vehicles. Indicate owner’s names and addresses. Complete “Report of Damage to Equipment or Property” (Appendix F).
Appendix F - Report of Damage to Equipment or Property

Date ________________
Contractor/Subcontractor ________________________________________________
Location of Accident ______________________________________________________
Equipment Involved _______________________________________________________

Personal injuries: Yes ________ No ______
Damage Estimate: $ ________________

<table>
<thead>
<tr>
<th>Witness to Accident</th>
<th>Statement Obtained</th>
<th>Statement Attached</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Remarks: ______________________________________________________________
______________________________________________________________
______________________________________________________________

Time of Accident _______ AM _____ PM _____ Date ______________
Weather Conditions ___________________________ Temperature __________
Roadway or surface type ___________ Wet _____ Dry _____ Other _______ *
*If other, explain ____________________________________________
______________________________________________________________

If more space is required, use back of this sheet for additional information and sketches.

Signed __________________________
Title ____________________________
Employee Name ____________________
## Appendix G - Contractor Monthly Report of Safety Statistics

### MONTHLY ACCIDENT EXPERIENCE SUMMARY

<table>
<thead>
<tr>
<th>CONTRACT NO:</th>
<th>CONTRACTOR/SUBCONTRACTOR NAME:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>MONTH</td>
<td>YEAR</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>REPORTING PERIOD:</td>
<td>THROUGH:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>THIS MONTH</th>
<th>YEAR TO DATE</th>
<th>PROJECT TO DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### HOURS WORKED

### PAYROLL

### A. FIRST-AID CASES

### B. OSHA RECORDABLE CASES

### C. LOST TIME CASES

(list each under comments)

### D. TOTAL LOST WORK DAYS

### E. PROPERTY DAMAGE

### F. EQUIPMENT

### G. GENERAL PUBLIC

### OSHA Recordable Incidence Rate*

### Lost Time Incident Rate*

### COMMENTS:

Prepared By: Date

PM/Superintendent Date
Appendix H – Safety Improvement Team Guidelines

The Owner recognizes that a cooperative effort is required to insure a safe construction project. Therefore, the Contractor shall establish a Safety Improvement Team to facilitate the proper cooperative attitude.

The Safety Improvement Team shall be composed of an equal number of employee and management representatives. The management personnel (4) will consist of one Owner representative, one person from the Contractor, one from the workers’ compensation/general liability insurance carrier and a representative of subcontractor supervision. The employee members (4) shall be selected from the various subcontractor trades on a voluntary basis or by nomination to serve a minimum of one year each.

The Contractor’s Safety Manager shall serve as the Safety Improvement Team advisor and is responsible for providing meeting agendas and minutes, giving assignments to the committee, and publicizing committee accomplishments. Safety Improvement Team meeting minutes and attendance roster shall be maintained.

The Contractor’s Safety Manager is responsible for assuring that Committee members are adequately trained to perform their duties and responsibilities.

The Contractor’s Safety Manager is responsible for assuring that subcontractors with 25 or more employees establish their own Safety Improvement Team commensurate with the NRS requirements.

The primary purpose of the Safety Improvement Team is to evaluate safety and health program effectiveness, suggestions, hazard reports, hotline reports, etc., and to provide suggestions and recommendations to improve workplace safety.

Additional duties include advising and educating employees in safe working practices, investigating accidents and their causes, recommending preventative measures, inspecting work areas, and other duties as assigned.

Meetings shall be held at least monthly, discussion items shall include:
- Inspection Reports
- Accident Reports
- The safety of construction methods and practices
- Review and make recommendations on employee hazard reports, hotlines, etc.

The Safety Improvement Team members will receive their regular rates of pay while performing Safety Improvement Team duties. Time spent performing Safety Improvement Team duties shall be documented using normal time reporting procedures.

END OF EXHIBIT D
EXHIBIT E
TO
LUMP SUM CONSTRUCTION CONTRACT
FOR
AIRFIELD MAINTENANCE TEMPORARY FACILITY - CONSTRUCTION

BY AND BETWEEN
THE MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY
AND
(CONTRACTOR NAME)

FAA REQUIRED CONTRACT PROVISIONS

Federal laws and regulations require that recipients of federal assistance (Sponsors) include contract provisions in certain contracts, requests for proposals, or invitations to bid. The provisions are as follows:

1. Title VI Clauses for Compliance with Nondiscrimination Requirements (FAA Provision A6.3.2). (Reference: 49 USC § 47123)

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the “contractor”) agrees as follows:

1. **Compliance with Regulations:** The contractor (hereinafter includes consultants) will comply with the Title VI List of Pertinent Nondiscrimination Acts And Authorities, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.

2. **Non-discrimination:** The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Nondiscrimination Acts and Authorities, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR part 21.

3. **Solicitations for Subcontracts, Including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the contractor of the contractor’s obligations under this contract and the Nondiscrimination Acts And Authorities on the grounds of race, color, or national origin.

4. **Information and Reports:** The contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the sponsor or the Federal Aviation Administration to be pertinent to ascertain compliance with such Nondiscrimination Acts And Authorities and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the contractor will so certify to the sponsor or the Federal Aviation Administration, as appropriate, and will set forth what efforts it has made to obtain the information.

5. **Sanctions for Noncompliance:** In the event of a contractor’s noncompliance with the Non-discrimination provisions of this contract, the sponsor will impose such contract sanctions as it or the Federal Aviation Administration may determine to be appropriate, including, but not limited to:

   a. Withholding payments to the contractor under the contract until the contractor complies; and/or
b. Cancelling, terminating, or suspending a contract, in whole or in part.

6. Incorporation of Provisions: The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as the sponsor or the Federal Aviation Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the contractor may request the sponsor to enter into any litigation to protect the interests of the sponsor. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

2. Title VI List of Pertinent Nondiscrimination Acts and Authorities (FAA Provision A6.3.6). During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the “contractor”) agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

(a) Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d et seq., 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin);
(b) 49 CFR part 21 (Non-discrimination In Federally-Assisted Programs of The Department of Transportation—Effectuation of Title VI of The Civil Rights Act of 1964);
(c) The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601), (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
(d) Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 et seq.), as amended, (prohibits discrimination on the basis of disability); and 49 CFR part 27;
(e) The Age Discrimination Act of 1975, as amended, (42 U.S.C. § 6101 et seq.), (prohibits discrimination on the basis of age);
(f) Airport and Airway Improvement Act of 1982, (49 USC § 471, Section 47123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex);
(g) The Civil Rights Restoration Act of 1987, (PL 100-209), (Broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms “programs or activities” to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);
(h) Titles II and III of the Americans with Disabilities Act of 1990, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131 – 12189) as implemented by Department of Transportation regulations at 49 CFR parts 37 and 38;
(i) The Federal Aviation Administration’s Non-discrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
(j) Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures non-discrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;
(k) Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);
(l) Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. 1681 et. seq.).

All contracts and subcontracts that result from this solicitation incorporate by reference the provisions of 29 CFR part 201, the Federal Fair Labor Standards Act (FLSA), with the same force and effect as if given in full text. The FLSA sets minimum wage, overtime pay, recordkeeping, and child labor standards for full and part time workers.

The Contractor has full responsibility to monitor compliance to the referenced statute or regulation. The Contractor must address any claims or disputes that arise from this requirement directly with the U.S. Department of Labor – Wage and Hour Division.

All contracts and subcontracts that result from this solicitation incorporate by reference the requirements of 29 CFR Part 1910 with the same force and effect as if given in full text. Contractor must provide a work environment that is free from recognized hazards that may cause death or serious physical harm to the employee. The Contractor retains full responsibility to monitor its compliance and their subcontractor’s compliance with the applicable requirements of the Occupational Safety and Health Act of 1970 (20 CFR Part 1910). Contractor must address any claims or disputes that pertain to a referenced requirement directly with the U.S. Department of Labor – Occupational Safety and Health Administration.

The Contractor agrees that it will comply with pertinent statutes, Executive Orders and such rules as are promulgated to ensure that no person shall, on the grounds of race, creed, color, national origin, sex, age, or disability be excluded from participating in any activity conducted with or benefiting from Federal assistance.

This provision binds the contractor and sub-tier contractors from the bid solicitation period through the completion of the contract. This provision is in addition to that required of Title VI of the Civil Rights Act of 1964.

END OF EXHIBIT E
DIVISION 0 – SECTION 00605

CERTIFICATE OF SECRETARY

AS TO RESOLUTION ADOPTED BY BOARD OF DIRECTORS

On _______________________

I, ____________________________, hereby certify that I am the duly authorized Secretary
of ____________________________, charged with keeping the records and the seal of
said Corporation, and that the following is a true and correct copy of a resolution adopted at a meeting of the Board
of Directors of the Corporation duly held on ____________________________, which resolution
is now in full force and effect.

RESOLVED, that ________________________, (President, Vice President) of ____________________________
is hereby authorized to execute contracts, performance bonds and labor materials bonds on behalf of the
Corporation.

WITNESS my hand as Secretary, and the seal of the Corporation this _____ day of ________________, 20____.

__________________________________________
Secretary

BEFORE ME, a notary public of the state and county mentioned, personally appeared
__________________________________________, with whom I am personally acquainted, and who, upon oath,
acknowledged such person to be ____________________________, and officer authorized to execute the
instrument, of ____________________________, the within named bargainor, a corporation, and that such
officer, as such ____________________________, executed the foregoing instrument for the purposes therein
contained, by personally signing their name of the corporation as _____________________________.

WITNESS my hand and seal, at office, this __________ day of ____________________, 20____.

__________________________________________
Notary Public
(SEAL)

My Commission Expires: ______________________

END OF SECTION 00605
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PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that

as Principal, hereinafter called Contractor or Principal, and

as Surety, hereinafter called Surety, are held and firmly bound unto

MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY

hereinafter called Owner, or Obligee, in the amount of ______________________ Dollars, for the performance whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly, severally, and solidarily, firmly by these presents.

The penal sum of this Performance Bond shall be increased by the amount that the Contract, as herein below defined, is increased during the term of the Performance Bond.

WHEREAS, Principal has entered into a written agreement with the Owner (hereinafter referred to as “Contract”) for:

in accordance with Drawings and Specifications prepared and to be prepared by

ANF ARCHITECTS, INC.

which Contract is by reference incorporated herein and made a part hereof.

WHEREAS, the Surety represents that it possesses an A-VIII rating or higher in the most recent edition of Best Insurance Reports and that Surety is authorized to execute and deliver bonds in the State of Tennessee.

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Principal shall promptly and faithfully perform each and every term, condition, obligation and provision of said Contract, including but not limited to, completion and delivery of the work described in the Contract within the scheduled time as such time may be extended from time to time as permitted in the Contract, then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

The Surety shall within sixty (60) days from notice by Owner to the Surety, either

1. Proceed to complete the performance of the Contract timely in accordance with the terms and conditions of the Contract, including but not limited to:

   (a) The responsibilities of the Principal for completion of the Work, correction of defective Work, warranty Work and payment for the Work; and

   (b) Payment of liquidated damages specified in the Contract, or

2. Pay to the Owner the amount of its costs and damages, up to the penal sum of this bond, that would be owed by the Principal to the Obligee under the Contract to complete the obligations of the Principal, including any liquidated damages that may be due and any additional legal, design professional or delay costs resulting from the Contractor’s default less any remaining contract funds.
The Surety hereby waives notice of any alteration or extension of time made by the Owner. The Surety hereby waives notice of any change in the scope of the Contract.

Any suit under this Performance Bond must be instituted in a court of competent jurisdiction, in Shelby County, Tennessee, and not elsewhere within four (4) years from Substantial Completion as defined in the Contract.

No right of action shall accrue on this bond to or for the use of any person, partnership or corporation other than the Owner or the heirs, executors, administrators, successors or assigns of the Owner.

Notice of claim to the Surety under the bond shall be sent to the following address:

SIGNED AND SEALED this ___ day of _____________________, 20____.

PRINCIPAL
TITLE: ________________________________

SURETY
TITLE: ________________________________

ADDRESS

CITY                              STATE       ZIP CODE
LABOR AND MATERIAL PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: that

as Principal, hereinafter called Contractor or Principal, and

as Surety, hereinafter called Surety, are held and firmly bound unto

MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY

hereinafter called Owner or Obligee, in the amount of _______________________ Dollars, for the payment

whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly,

severally, and solidarily, firmly by these presents.

The penal sum of this Labor and Material Payment Bond shall increase by the amount that the Contract, as

herein below defined, is increased during the term of the Labor and Material Payment Bond.

WHEREAS, Principal has entered into a written agreement with the Owner (hereinafter referred to as the

“Contract”) for:

in accordance with Drawings and Specifications prepared and to be prepared by

ANF ARCHITECTS, INC.

which Contract is by reference incorporated herein and made a part hereof.

WHEREAS, the Surety represents that it possesses an A--.VIII rating or higher in the most recent edition of

Best Insurance Reports and that Surety is authorized to execute and deliver bonds in the State of Tennessee.

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Principal shall promptly

and faithfully complete the work as defined in the Contract free and clear of all claims, liens and any other

contractual, statutory, or legal rights the Claimants, as hereinbelow defined, may have for the payment of amounts

owed in connection with or arising out of the Contract (“Claims”); and the Principal shall make prompt payment to

all persons having a Claim or lien pursuant to any statute or law of the State of Tennessee, then this obligation shall

be void; otherwise, it shall remain in full force and effect.

1. A Claimant is defined as one having a contract with the Principal or a subcontractor or supplier of

any tier for labor, materials, equipment used or reasonably required for use in the performance of

the Contract, labor and materials being construed to include water, power, gas, light, heat, oil,
gasoline, or telephone services applicable to the Contract.

2. No suit or action shall be commenced by any Claimant:

a) After the expiration of two (2) years following the date which Substantial Completion as

defined in the Contract is achieved. However, if any limitation embodied in this bond is

prohibited by any law controlling the construction hereof, such limitation shall be

deemed to be amended so as to be equal to the minimum period of limitation permitted

by such law.
b) Other than in a court of competent jurisdiction in Shelby County, Tennessee, and not elsewhere.

3. Upon written notice to Surety from the Owner, Surety shall, within forty-five (45) days after receipt of said notice, pay or cause to be paid all Claims made or if the Surety contests in good faith the validity of any Claim, the Surety shall, within forty-five (45) days after receipt of said notice, cause bonds to be posted in an amount and form acceptable to Obligee to bond off such Claims. Surety shall indemnify, defend and hold Obligee harmless from any such Claims together with any and all attorney's fees, costs and expenses or liability in any manner arising out of or in connection therewith.

4. The Surety hereby waives notice of any alteration or extension of time made by the Owner. The Surety hereby also waives notice of any changes in the scope of the Contract, including changes to the contract amount.

Notice of claim to the Surety under the bond shall be sent to the following address.

SIGNED AND SEALED this the _______ day of ____________, 20____.

___________________________________________
PRINCIPAL

TITLE: ____________________________________

___________________________________________
SURETY

TITLE: ____________________________________

___________________________________________
ADDRESS

___________________________________________
CITY                         STATE      ZIP CODE
APPLICATION FOR PAYMENT NO. ____

TO: MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY

REGARDING CONTRACT FOR: MSCAA PROJECT NO. 14-1379-10-01
AIRFIELD MAINTENANCE TEMPORARY FACILITY – CONSTRUCTION

CONTRACTOR: CONTRACTOR

FOR WORK ACCOMPLISHED FROM __ TO __

STATUS OF CONTRACT:

ORIGINAL CONTRACT PRICE: $0.00

APPROVED CONTRACT AMENDMENTS:

<table>
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<tr>
<th>No.</th>
<th>Approved</th>
<th>MM/DD/YYYY</th>
<th>Adds 0 days</th>
<th>$0.00</th>
</tr>
</thead>
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<td>MM/DD/YYYY</td>
<td>Adds 0 days</td>
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<td></td>
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<tr>
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<td>MM/DD/YYYY</td>
<td>Adds 0 days</td>
<td>$0.00</td>
<td></td>
</tr>
<tr>
<td>No. 6 Approved</td>
<td>MM/DD/YYYY</td>
<td>Adds 0 days</td>
<td>$0.00</td>
<td></td>
</tr>
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</table>

Total time extension: Adds 0 days

TOTAL AMENDED CONTRACT PRICE $0.00

NOTICE TO PROCEED DATE: TOTAL INSTALLED TO DATE

ORIGINAL COMPLETION DATE:

AMENDED COMPLETION DATE: plus STORED MATERIALS

REMARKS: previously stored materials

less PREVIOUSLY CERTIFIED FOR PAYMENT

equals AMOUNT DUE THIS APPLICATION

$0.00

CONTRACTOR'S CERTIFICATION:

The undersigned Contractor certifies that (1) all previous progress payments received from Owner on account of Work done under the Contract referred to above have been applied to discharge in full all obligations of Contractor incurred in connection with Work covered by prior Application for Payment number 0 through __ inclusive; and (2) title to all materials and equipment incorporated in said Work or otherwise listed or covered by this Application for Payment will pass to Owner at time of payment free and clear of all liens, claims, security interests and encumbrances (except such as covered by Bond acceptable to Owner). Progress status is as described in schedule under monthly construction payment request.

Dated: MM/DD/YYYY

State of: Tennessee

County of: Shelby

Subscribed and sworn to before me this _____ day of ____________, YYY.

Notary Public:

My Commission Expires:

CONTRACTOR: Contractor

BY: Signatory

Title

PROGRAM MANAGER'S RECOMMENDATION:

Payment of the above AMOUNT DUE THIS APPLICATION to CONTRACTOR is recommended.

DATED:

BY: Program Manager Signatory
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DIVISION 0 - SECTION 00640

Business Diversity Monthly Compliance Report

MSCAA Project. Name and Number: Airfield Maintenance Temporary Facility – Construction
(14-1379-10-01)    Date: ________________

To: Memphis Shelby County Airport Authority  From: Name:______________________________
    Attn: ReGina Armstrong                  Company: ________________________________
    2492 Winchester Rd., Ste. 113        Address: ________________________________
    Memphis, TN  38116-3856          Ph: ________________

Owner Gender & Ethnicity: ____________

For the month ending ________________, I certify that the current payment for this contract was satisfied by
the means shown below:

<table>
<thead>
<tr>
<th>Name, Address, &amp; Phone No. of All Subcontractors</th>
<th>Company Code</th>
<th>Current Payment Amt.</th>
<th>Check No.</th>
<th>Total for Calendar Year</th>
<th>Cumulative Total to Date</th>
<th>Gender</th>
<th>Ethnicity</th>
</tr>
</thead>
</table>

PLEASE PROVIDE PROOF OF YOUR PAYMENT AMOUNT TO YOUR SUB CONTRACTORS.

Signed: ________________________________    Title: ________________________________

Gender Code: M=Male, F=Female    Proof of Payments: Copy of Check, or Copy of E-Payment Confirmation

Company Code: DBE =Disadvantaged Business Enterprise, MOC=Majority Owner Company, INC=Incorporated/Partnership,
CM/WBE = M/WBEs the owners of which have been certified as having a personal net worth less than $1.32mil

Ethnicity Code: B=Black, H=Hispanic, N=Native American, AA=Asian American, APA=Asian Pacific American, SCA=Sub
Continent Asian, NM=Non-Minority, C=Caucasian & O=Other

Issued for Bid 00640
Page 1
DIVISION 0 – SECTION 00765
SUPPLEMENTAL PROVISIONS

00765-01 CONTRACTOR'S FIELD OFFICE

A Contractor's field office is required for this project. Contractor shall keep on file at the project site copies of contract drawings, shop drawings, specifications, and other records pertaining to the project, in good condition, and readily accessible to the Contractor, Owner, Engineer, and all parties concerned. If the Contractor elects to operate a field office, it may do so at no additional compensation.

00765-02 PROTECTION OF PERSONS AND PROPERTY

00765-02.1 The Contractor shall be responsible for initiating, maintaining and supervising safety and anti-substance abuse precautions and programs in connection with the Work, and shall provide all protection to prevent injury to all persons involved in any way in the Work and all other persons, including, without limitation, the employees, agents, guests, visitors, invitees and licensees of the Owner who may visit or be affected thereby. These precautions shall include, but in no event be limited to: the posting of danger signs and personal notification to all affected persons of the existence of a hazard of whatever nature; the furnishing and maintaining of necessary traffic control barricades and flagman services; the use, or storage, removal and disposal of required explosives or other hazardous materials only under the supervision of qualified personnel and after first obtaining permission of all applicable governmental authorities; and the maintenance of adequate quantities of both hose and operable fire extinguishers at the job site. The Contractor shall set forth in writing its safety and anti-substance abuse precautions and programs in connection with the Work and, if requested by the Owner, submit the same to the Owner for review. The Owner may, but shall not be obligated to, make suggestions and recommendations to the Contractor with respect thereto.

00765-02.2 All Work, whether performed by the Contractor, its Subcontractors or Sub-Subcontractors, or anyone directly or indirectly employed by any of them, and all equipment, appliances, machinery, materials, tools and like items incorporated or used in the Work, shall be in compliance with, and conform to: (a) all applicable laws, ordinances, rules, regulations and orders of any public, quasi-public or other governmental authority relating to the safety of persons and their protection against injury, specifically including, but in no event limited to, the Federal Occupational Safety and Health Act of 1970, as amended, and all rules and regulations now or hereafter in effect pursuant to said Act; and (b) all codes, rules, regulations and requirements of the Owner and its insurance carriers relating thereto. In the event of conflicting requirements, the more stringent shall govern.

00765-02.3 The Contractor shall designate a responsible member of its organization at the Job site as the Project Safety Officer, whose duties it shall be to enforce the Contractor's safety and anti-substance abuse programs, to assure compliance with the Contract Documents and to prevent accidents. This person shall have enforcement authority and be responsible for carrying out the relevant duties and be designated in writing by the Contractor and approved by the Owner. The Contractor shall further cause each of its Subcontractors and Sub-Subcontractors to designate a responsible supervisory representative to assist the Contractor's Project Safety Officer representative in the performance of their duties as aforesaid.

00765-02.4 Should the Contractor fail to provide a safe area for the performance of the Work or any portion thereof, the Owner shall have the right, but not the obligation, to suspend Work in the unsafe area. All costs of any nature (including, without limitation, overtime pay) resulting from the suspension, by whomsoever incurred, shall be borne by the Contractor.

00765-02.5 The Contractor shall provide to each worker on the job site the proper safety equipment for the duties being performed by that worker and will not permit any worker on the job site who fails or refuses to use the same. The Owner shall have the right, but not the obligation, to order the Contractor to send a worker home for the day or to discharge a worker for their failure to comply with safe practices or anti-substance abuse policies, with which order the Contractor shall promptly comply.
00765-02.6 The Contractor shall indemnify the Owner, from and against any and all liability, public or private, penalties, contractual or otherwise, losses, damages, costs, attorney's fees, expenses, causes of action, claims or judgments resulting either in whole or in part from any failure of the Contractor, its Subcontractors or Sub-Subcontractors or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, to comply with the provisions of the Contract. The Contractor shall not be relieved of its responsibilities under the Contract, should the Owner act or fail to act pursuant to its rights hereunder, nor shall the Owner thereby assume, nor be deemed to have assumed, any responsibilities otherwise imposed upon the Contractor by this Construction Contract, in any manner whatsoever.

00765-02.7 The Contractor shall, throughout the performance of the Work, maintain adequate and continuous protection of all Work and temporary facilities against loss or damage from whatever cause, shall protect the property of the Owner and third parties from loss or damage from whatever cause arising out of the performance of the Work and shall comply with the requirements of the Owner, its designated agents, and its insurance carriers and with all applicable laws, codes, rules and regulations with respect to the prevention of loss or damage to property as a result of fire or other hazards. The Owner may, but shall not be required to, make periodic patrols of the job site as a part of its normal security program. In such event, however, the Contractor shall not be relieved of its aforesaid responsibilities.

END OF SECTION 00765
DIVISION 0 – SECTION 00801

AIRPORT CONSTRUCTION SAFETY REQUIREMENTS

PART 1  GENERAL

1.01  SUMMARY

A. This section contains the minimum level of safety requirements for construction projects at Memphis International Airport, General DeWitt Spain Airport, and/or Charles W. Baker Airport.

B. Related work:

1. Other contract documents affecting construction safety include, but are not limited to, the DIVISION 0 AND DIVISION 1 specifications.

PART 2  PRODUCTS

Not used.

PART 3  EXECUTION

3.01  CONTRACTOR PERSONNEL SAFETY ORIENTATION

A. The Contractor shall be responsible for briefing all construction personnel on the requirements contained in this section prior to their working in the construction area and at periodic intervals throughout the course of the contract. These briefings will be documented in writing.

3.02  SCHEDULING WORK

A. See Specification section 01100, SEQUENCE OF CONSTRUCTION & LIQUIDATED DAMAGES.

B. See General Provision Section 80, Paragraph 80-04, Limitation of Operations.

3.03  CONSTRUCTION SECURITY

A. See Specification section 00802, AIRPORT SECURITY REQUIREMENTS.

3.04  LIMITATION ON CONSTRUCTION

A. The limits of construction, material storage areas, equipment parking and other areas defined as available for the contractor's exclusive use during construction shall be identified and defined by the contractor prior to starting work on the project. Temporary barricades, flagging and flashing caution lights may be required at access points, taxiway crossings and pavement tie-ins. The type markings, barricades and flashing caution lights are designated on the construction plans and must be inspected and approved by the Airport Authority.

B. The Contractor shall store all materials and park construction equipment, when not in use only in the areas designated on the plans or during the pre-construction conference.

C. Stockpiling of dirt and construction materials shall be constrained in a manner preventing movement resulting from jet blast or wind in excess of 10 knots.

D. Construction debris, waste, wrappings or loose material capable of causing damage to aircraft engines, propellers, or landing gear shall not be allowed on active aircraft movement areas. Material meeting this criteria shall be contained and removed immediately from the AOA.
E. Open flame, welding, or torch cutting operations are prohibited in the construction area unless written permission has been given by the Airport Authority and adequate fire and safety precautions have been taken.

F. The use or possession of explosives is prohibited on Airport property.

G. Extensive stockpiles of construction materials will not be permitted near runway ends, runway edges, taxiways or aircraft parking aprons.

H. Excavation and open trenches may be permitted within runway safety areas and up to the edge of structural pavement on taxiways and aprons, on a case-by-case basis, i.e. cable trenches, pavement tie-ins, etc.; but only with prior approval of the Owner and, where required, the FAA.

I. Hazardous areas, into which no part of an aircraft may enter, (i.e., excavations, open trenches, material stockpiles, etc.) must be permanently delineated by use of barricades with alternate orange and white markings. The barricades are to be supplemented with orange flags (20x20 inch minimum) made and installed so that they are always in the extended position and properly oriented. For nighttime use, the barricades are supplemented with flashing yellow lights. Light intensity and barricade spacing must adequately delineate the hazardous area. Flare pots are prohibited.

Note: The Contractor shall designate an individual by name who is on call 24 hours per day for emergency maintenance of airport hazard lighting and barricades.

J. FAA approval is required in advance of scheduled operation of any crane or other construction equipment with top elevation exceeding 300 feet mean sea level or that will penetrate any navigable surface as defined under FAR PART 77. Advance notification of intended use will be provided by the Owner well in advance of intended use.

3.06 CONSTRUCTION VEHICLE TRAFFIC

A. Access to the construction site is as shown on the plans or as directed by the Owner. No other access point is authorized unless designated in writing by the Airport Authority. Construction traffic will operate only on designated haul routes within the construction area limits.

B. Drivers of construction vehicles will be knowledgeable of construction routes or will be escorted by other Contractor or Owner designated personnel who are knowledgeable.

C. The Contractor will be responsible for traffic control in the various construction areas of the work site. The Contractor will not permit unauthorized personnel or vehicles on the construction site.

D. The Contractor shall be responsible for immediate cleanup of any debris deposited along construction routes, as result of his construction traffic.

E. Directional signing at the construction access gate and along the delivery route to work site temporary storage areas shall be as designated and approved by the Owner.

F. Construction vehicle identification shall be as prescribed in Specification Section 00802, AIRPORT SECURITY REQUIREMENTS.

G. No construction vehicle is authorized on any active AOA pavement surface or to enter runway safety areas without specific authorization from the Owner.
3.07 REPORTING PROPERTY DAMAGE OR PERSONNEL INJURY

A. All persons involved in any accident whether personal injury, aircraft or automotive, occurring on Airport property, shall make a full report to the Airport Police (922-8298) as soon after the accident as possible. The report shall include, but not be limited to, the names, addresses of all principals and witnesses, if known, and a statement of the facts. Construction accidents fall under this category.

B. In the event of personnel injury requiring ambulance response, the Airport Police Dispatcher, upon notification, telephone 922-8333, will call the ambulance and arrange Airport Police escort to the injury site. A written report will be prepared by the Airport Police after the injury is treated.

END OF SECTION 00801
DIVISION 0 – SECTION 00802
AIRPORT SECURITY REQUIREMENTS

PART 1  GENERAL

1.01 CONTRACTORS SECURITY AND VEHICLE PROCEDURES OVERVIEW
A. This overview outlines procedures concerning Airport security requirements, vehicle operation, and maintenance requirements for contractors at Memphis International Airport or any airport owned and operated by the Memphis-Shelby County Airport Authority. The sponsor Memphis-Shelby County Airport Authority (Airport Authority), airline, tenant, or concessionaire at the Airport who has hired the contractor is responsible for ensuring the contractor understands and complies with all the rules and regulations. This is a consolidated synopsis of the contractor requirements from the Airport Security Program and the Airport Rules and Regulations.

1.02 DEFINITIONS
A. Aircraft - shall mean any contrivance known or hereinafter invented, used or designed for navigation of or flight in the air.
B. Air Operations Area (AOA) - that part of the Airport used or intended to be used for landing, taking off, surface maneuvering, loading, unloading, or servicing the aircraft.
C. Airport - shall mean the Memphis International Airport and/or the General DeWitt Spain Airport and/or the Charles W. Baker Airport – where applicable.
D. Airport Restricted Area - area of Memphis International Airport that is not intended for public uses or access. These are areas designated by the Airport Authority as restricted areas and clearly identified with signs designating those areas as "RESTRICTED AREA." The restricted area also includes the AOA.
E. AOA Driver's Permit - permit issued by the Airport Authority for operating unescorted motor vehicles on the AOA.
F. Construction Restricted Area - any area, inside or outside of the Airport Restricted Area, which is fenced, or in some like manner defined by the Contractor. The Contractor is responsible for the security of the Construction Restricted Area.
G. Director - shall mean the Director of Operations and Public Safety or his duly authorized representatives.
H. Job Site - a predetermined geographic area with specific boundaries established by the Airport Authority.
I. Movement Area - runways, taxiways, and other areas of the Airport used for taxiing, takeoff, and landing of aircraft, except loading ramps and parking areas.
J. Personal Escort - remaining within sight of the individual under escort at all times while in the Airport restricted areas at a distance not to exceed 20 feet.
K. Public Area - any area within Airport facilities open to the general public.
L. SIDA - Security Identification Display Area.
M. **Unescorted Identification Badge** - pictured identification badge issued by the Airport Authority, which allows bearer to enter Airport Restricted Areas where there is a job related need.

N. **Vehicle Escort** - means the following of an authorized escort vehicle into the Airport Restricted Areas.

PART 2  PRODUCTS

(No products are required in this Section.)

PART 3  EXECUTION

3.01 AMENDMENTS AND SPECIAL NOTICES

A. The Contractor will be bound by any future amendments, additions, deletions, or corrections of the Airport Rules and Regulations promulgated by the Airport Authority, as dictated by changes in Federal Transportation Security Administration (TSA) regulations, as dictated by changes in Federal Aviation Administration (FAA) regulations, or safety requirements at Memphis International Airport or any airport owned and operated by Memphis-Shelby County Airport Authority.

B. Special regulations, notices, memoranda, or directions of an operations nature of interest to persons engaged in business with the Airport Authority, as generated by the Director, shall be issued under the authority of the Airport Regulations and shall have the same effect as the Airport Rules and Regulations.

C. The Director is authorized to interpret and construe these regulations wherever necessary, either by directions of general or specific application, and his interpretation and construction should be deemed a part of the regulations and binding upon all persons.

3.02 ENFORCEMENT AND COMPLIANCE WITH AIRPORT REGULATIONS

A. The uniformed Airport Police Officers of the Airport Authority and other representatives as designated by the Director are empowered to require compliance with Airport Rules and Regulations, ordinances of the City of Memphis, laws of the State of Tennessee, and federal rules and regulations. No authority is either hereby expressed or implied, however, that would permit any individual other than the Director to change, alter, or amend Airport Rules and Regulations.

B. It shall be unlawful for any person to do or commit any act forbidden herein or fail to perform any act required by Airport Rules and Regulations.

3.03 SCOPE

A. All users of and persons on Airport property shall be governed by the Airport Rules and Regulations and directions of the Director. Airport Rules and Regulations are subject to change by the Airport Authority Board of Directors at any time.

B. Airport Rules and Regulations are not intended to amend, modify or supersede federal, state, or local laws or regulations.

C. If any portion of the Airport Rules and Regulations shall be invalid or unenforceable, all other portions shall remain in effect and be construed to achieve the purposes hereof.
3.04 VEHICLE PARKING AND OPERATION

A. General.

1. All streets on the Airport shall have the status of dedicated city streets for the purpose of traffic enforcement.

2. Motor vehicles operated on the public roadways and parking lots of the Airport shall be governed by the traffic ordinance of the city and state laws applicable and, in addition thereto, the following regulations shall be applicable.


1. The driver of any motor vehicle operating within the Airport boundary shall comply with the lawful orders, signals or directives of Airport Police Officers.

2. All drivers operating motor vehicles within the Airport boundary must possess a valid state driver's license.

3. Only drivers possessing a valid Airport Driver's Permit issued by the Airport Authority are authorized to operate any motorized vehicle unescorted on the AOA of Memphis International Airport. (The Security Coordinator may designate certain construction areas as void of this requirement)

4. Riding on trailer hitches, fenders, or on any portion of a vehicle not equipped with proper seats, running boards, or handholds is prohibited. Standing up in a moving motor vehicle, riding outside of a moving motor vehicle, or riding with arms or legs protruding from the body of the vehicle is prohibited.

5. All vehicle lights shall be lighted during the hours of darkness or during the time of reduced visibility when said vehicle is being operated in the restricted area.

6. No person shall operate any motorized vehicle when vision is restricted due to the load being carried, or for any other reason.

7. No person under the influence of alcoholic beverages or narcotic drugs shall operate any motor vehicle or motorized equipment on the Airport.

8. It shall be the responsibility of the operator to ascertain that the vehicle is in good operating condition. Operators are required to check proper operation of the vehicle's brakes before commencing any operation on airport.

9. Vehicles dripping oil, gasoline, water, or debris of any kind, shall be restricted.

10. Pedestrians and aircraft shall at all times have right-of-way over vehicular traffic. All vehicles must pass to the rear of taxiing aircraft.

C. Radio Equipment.

1. All vehicles operating in the aircraft movement area must be equipped with a two-way radio and, when the movement area is being controlled, be in continuous communication with the Control Tower, unless being escorted by authorized escort vehicle.

2. The installation of two-way radios does not permit the operation of vehicles on the Airport without proper authorization of the Director.
D. Contractor Employee Parking.

1. Employee parking is not available on the job site. The Contractor must provide for remote parking for employees and transport them to the job site.

E. Authorized Contractor Vehicles.

1. Unless otherwise authorized, the Contractor and each subcontractor shall be permitted to have no more than one (1) vehicle per trade on the job site. All Contractor vehicles authorized access to Airport restricted areas shall be:
   
a. Owned or hired by the Contractor or subcontractor;
   b. Insured under company policy;
   c. On a pre-approved list; and
   d. Marked in accordance with Airport regulations.

2. Passenger type vehicles, including pickup trucks, must have the company name displayed on each front door of the vehicle. The company name must be readable, but at a minimum (the letter size shall be 4.5”). The vehicle must display the appropriate Airport registration decal. Specialized equipment such as bulldozers, cranes, etc., will be exempted from this requirement.

3. Cranes used during daylight hours shall have a red flag affixed to the top of boom. Cranes shall have a red obstruction light on the top of boom when used at night. Crane booms shall not be left erect when not in use or following end of workday.

F. Emergency Vehicles and Conditions.

1. Any person operating a motor vehicle on the air operations area shall immediately yield the right-of-way to the police, ambulance, fire department, or other emergency vehicle giving an audible or visual signal or as otherwise directed by an Airport law enforcement officer or fire/rescue department personnel.

2. Emergency conditions existing on the air operations area will not mitigate or cancel existing regulations for non-emergency vehicles in areas not affected by the emergency.

3. Under emergency conditions such as an aircraft accident or fire, access to the scene is denied to all vehicles or persons except those whose duties require their presence. Permits and licensing shall be rendered invalid in the area of emergency conditions and the Airport Authority shall determine when normal operations may be resumed.

G. Passing Aircraft.

1. All vehicles shall pass to the rear of taxiing aircraft and shall pass no nearer than 20 feet horizontal distance.

H. Passenger Concourse.

1. No motorized vehicles or carts of any type shall be used in any concourse or terminal lobby unless approved by the Director.

2. No vehicle or motorized equipment shall be driven under concourses except at authorized vehicle pass-throughs designated by the Director.
I. AOA Driving Lanes.

1. Vehicles on the aircraft parking apron at the terminal and air cargo buildings shall be operated within the marked driving lanes and in compliance with marked traffic control signs except for the following:
   a. Authorized vehicles engaged in parking apron repair and inspection; and
   b. Vehicles exceeding a width of 12 feet which shall follow marked lanes as closely as possible.

2. Vehicles shall enter and exit designated driving lanes at a point nearest to the origin and destination.

3. No vehicles or equipment shall be parked in a manner as to obstruct any portion of the driving lanes.

J. Taxiing Aircraft.

1. Vehicles shall yield to taxiing aircraft or aircraft under tow.

K. Speed Limits.

1. No person shall operate a motor vehicle or other motorized equipment at a speed greater than the following:
   a. Five miles per hour in designated drives under the terminal;
   b. Fifteen miles per hour on paved service roads in the vicinity of the terminal and air cargo buildings; or
   c. Twenty-five miles per hour on all aprons or ramps unless the area has an otherwise posted speed limit.
   d. Fifteen miles per hour on all aprons or ramps at General DeWitt Spain Airport and Charles W. Baker Airport unless the area has an otherwise posted speed limit.

L. Inspection of Vehicles.

1. Contractors authorized to operate vehicles on the air operations area shall be responsible for ensuring that each motor vehicle is inspected at least each 12 months by a qualified mechanic, is in good mechanical condition and has all the required safety equipment.

2. The Contractor shall remove from service any vehicle, which, in the opinion of the Director, is defective and in need of repair and said vehicle will not be returned to service until properly repaired.

M. Violations of Restricted Area Traffic Regulations.

1. The penalties for a violation of restricted area traffic regulations shall be as follows:
   a. First offense within any 12-month period: retraining;
   b. Second offense within any 12 month period: retraining and fine not to exceed $50.00;
   c. Third offense within any 12 month period: retraining and fine not to exceed $100.00; and
   d. Fourth offense within any 12 month period: revocation of privilege to drive in restricted area (unescored or escorted).
2. The above set penalties do not negate the right of the Airport Authority to immediately revoke driving privileges, dependent upon the seriousness of the violation.

N. Vehicle Registration.

1. The Contractor shall list all construction vehicles requiring passage through the access gate on the Construction Vehicle Registration Form, Exhibit D, and submit it to the Airport Authority prior to the start up date of the Contract. The Contractor must utilize the Construction Vehicle Registration Form provided by the Manager of Construction Security; photocopies of this Exhibit D are not acceptable.

2. Each vehicle approved will be issued a windshield decal, which must be affixed to the driver's side of the windshield. This decal is not transferable. Only those vehicles so marked will be allowed through the access gate with the following exceptions:
   a. dump trucks;
   b. concrete trucks;
   c. vehicles making deliveries; and
   d. cranes, tractor, etc.

O. Delivery Vehicles.

1. Each day the Contractor shall give the access gate guard a written list of deliveries expected. No delivery will be cleared into the restricted area unless it is on the list or the construction supervisor is contacted for clearance.

3.06 GENERAL INFORMATION

A. Access to Public Facilities.

1. Contractor employees are not authorized to use public facilities, (i.e., rest rooms, eating facilities, boarding gate hold rooms or other public areas of the terminal), except as specifically authorized by the Airport Authority and as necessary for access to job site.

2. Contractors shall provide adequate rest room and break facilities within the job site and staging areas as appropriate.

3. All public areas authorized for use by the Contractor's employees are to be kept in a clean and sanitary manner, free of all construction debris.

B. Accident Reports.

1. All persons involved in any accident whether personal injury, aircraft or automotive, occurring on Airport property, shall make a full report to the Airport Police (922-8298) as soon after the accident as possible. The report shall include, but not be limited to, the names, addresses of all principals and witnesses, if known, and a statement of the facts. Construction accidents fall under this category

2. To request paramedics call 922-8333.

C. Airport Rules and Regulations.

1. The Contractor shall conform to applicable public portions of the "Airport Rules and Regulations" of the Airport Authority, more specifically identified as follows:
   a. Section 100 General;
b. Section 200 Personal Conduct and Carrying on Business Activities;
c. Section 500 Regulation of Vehicular Traffic;
d. Section 700 Penalty Clauses; and
e. Section 800 Hearing and Appellate Procedures.

2. The Contractor shall conform to "Memphis-Shelby County Airport Authority's Air Operations Area Rules and Regulations and its Airport Security Program."

D. Alcoholic Beverages and Narcotic Drugs.

1. No person shall have any alcoholic beverages or narcotic drugs on Airport property.

E. Damages.

1. Contractors shall be fully responsible for all damages to buildings, equipment, real property and appurtenances in the ownerships or custody of the Airport Authority caused by negligence, abuse or carelessness on the part of their employees, agents, customers, visitors, suppliers or persons with whom they do business.

F. Disorderly Conduct.

1. No person shall commit any disorderly, obscene or indecent act nor commit any nuisance.

2. Abusive behavior by Contractor supervisors or their employees will not be tolerated.

G. Debris and Cleanup.

1. No person shall dispose of any garbage, trash, refuse or any other material on the Airport except in the receptacles provided for that purpose.

2. No person shall dispose of any fill or building materials or any other materials on Airport property except in such areas as are specifically designated by the Director.

3. Contractors are responsible for the cleanliness of the job site and access to the job site as appropriate. All Contractors must establish an active ongoing program to eliminate any foreign objects which may cause damage to aircraft or cause personal injury to other persons. Contractors must pay particular attention to haul routes used to and from the job site to clean up any debris which may be tracked onto or dropped on the air operations area. Contractor will immediately remove such debris to eliminate the hazard. **END OF THE WORKDAY CLEANUP WILL NOT SUFFICE.** Cleanup shall be done to the satisfaction of the Airport Authority. All Active taxiway crossings and work areas adjacent to the taxiways shall be kept clean.

4. If it should become necessary for the Airport Authority to remove debris left by a Contractor, the Contractor shall be billed at 2 1/2 times the actual cost of the cleanup or a minimum of $250 per trip whichever is greater.

H. Firearms and Explosives.

1. No person shall have any firearm, explosive or incendiary device on or about their person or accessible property while on Airport property.
I. Fire Equipment.

1. All Contractors shall supply and maintain adequate and readily accessible fire extinguishers for the particular hazard involved as directed by the Airport Authority or the Fire Marshal. All fire apparatus shall be maintained in first class operable condition.

2. The Contractor shall maintain the following items on site:
   a. Two-pound dry chemical extinguisher, or
   b. Four-pound carbon dioxide extinguisher.

3. Carbon tetrachloride chlorobromomethene or other vaporizing liquid extinguishers are not permitted inside buildings due to their high toxicity unless approved in writing by the Fire Marshal.

J. Gambling.

1. No person shall conduct gambling in any form or operate gambling devices anywhere on Airport property.

K. Hazards.

1. No person shall use flammable volatile liquids having a flash point of less than 100°F in cleaning of parts, appliances, or for any other purpose unless such operations are conducted in the open air not within 50 feet of an aircraft, away from structures and equipment or in properly ventilated, approved paint booths.

2. No person shall keep or store any flammable liquids, gases, oil, oil wastes, flares, paints, or other similar material in any building within the Airport boundary except that such materials may be kept in specially provided rooms or receptacles approved by the Fire Marshal.

3. Contractors shall provide suitable metal receptacles with covers for the storage of wastes, rags, or other rubbish.

4. No person shall start any open fires of any type, including flare posts, torches or fires in containers formerly used for oil, paint, or similar materials on any part of an Airport without permission of the Director.

L. Picketing and Public Demonstrations.

1. Subject to applicable federal, state and local regulations and laws, no persons shall walk in a picket line as a picketer or take part in any labor or other public demonstration on any Airport property or facilities therein except in those places which may be specifically assigned for use of such picket lines or other public demonstration by the Director.

M. Restricted Areas.

1. No persons shall enter any area posted as being restricted or closed to the public except for the following:

   a. Persons assigned to duty therein;
   b. Persons authorized by the Director; or
   c. Persons under contractual agreement with the Airport Authority or tenants of the Airport Authority.
2. All persons in restricted areas of Memphis International Airport must be duly authorized and must have displayed on their person an official identification badge which will clearly establish the individual by name, contractor affiliation, and construction project completion date.

3. The identification badge must be worn on the outermost garment above the waist except in those cases where there exists an overriding safety consideration approved by the FAA.

N. Signs on the Airport.

1. Signs may not be installed in public view on the Airport without prior approval of the Airport Authority. Proposals should be documented and submitted to the Airport Authority with an accompanying sketch depicting the general appearance and location of the desired sign, and the name and telephone number of an individual to contact.

O. Smoking.

1. No person shall smoke or carry lighted cigars, cigarettes, pipes, matches or any naked flame in or on any fuel storage areas, Air Operations Area, public aircraft parking and storage area, in any other place where smoking is specifically prohibited by signs or upon any open space within 50 feet of any fuel carrier which is not in motion. Smoking by tank vehicle drivers, helpers, repairmen, or other personnel is prohibited while they are driving, making deliveries, filling or making repairs to tank vehicles. No person shall smoke or permit any open flame within 100 feet of any aircraft undergoing fuel service or within at least 50 feet of any hangar or building.

P. Storage of Equipment.

1. Contractors shall store or stock material or equipment in a neat and orderly manner and in a manner not to constitute a hazard to personnel or property.

Q. Trash Containers.

1. Areas to be used for trash and garbage containers shall be designated by the Director and no other areas shall be used. Only trash containers approved by the Director shall be used by contractors for the collection of trash and garbage. The placement of trash or garbage outside approved containers is strictly prohibited.

R. Utilities.

1. The following instructions must be adhered to without exception:
   a. No contractor or employee for any craft shall turn off any utilities without contacting the Airport Authority. This includes water, electrical and HVAC;
   b. No one shall open any electrical substations, distribution or motor control centers without first notifying the Airport Authority. No branch circuits shall be turned off or on, without obtaining permission from the Airport Authority; and
   c. No one shall turn off the water or the HVAC or open any drain lines without notifying the Airport Authority.

2. All notifications for utility disruption must be made through the Airport Authority and must be made a minimum of 24 hours prior to scheduled shutoff.
3. The Airport Authority has a responsibility to keep the Airport in operation; it is your responsibility to conform to the above instructions. You may contact the Airport Authority.

FOR ANY QUESTIONS CONCERNING SECURITY REGULATIONS CONTACT THE SECURITY COORDINATOR AT 901/922-8021.
EXHIBIT D

CONSTRUCTION VEHICLE REGISTRATION FORM

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Part 1 – General Provisions

Section 10 Definition of Terms

Whenever the following terms are used in these specifications, in the contract, or in any documents or other instruments pertaining to construction where these specifications govern, the intent and meaning shall be interpreted as follows:

10-01 AASHTO. The American Association of State Highway and Transportation Officials, the successor association to AASHO.

10-02 Access road. The right-of-way, the roadway and all improvements constructed thereon connecting the airport to a public highway.

10-03 Advertisement. A public announcement, as required by local law, inviting bids for work to be performed and materials to be furnished.

10-04 Airport Improvement Program (AIP). A grant-in-aid program, administered by the Federal Aviation Administration (FAA).

10-05 Air operations area (AOA). For the purpose of these specifications, the term air operations area (AOA) shall mean any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operation area shall include such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiway, or apron.

10-06 Airport. Airport means an area of land or water which is used or intended to be used for the landing and takeoff of aircraft; an appurtenant area used or intended to be used for airport buildings or other airport facilities or rights of way; and airport buildings and facilities located in any of these areas, and includes a heliport.


10-08 Award. The Owner’s notice to the successful bidder of the acceptance of the submitted bid.

10-09 Bidder. Any individual, partnership, firm, or corporation, acting directly or through a duly authorized representative, who submits a proposal for the work contemplated.

10-10 Building area. An area on the airport to be used, considered, or intended to be used for airport buildings or other airport facilities or rights-of-way together with all airport buildings and facilities located thereon.

10-11 Calendar day. Every day shown on the calendar.

10-12 Change order. A written order to the Contractor covering changes in the plans, specifications, or proposal quantities and establishing the basis of payment and contract time adjustment, if any, for the work affected by such changes. The work, covered by a change order, must be within the scope of the contract.

10-13 Contract. The written agreement covering the work to be performed. The awarded contract shall include, but is not limited to: Advertisement, Contract Form, Proposal, Performance Bond, Payment Bond, any required insurance certificates, Specifications, Plans, and any addenda issued to bidders.
**10-14 Contract item (pay item).** A specific unit of work for which a price is provided in the contract.

**10-15 Contract time.** The number of calendar days or working days, stated in the proposal, allowed for completion of the contract, including authorized time extensions. If a calendar date of completion is stated in the proposal, in lieu of a number of calendar or working days, the contract shall be completed by that date.

**10-16 Contractor.** The individual, partnership, firm, or corporation primarily liable for the acceptable performance of the work contracted and for the payment of all legal debts pertaining to the work who acts directly or through lawful agents or employees to complete the contract work.

**10-17 Contractor’s laboratory.** The Contractor’s quality control organization in accordance with the Contractor Quality Control Program.

**10-18 Construction Safety and Phasing Plan (CSPP).** The overall plan for safety and phasing of a construction project developed by the airport operator, or developed by the airport operator’s consultant and approved by the airport operator. It is included in the invitation for bids and becomes part of the project specifications.

**10-19 Drainage system.** The system of pipes, ditches, and structures by which surface or subsurface waters are collected and conducted from the airport area.

**10-20 Engineer.** The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for engineering, inspection, and/or observation of the contract work and acting directly or through an authorized representative.

**10-21 Equipment.** All machinery, together with the necessary supplies for upkeep and maintenance, and also all tools and apparatus necessary for the proper construction and acceptable completion of the work.

**10-22 Extra work.** An item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, but which is found by the Engineer to be necessary to complete the work within the intended scope of the contract as previously modified.

**10-23 FAA.** The Federal Aviation Administration of the U.S. Department of Transportation. When used to designate a person, FAA shall mean the Administrator or his or her duly authorized representative.

**10-24 Federal specifications.** The Federal Specifications and Standards, Commercial Item Descriptions, and supplements, amendments, and indices thereto are prepared and issued by the General Services Administration of the Federal Government.

**10-25 Force account.** Force account work is planning, engineering, or construction work done by the Sponsor’s employees.

**10-26 Inspector.** An authorized representative of the Engineer assigned to make all necessary inspections, observations, and/or tests observation of tests of the work performed or being performed, or of the materials furnished or being furnished by the Contractor.

**10-27 Intention of terms.** Whenever, in these specifications or on the plans, the words “directed,” “required,” “permitted,” “ordered,” “designated,” “prescribed,” or words of like import are used, it shall be understood that the direction, requirement, permission, order, designation, or prescription of the Engineer is intended; and similarly, the words “approved,” “acceptable,” “satisfactory,” or words of like import, shall mean approved by, or acceptable to, or satisfactory to the Engineer, subject in each case to the final determination of the Owner.

Any reference to a specific requirement of a numbered paragraph of the contract specifications or a cited standard shall be interpreted to include all general requirements of the entire section, specification item, or cited standard that may be pertinent to such specific reference.
10-28 Laboratory. The official testing laboratories of the Owner or such other laboratories as may be designated by the Engineer. Also referred to as “Engineer’s Laboratory” or “quality assurance laboratory.”

10-29 Lighting. A system of fixtures providing or controlling the light sources used on or near the airport or within the airport buildings. The field lighting includes all luminous signals, markers, floodlights, and illuminating devices used on or near the airport or to aid in the operation of aircraft landing at, taking off from, or taxiing on the airport surface.

10-30 Major and minor contract items. A major contract item shall be any item that is listed in the proposal, the total cost of which is equal to or greater than 20% of the total amount of the award contract. All other items shall be considered minor contract items.


10-32 Notice to Proceed (NTP). A written notice to the Contractor to begin the actual contract work on a previously agreed to date. If applicable, the Notice to Proceed shall state the date on which the contract time begins.

10-33 Owner. The term “Owner” shall mean the party of the first part or the contracting agency signatory to the contract. Where the term “Owner” is capitalized in this document, it shall mean airport Sponsor only.

10-34 Passenger Facility Charge (PFC). Per 14 CFR Part 158 and 49 USC § 40117, a PFC is a charge imposed by a public agency on passengers enplaned at a commercial service airport it controls.”

10-35 Pavement. The combined surface course, base course, and subbase course, if any, considered as a single unit.

10-36 Payment bond. The approved form of security furnished by the Contractor and his or her surety as a guaranty that the Contractor will pay in full all bills and accounts for materials and labor used in the construction of the work.

10-37 Performance bond. The approved form of security furnished by the Contractor and his or her surety as a guaranty that the Contractor will complete the work in accordance with the terms of the contract.

10-38 Plans. The official drawings or exact reproductions which show the location, character, dimensions and details of the airport and the work to be done and which are to be considered as a part of the contract, supplementary to the specifications.

10-39 Project. The agreed scope of work for accomplishing specific airport development with respect to a particular airport.

10-40 Proposal. The written offer of the bidder (when submitted on the approved proposal form) to perform the contemplated work and furnish the necessary materials in accordance with the provisions of the plans and specifications.

10-41 Proposal guaranty. The security furnished with a proposal to guarantee that the bidder will enter into a contract if his or her proposal is accepted by the Owner.

10-42 Runway. The area on the airport prepared for the landing and takeoff of aircraft.

10-43 Specifications. A part of the contract containing the written directions and requirements for completing the contract work. Standards for specifying materials or testing which are cited in the contract specifications by reference shall have the same force and effect as if included in the contract physically.
**10-44 Sponsor.** A Sponsor is defined in 49 USC § 47102(24) as a public agency that submits to the FAA for an AIP grant; or a private Owner of a public-use airport that submits to the FAA an application for an AIP grant for the airport.

**10-45 Structures.** Airport facilities such as bridges; culverts; catch basins, inlets, retaining walls, cribbing; storm and sanitary sewer lines; water lines; underdrains; electrical ducts, manholes, handholes, lighting fixtures and bases; transformers; flexible and rigid pavements; navigational aids; buildings; vaults; and, other manmade features of the airport that may be encountered in the work and not otherwise classified herein.

**10-46 Subgrade.** The soil that forms the pavement foundation.

**10-47 Superintendent.** The Contractor’s executive representative who is present on the work during progress, authorized to receive and fulfill instructions from the Engineer, and who shall supervise and direct the construction.

**10-48 Supplemental agreement.** A written agreement between the Contractor and the Owner covering (1) work that would increase or decrease the total amount of the awarded contract, or any major contract item, by more than 25%, such increased or decreased work being within the scope of the originally awarded contract; or (2) work that is not within the scope of the originally awarded contract.

**10-49 Surety.** The corporation, partnership, or individual, other than the Contractor, executing payment or performance bonds that are furnished to the Owner by the Contractor.

**10-50 Taxiway.** For the purpose of this document, the term taxiway means the portion of the air operations area of an airport that has been designated by competent airport authority for movement of aircraft to and from the airport’s runways, aircraft parking areas, and terminal areas.

**10-51 Work.** The furnishing of all labor, materials, tools, equipment, and incidentals necessary or convenient to the Contractor’s performance of all duties and obligations imposed by the contract, plans, and specifications.

**10-52 Working day.** A working day shall be any day other than a legal holiday, Saturday, or Sunday on which the normal working forces of the Contractor may proceed with regular work for at least six (6) hours toward completion of the contract. When work is suspended for causes beyond the Contractor’s control, it will not be counted as a working day. Saturdays, Sundays and holidays on which the Contractor’s forces engage in regular work will be considered as working days.

END OF SECTION 10
Section 20 Proposal Requirements and Conditions

20-01 Advertisement (Notice to Bidders). See specification section 00100, Legal Notice to Bidders.

20-02 Qualification of bidders. Each bidder shall furnish the Owner satisfactory evidence of his or her competency to perform the proposed work. Such evidence of competency, unless otherwise specified, shall consist of statements covering the bidder’s past experience on similar work, a list of equipment that would be available for the work, and a list of key personnel that would be available. In addition, each bidder shall furnish the Owner satisfactory evidence of his or her financial responsibility. Such evidence of financial responsibility, unless otherwise specified, shall consist of a confidential statement or report of the bidder’s financial resources and liabilities as of the last calendar year or the bidder’s last fiscal year. Such statements or reports shall be certified by a public accountant. At the time of submitting such financial statements or reports, the bidder shall further certify whether his or her financial responsibility is approximately the same as stated or reported by the public accountant. If the bidder’s financial responsibility has changed, the bidder shall qualify the public accountant’s statement or report to reflect the bidder’s true financial condition at the time such qualified statement or report is submitted to the Owner.

Unless otherwise specified, a bidder may submit evidence that he or she is prequalified with the State Highway Division and is on the current “bidder’s list” of the state in which the proposed work is located. Such evidence of State Highway Division prequalification may be submitted as evidence of financial responsibility in lieu of the certified statements or reports specified above.

Each bidder shall submit “evidence of competency” and “evidence of financial responsibility” to the Owner at the time of bid opening.

20-03 Contents of proposal forms. The Owner shall furnish bidders with proposal forms. All papers bound with or attached to the proposal forms are necessary parts and must not be detached.

The plans, specifications, and other documents designated in the proposal form shall be considered a part of the proposal whether attached or not.

20-04 Issuance of proposal forms. The Owner reserves the right to refuse to issue a proposal form to a prospective bidder should such bidder be in default for any of the following reasons:

a. Failure to comply with any prequalification regulations of the Owner, if such regulations are cited, or otherwise included, in the proposal as a requirement for bidding.

b. Failure to pay, or satisfactorily settle, all bills due for labor and materials on former contracts in force with the Owner at the time the Owner issues the proposal to a prospective bidder.

c. Documented record of Contractor default under previous contracts with the Owner.

d. Documented record of unsatisfactory work on previous contracts with the Owner.

20-05 Interpretation of estimated proposal quantities. An estimate of quantities of work to be done and materials to be furnished under these specifications is given in the proposal. It is the result of careful calculations and is believed to be correct. It is given only as a basis for comparison of proposals and the award of the contract. The Owner does not expressly, or by implication, agree that the actual quantities involved will correspond exactly therewith; nor shall the bidder plead misunderstanding or deception because of such estimates of quantities, or of the character, location, or other conditions pertaining to the work. Payment to the Contractor will be made only for the actual quantities of work performed or
materials furnished in accordance with the plans and specifications. It is understood that the quantities
may be increased or decreased as hereinafter provided in the subsection 40-02 titled ALTERATION OF
WORK AND QUANTITIES of Section 40 without in any way invalidating the unit bid prices.

20-06 Examination of plans, specifications, and site. The bidder is expected to carefully examine the
site of the proposed work, the proposal, plans, specifications, and contract forms. Bidders shall satisfy
themselves as to the character, quality, and quantities of work to be performed, materials to be furnished,
and as to the requirements of the proposed contract. The submission of a proposal shall be prima facie
evidence that the bidder has made such examination and is satisfied as to the conditions to be encountered
in performing the work and as to the requirements of the proposed contract, plans, and specifications.

20-07 Preparation of proposal. The bidder shall submit his or her proposal on the forms furnished by
the Owner. All blank spaces in the proposal forms must be correctly filled in where indicated for each and
every item for which a quantity is given. The bidder shall state the price (written in ink or typed) both in
words and numerals for which they propose to do for each pay item furnished in the proposal. In case of
conflict between words and numerals, the words, unless obviously incorrect, shall govern.

The bidder shall sign the proposal correctly and in ink. If the proposal is made by an individual, his or her
name and post office address must be shown. If made by a partnership, the name and post office address
of each member of the partnership must be shown. If made by a corporation, the person signing the
proposal shall give the name of the state under the laws of which the corporation was chartered and the
name, titles, and business address of the president, secretary, and the treasurer. Anyone signing a proposal
as an agent shall file evidence of his or her authority to do so and that the signature is binding upon the
firm or corporation.

20-08 Responsive and responsible bidder. A responsive bid conforms to all significant terms and
conditions contained in the Sponsor’s invitation for bid. It is the Sponsor’s responsibility to decide if the
exceptions taken by a bidder to the solicitation are material or not and the extent of deviation it is willing
to accept.

A responsible bidder has the ability to perform successfully under the terms and conditions of a proposed
procurement, as defined in 49 CFR § 18.36(b)(8). This includes such matters as Contractor integrity,
compliance with public policy, record of past performance, and financial and technical resources.

20-09 Irregular proposals. Proposals shall be considered irregular for the following reasons:

a. If the proposal is on a form other than that furnished by the Owner, or if the Owner’s form is
   altered, or if any part of the proposal form is detached.

b. If there are unauthorized additions, conditional or alternate pay items, or irregularities of any kind
   that make the proposal incomplete, indefinite, or otherwise ambiguous.

c. If the proposal does not contain a unit price for each pay item listed in the proposal, except in the
case of authorized alternate pay items, for which the bidder is not required to furnish a unit price.

d. If the proposal contains unit prices that are obviously unbalanced.

e. If the proposal is not accompanied by the proposal guaranty specified by the Owner.

The Owner reserves the right to reject any irregular proposal and the right to waive technicalities if such
waiver is in the best interest of the Owner and conforms to local laws and ordinances pertaining to the
letting of construction contracts.

20-10 Bid guarantee. Each separate proposal shall be accompanied by a certified check, or other
specified acceptable collateral, in the amount specified in the proposal form. Such check, or collateral,
shall be made payable to the Owner.
20-11 **Delivery of proposal.** Each proposal submitted shall be placed in a sealed envelope plainly marked with the project number, location of airport, and name and business address of the bidder on the outside. When sent by mail, preferably registered, the sealed proposal, marked as indicated above, should be enclosed in an additional envelope. No proposal will be considered unless received at the place specified in the advertisement or as modified by Addendum before the time specified for opening all bids. Proposals received after the bid opening time shall be returned to the bidder unopened.

20-12 **Withdrawal or revision of proposals.** A bidder may withdraw or revise (by withdrawal of one proposal and submission of another) a proposal provided that the bidder’s request for withdrawal is received by the Owner in writing or by fax or email before the time specified for opening bids. Revised proposals must be received at the place specified in the advertisement before the time specified for opening all bids.

20-13 **Public opening of proposals.** Proposals shall be opened, and read, publicly at the time and place specified in the advertisement. Bidders, their authorized agents, and other interested persons are invited to attend. Proposals that have been withdrawn (by written or telegraphic request) or received after the time specified for opening bids shall be returned to the bidder unopened.

20-14 **Disqualification of bidders.** A bidder shall be considered disqualified for any of the following reasons:

- **a.** Submitting more than one proposal from the same partnership, firm, or corporation under the same or different name.

- **b.** Evidence of collusion among bidders. Bidders participating in such collusion shall be disqualified as bidders for any future work of the Owner until any such participating bidder has been reinstated by the Owner as a qualified bidder.

- **c.** If the bidder is considered to be in “default” for any reason specified in the subsection 20-04 titled ISSUANCE OF PROPOSAL FORMS of this section.

**END OF SECTION 20**
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Section 30 Award and Execution of Contract

30-01 Consideration of proposals. After the proposals are publicly opened and read, they will be compared on the basis of the summation of the products obtained by multiplying the estimated quantities shown in the proposal by the unit bid prices. If a bidder’s proposal contains a discrepancy between unit bid prices written in words and unit bid prices written in numbers, the unit price written in words shall govern.

Until the award of a contract is made, the Owner reserves the right to reject a bidder’s proposal for any of the following reasons:

a. If the proposal is irregular as specified in the subsection 20-09 titled IRREGULAR PROPOSALS of Section 20.

b. If the bidder is disqualified for any of the reasons specified in the subsection 20-14 titled DISQUALIFICATION OF BIDDERS of Section 20.

In addition, until the award of a contract is made, the Owner reserves the right to reject any or all proposals, waive technicalities, if such waiver is in the best interest of the Owner and is in conformance with applicable state and local laws or regulations pertaining to the letting of construction contracts; advertise for new proposals; or proceed with the work otherwise. All such actions shall promote the Owner’s best interests.

30-02 Award of contract. The award of a contract, if it is to be awarded, shall be made within 75 calendar days of the date specified for publicly opening proposals, unless otherwise specified herein.

Award of the contract shall be made by the Owner to the lowest, qualified bidder whose proposal conforms to the cited requirements of the Owner.

30-03 Cancellation of award. The Owner reserves the right to cancel the award without liability to the bidder, except return of proposal guaranty, at any time before a contract has been fully executed by all parties and is approved by the Owner in accordance with the subsection 30-07 titled APPROVAL OF CONTRACT of this section.

30-04 Return of proposal guaranty. All proposal guaranties, except those of the two lowest bidders, will be returned immediately after the Owner has made a comparison of bids as specified in the subsection 30-01 titled CONSIDERATION OF PROPOSALS of this section. Proposal guaranties of the two lowest bidders will be retained by the Owner until such time as an award is made, at which time, the unsuccessful bidder’s proposal guaranty will be returned. The successful bidder’s proposal guaranty will be returned as soon as the Owner receives the contract bonds as specified in the subsection 30-05 titled REQUIREMENTS OF CONTRACT BONDS of this section.

30-05 Requirements of contract bonds. At the time of the execution of the contract, the successful bidder shall furnish the Owner a surety bond or bonds that have been fully executed by the bidder and the surety guaranteeing the performance of the work and the payment of all legal debts that may be incurred by reason of the Contractor’s performance of the work. The surety and the form of the bond or bonds shall be acceptable to the Owner. Unless otherwise specified in this subsection, the surety bond or bonds shall be in a sum equal to the full amount of the contract.

30-06 Execution of contract. The successful bidder shall sign (execute) the necessary agreements for entering into the contract and return the signed contract to the Owner, along with the fully executed surety...
bond or bonds specified in the subsection 30-05 titled REQUIREMENTS OF CONTRACT BONDS of this section, within 15 calendar days from the date mailed or otherwise delivered to the successful bidder.

30-07 Approval of contract. Upon receipt of the contract and contract bond or bonds that have been executed by the successful bidder, the Owner shall complete the execution of the contract in accordance with local laws or ordinances, and return the fully executed contract to the Contractor. Delivery of the fully executed contract to the Contractor shall constitute the Owner’s approval to be bound by the successful bidder’s proposal and the terms of the contract.

30-08 Failure to execute contract. Failure of the successful bidder to execute the contract and furnish an acceptable surety bond or bonds within the 15 calendar day period specified in the subsection 30-06 titled EXECUTION OF CONTRACT of this section shall be just cause for cancellation of the award and forfeiture of the proposal guaranty, not as a penalty, but as liquidation of damages to the Owner.

END OF SECTION 30
Section 40 Scope of Work

40-01 Intent of contract. The intent of the contract is to provide for construction and completion, in every detail, of the work described. It is further intended that the Contractor shall furnish all labor, materials, equipment, tools, transportation, and supplies required to complete the work in accordance with the plans, specifications, and terms of the contract.

40-02 Alteration of work and quantities. The Owner reserves and shall have the right to make such alterations in the work as may be necessary or desirable to complete the work originally intended in an acceptable manner. Unless otherwise specified herein, the Engineer shall be and is hereby authorized to make such alterations in the work as may increase or decrease the originally awarded contract quantities, provided that the aggregate of such alterations does not change the total contract cost or the total cost of any major contract item by more than 25% (total cost being based on the unit prices and estimated quantities in the awarded contract). Alterations that do not exceed the 25% limitation shall not invalidate the contract nor release the surety, and the Contractor agrees to accept payment for such alterations as if the altered work had been a part of the original contract. These alterations that are for work within the general scope of the contract shall be covered by “Change Orders” issued by the Engineer. Change orders for altered work shall include extensions of contract time where, in the Engineer’s opinion, such extensions are commensurate with the amount and difficulty of added work.

Should the aggregate amount of altered work exceed the 25% limitation hereinbefore specified, such excess altered work shall be covered by supplemental agreement. If the Owner and the Contractor are unable to agree on a unit adjustment for any contract item that requires a supplemental agreement, the Owner reserves the right to terminate the contract with respect to the item and make other arrangements for its completion.

Supplemental agreements shall be approved by the FAA and shall include all applicable Federal contract provisions for procurement and contracting required under AIP. Supplemental agreements shall also require consent of the Contractor’s surety and separate performance and payment bonds.

40-03 Omitted items. The Engineer may, in the Owner’s best interest, omit from the work any contract item, except major contract items. Major contract items may be omitted by a supplemental agreement. Such omission of contract items shall not invalidate any other contract provision or requirement.

Should a contract item be omitted or otherwise ordered to be non-performed, the Contractor shall be paid for all work performed toward completion of such item prior to the date of the order to omit such item. Payment for work performed shall be in accordance with the subsection 90-04 titled PAYMENT FOR OMITTED ITEMS of Section 90.

40-04 Extra work. Should acceptable completion of the contract require the Contractor to perform an item of work for which no basis of payment has been provided in the original contract or previously issued change orders or supplemental agreements, the same shall be called “Extra Work.” Extra Work that is within the general scope of the contract shall be covered by written change order. Change orders for such Extra Work shall contain agreed unit prices for performing the change order work in accordance with the requirements specified in the order, and shall contain any adjustment to the contract time that, in the Engineer’s opinion, is necessary for completion of such Extra Work.

When determined by the Engineer to be in the Owner’s best interest, the Engineer may order the Contractor to proceed with Extra Work as provided in the subsection 90-05 titled PAYMENT FOR EXTRA WORK of Section 90. Extra Work that is necessary for acceptable completion of the project, but
is not within the general scope of the work covered by the original contract shall be covered by a Supplemental Agreement as defined in the subsection 10-48 titled SUPPLEMENTAL AGREEMENT of Section 10.

Any claim for payment of Extra Work that is not covered by written agreement (change order or supplemental agreement) shall be rejected by the Owner.

**40-05 Maintenance of traffic.** It is the explicit intention of the contract that the safety of aircraft, as well as the Contractor’s equipment and personnel, is the most important consideration.

   a. It is understood and agreed that the Contractor shall provide for the free and unobstructed movement of aircraft in the air operations areas (AOAs) of the airport with respect to his or her own operations and the operations of all subcontractors as specified in the subsection 80-04 titled LIMITATION OF OPERATIONS of Section 80. It is further understood and agreed that the Contractor shall provide for the uninterrupted operation of visual and electronic signals (including power supplies thereto) used in the guidance of aircraft while operating to, from, and upon the airport as specified in the subsection 70-15 titled CONTRACTOR’S RESPONSIBILITY FOR UTILITY SERVICE AND FACILITIES OF OTHERS in Section 70.

   b. With respect to his or her own operations and the operations of all subcontractors, the Contractor shall provide marking, lighting, and other acceptable means of identifying personnel, equipment, vehicles, storage areas, and any work area or condition that may be hazardous to the operation of aircraft, fire-rescue equipment, or maintenance vehicles at the airport.

   c. When the contract requires the maintenance of vehicular traffic on an existing road, street, or highway during the Contractor’s performance of work that is otherwise provided for in the contract, plans, and specifications, the Contractor shall keep such road, street, or highway open to all traffic and shall provide such maintenance as may be required to accommodate traffic. The Contractor shall be responsible for the repair of any damage caused by the Contractor’s equipment and personnel. The Contractor shall furnish, erect, and maintain barricades, warning signs, flag person, and other traffic control devices in reasonable conformity with the Manual on Uniform Traffic Control Devices (MUTCD) (http://mutcd.fhwa.dot.gov/), unless otherwise specified. The Contractor shall also construct and maintain in a safe condition any temporary connections necessary for ingress to and egress from abutting property or intersecting roads, streets or highways. Unless otherwise specified herein, the Contractor will not be required to furnish snow removal for such existing road, street, or highway.

**40-06 Removal of existing structures.** All existing structures encountered within the established lines, grades, or grading sections shall be removed by the Contractor, unless such existing structures are otherwise specified to be relocated, adjusted up or down, salvaged, abandoned in place, reused in the work or to remain in place. The cost of removing such existing structures shall not be measured or paid for directly, but shall be included in the various contract items.

Should the Contractor encounter an existing structure (above or below ground) in the work for which the disposition is not indicated on the plans, the Engineer shall be notified prior to disturbing such structure. The disposition of existing structures so encountered shall be immediately determined by the Engineer in accordance with the provisions of the contract.

Except as provided in the subsection 40-07 titled RIGHTS IN AND USE OF MATERIALS FOUND IN THE WORK of this section, it is intended that all existing materials or structures that may be encountered (within the lines, grades, or grading sections established for completion of the work) shall be used in the work as otherwise provided for in the contract and shall remain the property of the Owner when so used in the work.

**40-07 Rights in and use of materials found in the work.** Should the Contractor encounter any material such as (but not restricted to) sand, stone, gravel, slag, or concrete slabs within the established lines,
grades, or grading sections, the use of which is intended by the terms of the contract to be either embankment or waste, the Contractor may at his or her option either:

   a. Use such material in another contract item, providing such use is approved by the Engineer and is in conformance with the contract specifications applicable to such use; or,

   b. Remove such material from the site, upon written approval of the Engineer; or

   c. Use such material for the Contractor’s own temporary construction on site; or,

   d. Use such material as intended by the terms of the contract.

Should the Contractor wish to exercise option a., b., or c., the Contractor shall request the Engineer’s approval in advance of such use.

Should the Engineer approve the Contractor’s request to exercise option a., b., or c., the Contractor shall be paid for the excavation or removal of such material at the applicable contract price. The Contractor shall replace, at his or her own expense, such removed or excavated material with an agreed equal volume of material that is acceptable for use in constructing embankment, backfills, or otherwise to the extent that such replacement material is needed to complete the contract work. The Contractor shall not be charged for use of such material used in the work or removed from the site.

Should the Engineer approve the Contractor’s exercise of option a., the Contractor shall be paid, at the applicable contract price, for furnishing and installing such material in accordance with requirements of the contract item in which the material is used.

It is understood and agreed that the Contractor shall make no claim for delays by reason of his or her exercise of option a., b., or c.

The Contractor shall not excavate, remove, or otherwise disturb any material, structure, or part of a structure which is located outside the lines, grades, or grading sections established for the work, except where such excavation or removal is provided for in the contract, plans, or specifications.

**40-08 Final cleanup.** Upon completion of the work and before acceptance and final payment will be made, the Contractor shall remove from the site all machinery, equipment, surplus and discarded materials, rubbish, temporary structures, and stumps or portions of trees. The Contractor shall cut all brush and woods within the limits indicated and shall leave the site in a neat and presentable condition. Material cleared from the site and deposited on adjacent property will not be considered as having been disposed of satisfactorily, unless the Contractor has obtained the written permission of such property Owner.

**END OF SECTION 40**
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Section 50 Control of Work

50-01 Authority of the Engineer. The Engineer shall decide any and all questions which may arise as to the quality and acceptability of materials furnished, work performed, and as to the manner of performance and rate of progress of the work. The Engineer shall decide all questions that may arise as to the interpretation of the specifications or plans relating to the work. The Engineer shall determine the amount and quality of the several kinds of work performed and materials furnished which are to be paid for under the contract.

The Engineer does not have the authority to accept pavements that do not conform to FAA specification requirements.

50-02 Conformity with plans and specifications. All work and all materials furnished shall be in reasonably close conformity with the lines, grades, grading sections, cross-sections, dimensions, material requirements, and testing requirements that are specified (including specified tolerances) in the contract, plans or specifications.

If the Engineer finds the materials furnished, work performed, or the finished product not within reasonably close conformity with the plans and specifications but that the portion of the work affected will, in his or her opinion, result in a finished product having a level of safety, economy, durability, and workmanship acceptable to the Owner, the Engineer will advise the Owner of his or her determination that the affected work be accepted and remain in place. In this event, the Engineer will document the determination and recommend to the Owner a basis of acceptance that will provide for an adjustment in the contract price for the affected portion of the work. The Engineer’s determination and recommended contract price adjustments will be based on sound engineering judgment and such tests or retests of the affected work as are, in the Engineer’s opinion, needed. Changes in the contract price shall be covered by contract change order or supplemental agreement as applicable.

If the Engineer finds the materials furnished, work performed, or the finished product are not in reasonably close conformity with the plans and specifications and have resulted in an unacceptable finished product, the affected work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor in accordance with the Engineer’s written orders.

For the purpose of this subsection, the term “reasonably close conformity” shall not be construed as waiving the Contractor’s responsibility to complete the work in accordance with the contract, plans, and specifications. The term shall not be construed as waiving the Engineer’s responsibility to insist on strict compliance with the requirements of the contract, plans, and specifications during the Contractor’s execution of the work, when, in the Engineer’s opinion, such compliance is essential to provide an acceptable finished portion of the work.

For the purpose of this subsection, the term “reasonably close conformity” is also intended to provide the Engineer with the authority, after consultation with the FAA, to use sound engineering judgment in his or her determinations as to acceptance of work that is not in strict conformity, but will provide a finished product equal to or better than that intended by the requirements of the contract, plans and specifications.

The Engineer will not be responsible for the Contractor’s means, methods, techniques, sequences, or procedures of construction or the safety precautions incident thereto.

50-03 Coordination of contract, plans, and specifications. The contract, plans, specifications, and all referenced standards cited are essential parts of the contract requirements. A requirement occurring in one

Section 50 Control of Work
is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. In case of discrepancy, calculated dimensions will govern over scaled dimensions; contract technical specifications shall govern over contract general provisions, plans, cited standards for materials or testing, and cited advisory circulars (ACs); contract general provisions shall govern over plans, cited standards for materials or testing, and cited ACs; plans shall govern over cited standards for materials or testing and cited ACs. If any paragraphs contained in the Special Provisions conflict with General Provisions or Technical Specifications, the Special Provisions shall govern.

From time to time, discrepancies within cited testing standards occur due to the timing of the change, edits, and/or replacement of the standards. If the Contractor discovers any apparent discrepancy within standard test methods, the Contractor shall immediately ask the Engineer for an interpretation and decision, and such decision shall be final.

50-04 Cooperation of Contractor. The Contractor will be supplied with two copies each of the plans and specifications. The Contractor shall have available on the work at all times one copy each of the plans and specifications. Additional copies of plans and specifications may be obtained by the Contractor for the cost of reproduction.

The Contractor shall give constant attention to the work to facilitate the progress thereof, and shall cooperate with the Engineer and his or her inspectors and with other contractors in every way possible. The Contractor shall have a competent superintendent on the work at all times who is fully authorized as his or her agent on the work. The superintendent shall be capable of reading and thoroughly understanding the plans and specifications and shall receive and fulfill instructions from the Engineer or his or her authorized representative.

50-05 Cooperation between contractors. The Owner reserves the right to contract for and perform other or additional work on or near the work covered by this contract.

When separate contracts are let within the limits of any one project, each Contractor shall conduct the work so as not to interfere with or hinder the progress of completion of the work being performed by other Contractors. Contractors working on the same project shall cooperate with each other as directed.

Each Contractor involved shall assume all liability, financial or otherwise, in connection with his or her contract and shall protect and save harmless the Owner from any and all damages or claims that may arise because of inconvenience, delays, or loss experienced because of the presence and operations of other Contractors working within the limits of the same project.

The Contractor shall arrange his or her work and shall place and dispose of the materials being used so as not to interfere with the operations of the other Contractors within the limits of the same project. The Contractor shall join his or her work with that of the others in an acceptable manner and shall perform it in proper sequence to that of the others.

50-06 Construction layout and stakes. Not used.

50-07 Automatically controlled equipment. Whenever batching or mixing plant equipment is required to be operated automatically under the contract and a breakdown or malfunction of the automatic controls occurs, the equipment may be operated manually or by other methods for a period 48 hours following the breakdown or malfunction, provided this method of operations will produce results which conform to all other requirements of the contract.

50-08 Authority and duties of inspectors. Inspectors shall be authorized to inspect all work done and all material furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. Inspectors are not authorized to revoke, alter, or waive any provision of the contract. Inspectors are not authorized to issue instructions contrary to the plans and specifications or to act as foreman for the Contractor.
Inspectors are authorized to notify the Contractor or his or her representatives of any failure of the work or materials to conform to the requirements of the contract, plans, or specifications and to reject such nonconforming materials in question until such issues can be referred to the Engineer for a decision.

**50-09 Inspection of the work.** All materials and each part or detail of the work shall be subject to inspection. The Engineer shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection.

If the Engineer requests it, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be at the Contractor’s expense.

Any work done or materials used without supervision or inspection by an authorized representative of the Owner may be ordered removed and replaced at the Contractor’s expense unless the Owner’s representative failed to inspect after having been given reasonable notice in writing that the work was to be performed.

Should the contract work include relocation, adjustment, or any other modification to existing facilities, not the property of the (contract) Owner, authorized representatives of the Owners of such facilities shall have the right to inspect such work. Such inspection shall in no sense make any facility owner a party to the contract, and shall in no way interfere with the rights of the parties to this contract.

**50-10 Removal of unacceptable and unauthorized work.** All work that does not conform to the requirements of the contract, plans, and specifications will be considered unacceptable, unless otherwise determined acceptable by the Engineer as provided in the subsection 50-02 titled CONFORMITY WITH PLANS AND SPECIFICATIONS of this section.

Unacceptable work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or any other cause found to exist prior to the final acceptance of the work, shall be removed immediately and replaced in an acceptable manner in accordance with the provisions of the subsection 70-14 titled CONTRACTOR’S RESPONSIBILITY FOR WORK of Section 70.

No removal work made under provision of this subsection shall be done without lines and grades having been established by the Engineer. Work done contrary to the instructions of the Engineer, work done beyond the lines shown on the plans or as established by the Engineer, except as herein specified, or any extra work done without authority, will be considered as unauthorized and will not be paid for under the provisions of the contract. Work so done may be ordered removed or replaced at the Contractor’s expense.

Upon failure on the part of the Contractor to comply with any order of the Engineer made under the provisions of this subsection, the Engineer will have authority to cause unacceptable work to be remedied or removed and replaced and unauthorized work to be removed and to deduct the costs incurred by the Owner from any monies due or to become due the Contractor.

**50-11 Load restrictions.** The Contractor shall comply with all legal load restrictions in the hauling of materials on public roads beyond the limits of the work. A special permit will not relieve the Contractor of liability for damage that may result from the moving of material or equipment.

The operation of equipment of such weight or so loaded as to cause damage to structures or to any other type of construction will not be permitted. Hauling of materials over the base course or surface course under construction shall be limited as directed. No loads will be permitted on a concrete pavement, base,
or structure before the expiration of the curing period. The Contractor shall be responsible for all damage done by his or her hauling equipment and shall correct such damage at his or her own expense.

50-12 Maintenance during construction. The Contractor shall maintain the work during construction and until the work is accepted. Maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces so that the work is maintained in satisfactory condition at all times.

In the case of a contract for the placing of a course upon a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.

All costs of maintenance work during construction and before the project is accepted shall be included in the unit prices bid on the various contract items, and the Contractor will not be paid an additional amount for such work.

50-13 Failure to maintain the work. Should the Contractor at any time fail to maintain the work as provided in the subsection 50-12 titled MAINTENANCE DURING CONSTRUCTION of this section, the Engineer shall immediately notify the Contractor of such noncompliance. Such notification shall specify a reasonable time within which the Contractor shall be required to remedy such unsatisfactory maintenance condition. The time specified will give due consideration to the exigency that exists.

Should the Contractor fail to respond to the Engineer’s notification, the Owner may suspend any work necessary for the Owner to correct such unsatisfactory maintenance condition, depending on the exigency that exists. Any maintenance cost incurred by the Owner, shall be deducted from monies due or to become due the Contractor.

50-14 Partial acceptance. If at any time during the execution of the project the Contractor substantially completes a usable unit or portion of the work, the occupancy of which will benefit the Owner, the Contractor may request the Engineer to make final inspection of that unit. If the Engineer finds upon inspection that the unit has been satisfactorily completed in compliance with the contract, the Engineer may accept it as being complete, and the Contractor may be relieved of further responsibility for that unit. Such partial acceptance and beneficial occupancy by the Owner shall not void or alter any provision of the contract.

50-15 Final acceptance. Upon due notice from the Contractor of presumptive completion of the entire project, the Engineer and Owner will make an inspection. If all construction provided for and contemplated by the contract is found to be complete in accordance with the contract, plans, and specifications, such inspection shall constitute the final inspection. The Engineer shall notify the Contractor in writing of final acceptance as of the date of the final inspection.

If, however, the inspection discloses any work, in whole or in part, as being unsatisfactory, the Engineer will give the Contractor the necessary instructions for correction of same and the Contractor shall immediately comply with and execute such instructions. Upon correction of the work, another inspection will be made which shall constitute the final inspection, provided the work has been satisfactorily completed. In such event, the Engineer will make the final acceptance and notify the Contractor in writing of this acceptance as of the date of final inspection.

50-16 Claims for adjustment and disputes. If for any reason the Contractor deems that additional compensation is due for work or materials not clearly provided for in the contract, plans, or specifications or previously authorized as extra work, the Contractor shall notify the Engineer in writing of his or her intention to claim such additional compensation before the Contractor begins the work on which the Contractor bases the claim. If such notification is not given or the Engineer is not afforded proper opportunity by the Contractor for keeping strict account of actual cost as required, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor and the fact that the Engineer has kept account of the cost of the work shall not in any way be construed as
proving or substantiating the validity of the claim. When the work on which the claim for additional compensation is based has been completed, the Contractor shall, within 10 calendar days, submit a written claim to the Engineer who will present it to the Owner for consideration in accordance with local laws or ordinances.

Nothing in this subsection shall be construed as a waiver of the Contractor’s right to dispute final payment based on differences in measurements or computations.

END OF SECTION 50
Section 60 Control of Materials

60-01 Source of supply and quality requirements. The materials used in the work shall conform to the requirements of the contract, plans, and specifications. Unless otherwise specified, such materials that are manufactured or processed shall be new (as compared to used or reprocessed).

In order to expedite the inspection and testing of materials, the Contractor shall furnish complete statements to the Engineer as to the origin, composition, and manufacture of all materials to be used in the work. Such statements shall be furnished promptly after execution of the contract but, in all cases, prior to delivery of such materials.

At the Engineer’s option, materials may be approved at the source of supply before delivery is stated. If it is found after trial that sources of supply for previously approved materials do not produce specified products, the Contractor shall furnish materials from other sources.

The Contractor shall furnish airport lighting equipment that conforms to the requirements of cited materials specifications. In addition, where an FAA specification for airport lighting equipment is cited in the plans or specifications, the Contractor shall furnish such equipment that is:

a. Listed in advisory circular (AC) 150/5345-53, Airport Lighting Equipment Certification Program, and Addendum that is in effect on the date of advertisement; and,

b. Produced by the manufacturer as listed in the Addendum cited above for the certified equipment part number.

The following airport lighting equipment is required for this contract and is to be furnished by the Contractor in accordance with the requirements of this subsection: none.

60-02 Samples, tests, and cited specifications. Unless otherwise designated, all materials used in the work shall be inspected, tested, and approved by the Engineer before incorporation in the work. Any work in which untested materials are used without approval or written permission of the Engineer shall be performed at the Contractor’s risk. Materials found to be unacceptable and unauthorized will not be paid for and, if directed by the Engineer, shall be removed at the Contractor’s expense.

Unless otherwise designated, quality assurance tests in accordance with the cited standard methods of ASTM, American Association of State Highway and Transportation Officials (AASHTO), Federal Specifications, Commercial Item Descriptions, and all other cited methods, which are current on the date of advertisement for bids, will be made by and at the expense of the Engineer.

The testing organizations performing on-site quality assurance field tests shall have copies of all referenced standards on the construction site for use by all technicians and other personnel, including the Contractor’s representative at his or her request. Unless otherwise designated, samples for quality assurance will be taken by a qualified representative of the Engineer. All materials being used are subject to inspection, test, or rejection at any time prior to or during incorporation into the work. Copies of all tests will be furnished to the Contractor’s representative at their request after review and approval of the Engineer.

The Contractor shall employ a testing organization to perform all Contractor required Quality Control tests. The Contractor shall submit to the Engineer resumes on all testing organizations and individual persons who will be performing the tests. The Engineer will determine if such persons are qualified. All the test data shall be reported to the Engineer after the results are known. A legible, handwritten copy of
all test data shall be given to the Engineer daily, along with printed reports, in an approved format, on a weekly basis. After completion of the project, and prior to final payment, the Contractor shall submit a final report to the Engineer showing all test data reports, plus an analysis of all results showing ranges, averages, and corrective action taken on all failing tests.

**60-03 Certification of compliance.** The Engineer may permit the use, prior to sampling and testing, of certain materials or assemblies when accompanied by manufacturer’s certificates of compliance stating that such materials or assemblies fully comply with the requirements of the contract. The certificate shall be signed by the manufacturer. Each lot of such materials or assemblies delivered to the work must be accompanied by a certificate of compliance in which the lot is clearly identified.

Materials or assemblies used on the basis of certificates of compliance may be sampled and tested at any time and if found not to be in conformity with contract requirements will be subject to rejection whether in place or not.

The form and distribution of certificates of compliance shall be as approved by the Engineer.

When a material or assembly is specified by “brand name or equal” and the Contractor elects to furnish the specified “brand name,” the Contractor shall be required to furnish the manufacturer’s certificate of compliance for each lot of such material or assembly delivered to the work. Such certificate of compliance shall clearly identify each lot delivered and shall certify as to:

- **a.** Conformance to the specified performance, testing, quality or dimensional requirements; and,
- **b.** Suitability of the material or assembly for the use intended in the contract work.

Should the Contractor propose to furnish an “or equal” material or assembly, the Contractor shall furnish the manufacturer’s certificates of compliance as hereinbefore described for the specified brand name material or assembly. However, the Engineer shall be the sole judge as to whether the proposed “or equal” is suitable for use in the work.

The Engineer reserves the right to refuse permission for use of materials or assemblies on the basis of certificates of compliance.

**60-04 Plant inspection.** The Engineer or his or her authorized representative may inspect, at its source, any specified material or assembly to be used in the work. Manufacturing plants may be inspected from time to time for the purpose of determining compliance with specified manufacturing methods or materials to be used in the work and to obtain samples required for acceptance of the material or assembly.

Should the Engineer conduct plant inspections, the following conditions shall exist:

- **a.** The Engineer shall have the cooperation and assistance of the Contractor and the producer with whom the Engineer has contracted for materials.
- **b.** The Engineer shall have full entry at all reasonable times to such parts of the plant that concern the manufacture or production of the materials being furnished.
- **c.** If required by the Engineer, the Contractor shall arrange for adequate office or working space that may be reasonably needed for conducting plant inspections. Office or working space should be conveniently located with respect to the plant.

It is understood and agreed that the Owner shall have the right to retest any material that has been tested and approved at the source of supply after it has been delivered to the site. The Engineer shall have the right to reject only material which, when retested, does not meet the requirements of the contract, plans, or specifications.

**60-05 Engineer’s field office.** Not required.
60-06 Storage of materials. Materials shall be so stored as to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located to facilitate their prompt inspection. The Contractor shall coordinate the storage of all materials with the Engineer. Materials to be stored on airport property shall not create an obstruction to air navigation nor shall they interfere with the free and unobstructed movement of aircraft. Unless otherwise shown on the plans, the storage of materials and the location of the Contractor’s plant and parked equipment or vehicles shall be as directed by the Engineer. Private property shall not be used for storage purposes without written permission of the Owner or lessee of such property. The Contractor shall make all arrangements and bear all expenses for the storage of materials on private property. Upon request, the Contractor shall furnish the Engineer a copy of the property Owner’s permission.

All storage sites on private or airport property shall be restored to their original condition by the Contractor at his or her entire expense, except as otherwise agreed to (in writing) by the Owner or lessee of the property.

60-07 Unacceptable materials. Any material or assembly that does not conform to the requirements of the contract, plans, or specifications shall be considered unacceptable and shall be rejected. The Contractor shall remove any rejected material or assembly from the site of the work, unless otherwise instructed by the Engineer.

Rejected material or assembly, the defects of which have been corrected by the Contractor, shall not be returned to the site of the work until such time as the Engineer has approved its use in the work.

60-08 Owner furnished materials. The Contractor shall furnish all materials required to complete the work, except those specified, if any, to be furnished by the Owner. Owner-furnished materials shall be made available to the Contractor at the location specified.

All costs of handling, transportation from the specified location to the site of work, storage, and installing Owner-furnished materials shall be included in the unit price bid for the contract item in which such Owner-furnished material is used.

After any Owner-furnished material has been delivered to the location specified, the Contractor shall be responsible for any demurrage, damage, loss, or other deficiencies that may occur during the Contractor’s handling, storage, or use of such Owner-furnished material. The Owner will deduct from any monies due or to become due the Contractor any cost incurred by the Owner in making good such loss due to the Contractor’s handling, storage, or use of Owner-furnished materials.

END OF SECTION 60
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Section 70 Legal Regulations and Responsibility to Public

70-01 Laws to be observed. The Contractor shall keep fully informed of all Federal and state laws, all local laws, ordinances, and regulations and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of the work. The Contractor shall at all times observe and comply with all such laws, ordinances, regulations, orders, and decrees; and shall protect and indemnify the Owner and all his or her officers, agents, or servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by the Contractor or the Contractor’s employees.

70-02 Permits, licenses, and taxes. The Contractor shall procure all permits and licenses, pay all charges, fees, and taxes, and give all notices necessary and incidental to the due and lawful execution of the work.

70-03 Patented devices, materials, and processes. If the Contractor is required or desires to use any design, device, material, or process covered by letters of patent or copyright, the Contractor shall provide for such use by suitable legal agreement with the Patentee or Owner. The Contractor and the surety shall indemnify and hold harmless the Owner, any third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material or process, or any trademark or copyright, and shall indemnify the Owner for any costs, expenses, and damages which it may be obliged to pay by reason of an infringement, at any time during the execution or after the completion of the work.

70-04 Restoration of surfaces disturbed by others. The Owner reserves the right to authorize the construction, reconstruction, or maintenance of any public or private utility service, FAA or National Oceanic and Atmospheric Administration (NOAA) facility, or a utility service of another government agency at any time during the progress of the work. To the extent that such construction, reconstruction, or maintenance has been coordinated with the Owner, such authorized work (by others) is indicated as follows: none.

Except as listed above, the Contractor shall not permit any individual, firm, or corporation to excavate or otherwise disturb such utility services or facilities located within the limits of the work without the written permission of the Engineer.

Should the Owner of public or private utility service, FAA, or NOAA facility, or a utility service of another government agency be authorized to construct, reconstruct, or maintain such utility service or facility during the progress of the work, the Contractor shall cooperate with such Owners by arranging and performing the work in this contract to facilitate such construction, reconstruction or maintenance by others whether or not such work by others is listed above. When ordered as extra work by the Engineer, the Contractor shall make all necessary repairs to the work which are due to such authorized work by others, unless otherwise provided for in the contract, plans, or specifications. It is understood and agreed that the Contractor shall not be entitled to make any claim for damages due to such authorized work by others or for any delay to the work resulting from such authorized work.

70-05 Federal aid participation. For Airport Improvement Program (AIP) contracts, the United States Government has agreed to reimburse the Owner for some portion of the contract costs. Such reimbursement is made from time to time upon the Owner’s request to the FAA. In consideration of the United States Government’s (FAA’s) agreement with the Owner, the Owner has included provisions in
this contract pursuant to the requirements of Title 49 of the USC and the Rules and Regulations of the FAA that pertain to the work.

As required by the USC, the contract work is subject to the inspection and approval of duly authorized representatives of the FAA Administrator, and is further subject to those provisions of the rules and regulations that are cited in the contract, plans, or specifications.

No requirement of the USC, the rules and regulations implementing the USC, or this contract shall be construed as making the Federal Government a party to the contract nor will any such requirement interfere, in any way, with the rights of either party to the contract.

**70-06 Sanitary, health, and safety provisions.** The Contractor shall provide and maintain in a neat, sanitary condition such accommodations for the use of his or her employees as may be necessary to comply with the requirements of the state and local Board of Health, or of other bodies or tribunals having jurisdiction.

Attention is directed to Federal, state, and local laws, rules and regulations concerning construction safety and health standards. The Contractor shall not require any worker to work in surroundings or under conditions that are unsanitary, hazardous, or dangerous to his or her health or safety.

**70-07 Public convenience and safety.** The Contractor shall control his or her operations and those of his or her subcontractors and all suppliers, to assure the least inconvenience to the traveling public. Under all circumstances, safety shall be the most important consideration.

The Contractor shall maintain the free and unobstructed movement of aircraft and vehicular traffic with respect to his or her own operations and those of his or her subcontractors and all suppliers in accordance with the subsection 40-05 titled MAINTENANCE OF TRAFFIC of Section 40 hereinbefore specified and shall limit such operations for the convenience and safety of the traveling public as specified in the subsection 80-04 titled LIMITATION OF OPERATIONS of Section 80 hereinafter.

**70-08 Barricades, warning signs, and hazard markings.** The Contractor shall furnish, erect, and maintain all barricades, warning signs, and markings for hazards necessary to protect the public and the work. When used during periods of darkness, such barricades, warning signs, and hazard markings shall be suitably illuminated. Unless otherwise specified, barricades, warning signs, and markings for hazards that are in the air operations area (AOAs) shall be a maximum of 18 inches (0.5 m) high. Unless otherwise specified, barricades shall be spaced not more than 4 feet (1.2 m) apart. Barricades, warning signs, and markings shall be paid for under subsection 40-05.

For vehicular and pedestrian traffic, the Contractor shall furnish, erect, and maintain barricades, warning signs, lights and other traffic control devices in reasonable conformity with the Manual on Uniform Traffic Control Devices.

When the work requires closing an air operations area of the airport or portion of such area, the Contractor shall furnish, erect, and maintain temporary markings and associated lighting conforming to the requirements of advisory circular (AC) 150/5340-1, Standards for Airport Markings.

The Contractor shall furnish, erect, and maintain markings and associated lighting of open trenches, excavations, temporary stock piles, and the Contractor’s parked construction equipment that may be hazardous to the operation of emergency fire-rescue or maintenance vehicles on the airport in reasonable conformance to AC 150/5370-2, Operational Safety on Airports During Construction.

The Contractor shall identify each motorized vehicle or piece of construction equipment in reasonable conformance to AC 150/5370-2.

The Contractor shall furnish and erect all barricades, warning signs, and markings for hazards prior to commencing work that requires such erection and shall maintain the barricades, warning signs, and markings for hazards until their removal is directed by the Engineer.
Open-flame type lights shall not be permitted.

70-09 Use of explosives. When the use of explosives is necessary for the execution of the work, the Contractor shall exercise the utmost care not to endanger life or property, including new work. The Contractor shall be responsible for all damage resulting from the use of explosives.

All explosives shall be stored in a secure manner in compliance with all laws and ordinances, and all such storage places shall be clearly marked. Where no local laws or ordinances apply, storage shall be provided satisfactory to the Engineer and, in general, not closer than 1,000 feet (300 m) from the work or from any building, road, or other place of human occupancy.

The Contractor shall notify each property Owner and public utility company having structures or facilities in proximity to the site of the work of his or her intention to use explosives. Such notice shall be given sufficiently in advance to enable them to take such steps as they may deem necessary to protect their property from injury.

The use of electrical blasting caps shall not be permitted on or within 1,000 feet (300 m) of the airport property.

70-10 Protection and restoration of property and landscape. The Contractor shall be responsible for the preservation of all public and private property, and shall protect carefully from disturbance or damage all land monuments and property markers until the Engineer has witnessed or otherwise referenced their location and shall not move them until directed.

The Contractor shall be responsible for all damage or injury to property of any character, during the execution of the work, resulting from any act, omission, neglect, or misconduct in manner or method of executing the work, or at any time due to defective work or materials, and said responsibility shall not be released until the project has been completed and accepted.

When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work, or in consequence of the non-execution thereof by the Contractor, the Contractor shall restore, at his or her own expense, such property to a condition similar or equal to that existing before such damage or injury was done, by repairing, or otherwise restoring as may be directed, or the Contractor shall make good such damage or injury in an acceptable manner.

70-11 Responsibility for damage claims. The Contractor shall indemnify and save harmless the Engineer and the Owner and their officers, and employees from all suits, actions, or claims, of any character, brought because of any injuries or damage received or sustained by any person, persons, or property on account of the operations of the Contractor; or on account of or in consequence of any neglect in safeguarding the work; or through use of unacceptable materials in constructing the work; or because of any act or omission, neglect, or misconduct of said Contractor; or because of any claims or amounts recovered from any infringements of patent, trademark, or copyright; or from any claims or amounts arising or recovered under the “Workmen’s Compensation Act,” or any other law, ordinance, order, or decree. Money due the Contractor under and by virtue of his or her contract considered necessary by the Owner for such purpose may be retained for the use of the Owner or, in case no money is due, his or her surety may be held until such suits, actions, or claims for injuries or damages shall have been settled and suitable evidence to that effect furnished to the Owner, except that money due the Contractor will not be withheld when the Contractor produces satisfactory evidence that he or she is adequately protected by public liability and property damage insurance.

70-12 Third party beneficiary clause. It is specifically agreed between the parties executing the contract that it is not intended by any of the provisions of any part of the contract to create for the public or any member thereof, a third party beneficiary or to authorize anyone not a party to the contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of the contract.
70-13 Opening sections of the work to traffic. Not used.

Upon completion of any portion of the work listed above, such portion shall be accepted by the Owner in accordance with the subsection 50-14 titled PARTIAL ACCEPTANCE of Section 50.

No portion of the work may be opened by the Contractor for public use until ordered by the Engineer in writing. Should it become necessary to open a portion of the work to public traffic on a temporary or intermittent basis, such openings shall be made when, in the opinion of the Engineer, such portion of the work is in an acceptable condition to support the intended traffic. Temporary or intermittent openings are considered to be inherent in the work and shall not constitute either acceptance of the portion of the work so opened or a waiver of any provision of the contract. Any damage to the portion of the work so opened that is not attributable to traffic which is permitted by the Owner shall be repaired by the Contractor at his or her expense.

The Contractor shall make his or her own estimate of the inherent difficulties involved in completing the work under the conditions herein described and shall not claim any added compensation by reason of delay or increased cost due to opening a portion of the contract work.

Contractor shall be required to conform to safety standards contained AC 150/5370-2 (see Special Provisions).

Contractor shall refer to the approved Construction Safety Phasing Plan (CSPP) to identify barricade requirements and other safety requirements prior to opening up sections of work to traffic.

70-14 Contractor’s responsibility for work. Until the Engineer’s final written acceptance of the entire completed work, excepting only those portions of the work accepted in accordance with the subsection 50-14 titled PARTIAL ACCEPTANCE of Section 50, the Contractor shall have the charge and care thereof and shall take every precaution against injury or damage to any part due to the action of the elements or from any other cause, whether arising from the execution or from the non-execution of the work. The Contractor shall rebuild, repair, restore, and make good all injuries or damages to any portion of the work occasioned by any of the above causes before final acceptance and shall bear the expense thereof except damage to the work due to unforeseeable causes beyond the control of and without the fault or negligence of the Contractor, including but not restricted to acts of God such as earthquake, tidal wave, tornado, hurricane or other cataclysmic phenomenon of nature, or acts of the public enemy or of government authorities.

If the work is suspended for any cause whatever, the Contractor shall be responsible for the work and shall take such precautions necessary to prevent damage to the work. The Contractor shall provide for normal drainage and shall erect necessary temporary structures, signs, or other facilities at his or her expense. During such period of suspension of work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established planting, seeding, and sodding furnished under the contract, and shall take adequate precautions to protect new tree growth and other important vegetative growth against injury.

70-15 Contractor’s responsibility for utility service and facilities of others. As provided in the subsection 70-04 titled RESTORATION OF SURFACES DISTURBED BY OTHERS of this section, the Contractor shall cooperate with the Owner of any public or private utility service, FAA or NOAA, or a utility service of another government agency that may be authorized by the Owner to construct, reconstruct or maintain such utility services or facilities during the progress of the work. In addition, the Contractor shall control their operations to prevent the unscheduled interruption of such utility services and facilities.

To the extent that such public or private utility services, FAA, or NOAA facilities, or utility services of another governmental agency are known to exist within the limits of the contract work, the approximate locations have been indicated on the plans and the Owners are indicated as follows: none.
It is understood and agreed that the Owner does not guarantee the accuracy or the completeness of the location information relating to existing utility services, facilities, or structures that may be shown on the plans or encountered in the work. Any inaccuracy or omission in such information shall not relieve the Contractor of the responsibility to protect such existing features from damage or unscheduled interruption of service.

It is further understood and agreed that the Contractor shall, upon execution of the contract, notify the Owners of all utility services or other facilities of his or her plan of operations. Such notification shall be in writing addressed to THE PERSON TO CONTACT as provided in this subsection and subsection 70-04 titled RESTORATION OF SURFACES DISTURBED BY OTHERS of this section. A copy of each notification shall be given to the Engineer.

In addition to the general written notification provided, it shall be the responsibility of the Contractor to keep such individual Owners advised of changes in their plan of operations that would affect such Owners.

Prior to beginning the work in the general vicinity of an existing utility service or facility, the Contractor shall again notify each such Owner of their plan of operation. If, in the Contractor’s opinion, the Owner’s assistance is needed to locate the utility service or facility or the presence of a representative of the Owner is desirable to observe the work, such advice should be included in the notification. Such notification shall be given by the most expeditious means to reach the utility owner’s PERSON TO CONTACT no later than two normal business days prior to the Contractor’s commencement of operations in such general vicinity. The Contractor shall furnish a written summary of the notification to the Engineer.

The Contractor’s failure to give the two days’ notice shall be cause for the Owner to suspend the Contractor’s operations in the general vicinity of a utility service or facility.

Where the outside limits of an underground utility service have been located and staked on the ground, the Contractor shall be required to use hand excavation methods within 3 feet (1 m) of such outside limits at such points as may be required to ensure protection from damage due to the Contractor’s operations.

Should the Contractor damage or interrupt the operation of a utility service or facility by accident or otherwise, the Contractor shall immediately notify the proper authority and the Engineer and shall take all reasonable measures to prevent further damage or interruption of service. The Contractor, in such events, shall cooperate with the utility service or facility owner and the Engineer continuously until such damage has been repaired and service restored to the satisfaction of the utility or facility owner.

The Contractor shall bear all costs of damage and restoration of service to any utility service or facility due to their operations whether due to negligence or accident. The Owner reserves the right to deduct such costs from any monies due or which may become due the Contractor, or his or her surety.

70-16 Furnishing rights-of-way. The Owner will be responsible for furnishing all rights-of-way upon which the work is to be constructed in advance of the Contractor’s operations.

70-17 Personal liability of public officials. In carrying out any of the contract provisions or in exercising any power or authority granted by this contract, there shall be no liability upon the Engineer, his or her authorized representatives, or any officials of the Owner either personally or as an official of the Owner. It is understood that in such matters they act solely as agents and representatives of the Owner.

70-18 No waiver of legal rights. Upon completion of the work, the Owner will expeditiously make final inspection and notify the Contractor of final acceptance. Such final acceptance, however, shall not preclude or stop the Owner from correcting any measurement, estimate, or certificate made before or after completion of the work, nor shall the Owner be precluded or stopped from recovering from the Contractor or his or her surety, or both, such overpayment as may be sustained, or by failure on the part of the
Contractor to fulfill his or her obligations under the contract. A waiver on the part of the Owner of any breach of any part of the contract shall not be held to be a waiver of any other or subsequent breach.

The Contractor, without prejudice to the terms of the contract, shall be liable to the Owner for latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the Owner’s rights under any warranty or guaranty.

70-19 Environmental protection. The Contractor shall comply with all Federal, state, and local laws and regulations controlling pollution of the environment. The Contractor shall take necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oils, bitumens, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter.

70-20 Archaeological and historical findings. Unless otherwise specified in this subsection, the Contractor is advised that the site of the work is not within any property, district, or site, and does not contain any building, structure, or object listed in the current National Register of Historic Places published by the United States Department of Interior.

Should the Contractor encounter, during his or her operations, any building, part of a building, structure, or object that is incongruous with its surroundings, the Contractor shall immediately cease operations in that location and notify the Engineer. The Engineer will immediately investigate the Contractor’s finding and the Owner will direct the Contractor to either resume operations or to suspend operations as directed.

Should the Owner order suspension of the Contractor’s operations in order to protect an archaeological or historical finding, or order the Contractor to perform extra work, such shall be covered by an appropriate contract change order or supplemental agreement as provided in the subsection 40-04 titled EXTRA WORK of Section 40 and the subsection 90-05 titled PAYMENT FOR EXTRA WORK of Section 90. If appropriate, the contract change order or supplemental agreement shall include an extension of contract time in accordance with the subsection 80-07 titled DETERMINATION AND EXTENSION OF CONTRACT TIME of Section 80.

END OF SECTION 70
Section 80 Execution and Progress

80-01 Subletting of contract. The Owner will not recognize any subcontractor on the work. The Contractor shall at all times when work is in progress be represented either in person, by a qualified superintendent, or by other designated, qualified representative who is duly authorized to receive and execute orders of the Engineer.

The Contractor shall provide copies of all subcontracts to the Engineer. The Contractor shall perform, with his organization, an amount of work equal to at least 35 percent of the total contract cost.

Should the Contractor elect to assign his or her contract, said assignment shall be concurred in by the surety, shall be presented for the consideration and approval of the Owner, and shall be consummated only on the written approval of the Owner.

80-02 Notice to proceed. The notice to proceed shall state the date on which it is expected the Contractor will begin the construction and from which date contract time will be charged. The Contractor shall begin the work to be performed under the contract within 10 days of the date set by the Engineer in the written notice to proceed, but in any event, the Contractor shall notify the Engineer at least 24 hours in advance of the time actual construction operations will begin. The Contractor shall not commence any actual construction prior to the date on which the notice to proceed is issued by the Owner.

80-03 Execution and progress. Unless otherwise specified, the Contractor shall submit their progress schedule for the Engineer’s approval within 10 days after the effective date of the notice to proceed. The Contractor’s progress schedule, when approved by the Engineer, may be used to establish major construction operations and to check on the progress of the work. The Contractor shall provide sufficient materials, equipment, and labor to guarantee the completion of the project in accordance with the plans and specifications within the time set forth in the proposal.

If the Contractor falls significantly behind the submitted schedule, the Contractor shall, upon the Engineer’s request, submit a revised schedule for completion of the work within the contract time and modify their operations to provide such additional materials, equipment, and labor necessary to meet the revised schedule. Should the execution of the work be discontinued for any reason, the Contractor shall notify the Engineer at least 24 hours in advance of resuming operations.

The Contractor shall not commence any actual construction prior to the date on which the notice to proceed is issued by the Owner.

80-04 Limitation of operations. Not used.

80-04.1 Operational safety on airport during construction. Not used.

80-05 Character of workers, methods, and equipment. The Contractor shall, at all times, employ sufficient labor and equipment for prosecuting the work to full completion in the manner and time required by the contract, plans, and specifications.

All workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform the work satisfactorily.

Any person employed by the Contractor or by any subcontractor who violates any operational regulations or operational safety requirements and, in the opinion of the Engineer, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Engineer, be
removed forthwith by the Contractor or subcontractor employing such person, and shall not be employed again in any portion of the work without approval of the Engineer.

Should the Contractor fail to remove such persons or person, or fail to furnish suitable and sufficient personnel for the proper execution of the work, the Engineer may suspend the work by written notice until compliance with such orders.

All equipment that is proposed to be used on the work shall be of sufficient size and in such mechanical condition as to meet requirements of the work and to produce a satisfactory quality of work. Equipment used on any portion of the work shall be such that no injury to previously completed work, adjacent property, or existing airport facilities will result from its use.

When the methods and equipment to be used by the Contractor in accomplishing the work are not prescribed in the contract, the Contractor is free to use any methods or equipment that will accomplish the work in conformity with the requirements of the contract, plans, and specifications.

When the contract specifies the use of certain methods and equipment, such methods and equipment shall be used unless others are authorized by the Engineer. If the Contractor desires to use a method or type of equipment other than specified in the contract, the Contractor may request authority from the Engineer to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed and of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing work in conformity with contract requirements. If, after trial use of the substituted methods or equipment, the Engineer determines that the work produced does not meet contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining work with the specified methods and equipment. The Contractor shall remove any deficient work and replace it with work of specified quality, or take such other corrective action as the Engineer may direct. No change will be made in basis of payment for the contract items involved nor in contract time as a result of authorizing a change in methods or equipment under this subsection.

**80-06 Temporary suspension of the work.** The Owner shall have the authority to suspend the work wholly, or in part, for such period or periods as the Owner may deem necessary, due to unsuitable weather, or such other conditions as are considered unfavorable for the execution of the work, or for such time as is necessary due to the failure on the part of the Contractor to carry out orders given or perform any or all provisions of the contract.

In the event that the Contractor is ordered by the Owner, in writing, to suspend work for some unforeseen cause not otherwise provided for in the contract and over which the Contractor has no control, the Contractor may be reimbursed for actual money expended on the work during the period of shutdown. No allowance will be made for anticipated profits. The period of shutdown shall be computed from the effective date of the Engineer’s order to suspend work to the effective date of the Engineer’s order to resume the work. Claims for such compensation shall be filed with the Engineer within the time period stated in the Engineer’s order to resume work. The Contractor shall submit with his or her claim information substantiating the amount shown on the claim. The Engineer will forward the Contractor’s claim to the Owner for consideration in accordance with local laws or ordinances. No provision of this article shall be construed as entitling the Contractor to compensation for delays due to inclement weather, for suspensions made at the request of the Owner, or for any other delay provided for in the contract, plans, or specifications.

If it should become necessary to suspend work for an indefinite period, the Contractor shall store all materials in such manner that they will not become an obstruction nor become damaged in any way. The Contractor shall take every precaution to prevent damage or deterioration of the work performed and provide for normal drainage of the work. The Contractor shall erect temporary structures where necessary to provide for traffic on, to, or from the airport.
80-07 Determination and extension of contract time. The number of calendar or working days allowed for completion of the work shall be stated in the proposal and contract and shall be known as the CONTRACT TIME.

Should the contract time require extension for reasons beyond the Contractor’s control, it shall be adjusted as follows:

a. CONTRACT TIME based on WORKING DAYS shall be calculated weekly by the Engineer. The Engineer will furnish the Contractor a copy of his or her weekly statement of the number of working days charged against the contract time during the week and the number of working days currently specified for completion of the contract (the original contract time plus the number of working days, if any, that have been included in approved CHANGE ORDERS or SUPPLEMENTAL AGREEMENTS covering EXTRA WORK).

The Engineer shall base his or her weekly statement of contract time charged on the following considerations:

1. No time shall be charged for days on which the Contractor is unable to proceed with the principal item of work under construction at the time for at least six (6) hours with the normal work force employed on such principal item. Should the normal work force be on a double-shift, 12 hours shall be used. Should the normal work force be on a triple-shift, 18 hours shall apply. Conditions beyond the Contractor’s control such as strikes, lockouts, unusual delays in transportation, temporary suspension of the principal item of work under construction or temporary suspension of the entire work which have been ordered by the Owner for reasons not the fault of the Contractor, shall not be charged against the contract time.

2. The Engineer will not make charges against the contract time prior to the effective date of the notice to proceed.

3. The Engineer will begin charges against the contract time on the first working day after the effective date of the notice to proceed.

4. The Engineer will not make charges against the contract time after the date of final acceptance as defined in the subsection 50-15 titled FINAL ACCEPTANCE of Section 50.

5. The Contractor will be allowed one (1) week in which to file a written protest setting forth his or her objections to the Engineer’s weekly statement. If no objection is filed within such specified time, the weekly statement shall be considered as acceptable to the Contractor.

The contract time (stated in the proposal) is based on the originally estimated quantities as described in the subsection 20-05 titled INTERPRETATION OF ESTIMATED PROPOSAL QUANTITIES of Section 20. Should the satisfactory completion of the contract require performance of work in greater quantities than those estimated in the proposal, the contract time shall be increased in the same proportion as the cost of the actually completed quantities bears to the cost of the originally estimated quantities in the proposal. Such increase in contract time shall not consider either the cost of work or the extension of contract time that has been covered by change order or supplemental agreement and shall be made at the time of final payment.

b. Contract Time based on calendar days shall consist of the number of calendar days stated in the contract counting from the effective date of the notice to proceed and including all Saturdays, Sundays, holidays, and non-work days. All calendar days elapsing between the effective dates of the Owner’s orders to suspend and resume all work, due to causes not the fault of the Contractor, shall be excluded.

At the time of final payment, the contract time shall be increased in the same proportion as the cost of the actually completed quantities bears to the cost of the originally estimated quantities in the proposal. Such increase in the contract time shall not consider either cost of work or the extension of contract time
that has been covered by a change order or supplemental agreement. Charges against the contract time will cease as of the date of final acceptance.

c. When the contract time is a specified completion date, it shall be the date on which all contract work shall be substantially complete.

If the Contractor finds it impossible for reasons beyond his or her control to complete the work within the contract time as specified, or as extended in accordance with the provisions of this subsection, the Contractor may, at any time prior to the expiration of the contract time as extended, make a written request to the Owner for an extension of time setting forth the reasons which the Contractor believes will justify the granting of his or her request. Requests for extension of time on calendar day projects, caused by inclement weather, shall be supported with National Weather Bureau data showing the actual amount of inclement weather exceeded what could normally be expected during the contract period. The Contractor's plea that insufficient time was specified is not a valid reason for extension of time. If the supporting documentation justify the work was delayed because of conditions beyond the control and without the fault of the Contractor, the Owner may extend the time for completion by a change order that adjusts the contract time or completion date. The extended time for completion shall then be in full force and effect, the same as though it were the original time for completion.

80-08 Failure to complete on time. For each calendar day or working day, as specified in the contract, that any work remains uncompleted after the contract time (including all extensions and adjustments as provided in the subsection 80-07 titled DETERMINATION AND EXTENSION OF CONTRACT TIME of this Section) the sum specified in the contract and proposal as liquidated damages will be deducted from any money due or to become due the Contractor or his or her surety. Such deducted sums shall not be deducted as a penalty but shall be considered as liquidation of a reasonable portion of damages including but not limited to additional engineering services that will be incurred by the Owner should the Contractor fail to complete the work in the time provided in their contract.

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Liquidated Damages Cost</th>
<th>Allowed Construction Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substantial Completion</td>
<td>$1,000 per calendar day</td>
<td>120 calendar days</td>
</tr>
<tr>
<td>Final Completion</td>
<td>$500 per calendar day</td>
<td>45 calendar days</td>
</tr>
</tbody>
</table>

Permitting the Contractor to continue and finish the work or any part of it after the time fixed for its completion, or after the date to which the time for completion may have been extended, will in no way operate as a waiver on the part of the Owner of any of its rights under the contract.

80-09 Default and termination of contract. The Contractor shall be considered in default of his or her contract and such default will be considered as cause for the Owner to terminate the contract for any of the following reasons if the Contractor:

a. Fails to begin the work under the contract within the time specified in the Notice to Proceed, or

b. Fails to perform the work or fails to provide sufficient workers, equipment and/or materials to assure completion of work in accordance with the terms of the contract, or

c. Performs the work unsuitably or neglects or refuses to remove materials or to perform anew such work as may be rejected as unacceptable and unsuitable, or

d. Discontinues the execution of the work, or

e. Fails to resume work which has been discontinued within a reasonable time after notice to do so, or

f. Becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or
g. Allows any final judgment to stand against the Contractor unsatisfied for a period of 10 days, or
h. Makes an assignment for the benefit of creditors, or
i. For any other cause whatsoever, fails to carry on the work in an acceptable manner.

Should the Engineer consider the Contractor in default of the contract for any reason above, the Engineer shall immediately give written notice to the Contractor and the Contractor’s surety as to the reasons for considering the Contractor in default and the Owner’s intentions to terminate the contract.

If the Contractor or surety, within a period of 10 days after such notice, does not proceed in accordance therewith, then the Owner will, upon written notification from the Engineer of the facts of such delay, neglect, or default and the Contractor’s failure to comply with such notice, have full power and authority without violating the contract, to take the execution of the work out of the hands of the Contractor. The Owner may appropriate or use any or all materials and equipment that have been mobilized for use in the work and are acceptable and may enter into an agreement for the completion of said contract according to the terms and provisions thereof, or use such other methods as in the opinion of the Engineer will be required for the completion of said contract in an acceptable manner.

All costs and charges incurred by the Owner, together with the cost of completing the work under contract, will be deducted from any monies due or which may become due the Contractor. If such expense exceeds the sum which would have been payable under the contract, then the Contractor and the surety shall be liable and shall pay to the Owner the amount of such excess.

**80-10 Termination for national emergencies.** The Owner shall terminate the contract or portion thereof by written notice when the Contractor is prevented from proceeding with the construction contract as a direct result of an Executive Order of the President with respect to the execution of war or in the interest of national defense.

When the contract, or any portion thereof, is terminated before completion of all items of work in the contract, payment will be made for the actual number of units or items of work completed at the contract price or as mutually agreed for items of work partially completed or not started. No claims or loss of anticipated profits shall be considered.

Reimbursement for organization of the work, and other overhead expenses, (when not otherwise included in the contract) and moving equipment and materials to and from the job will be considered, the intent being that an equitable settlement will be made with the Contractor.

Acceptable materials, obtained or ordered by the Contractor for the work and that are not incorporated in the work shall, at the option of the Contractor, be purchased from the Contractor at actual cost as shown by receipted bills and actual cost records at such points of delivery as may be designated by the Engineer.

Termination of the contract or a portion thereof shall neither relieve the Contractor of his or her responsibilities for the completed work nor shall it relieve his or her surety of its obligation for and concerning any just claim arising out of the work performed.

**80-11 Work area, storage area and sequence of operations.** Not used.

**END OF SECTION 80**
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Section 90 Measurement and Payment

90-01 Measurement of quantities. All work completed under the contract will be measured by the Engineer, or his or her authorized representatives, using United States Customary Units of Measurement or the International System of Units.

The method of measurement and computations to be used in determination of quantities of material furnished and of work performed under the contract will be those methods generally recognized as conforming to good engineering practice.

Unless otherwise specified, longitudinal measurements for area computations will be made horizontally, and no deductions will be made for individual fixtures (or leave-outs) having an area of 9 square feet (0.8 square meters) or less. Unless otherwise specified, transverse measurements for area computations will be the neat dimensions shown on the plans or ordered in writing by the Engineer.

Structures will be measured according to neat lines shown on the plans or as altered to fit field conditions.

Unless otherwise specified, all contract items which are measured by the linear foot such as electrical ducts, conduits, pipe culverts, underdrains, and similar items shall be measured parallel to the base or foundation upon which such items are placed.

In computing volumes of excavation the average end area method or other acceptable methods will be used.

The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing will be specified and measured in decimal fraction of inch.

The term “ton” will mean the short ton consisting of 2,000 lb (907 kg) avoirdupois. All materials that are measured or proportioned by weights shall be weighed on accurate, approved scales by competent, qualified personnel at locations designed by the Engineer. If material is shipped by rail, the car weight may be accepted provided that only the actual weight of material is paid for. However, car weights will not be acceptable for material to be passed through mixing plants. Trucks used to haul material being paid for by weight shall be weighed empty daily at such times as the Engineer directs, and each truck shall bear a plainly legible identification mark.

Materials to be measured by volume in the hauling vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. Vehicles for this purpose may be of any size or type acceptable for the materials hauled, provided that the body is of such shape that the actual contents may be readily and accurately determined. All vehicles shall be loaded to at least their water level capacity, and all loads shall be leveled when the vehicles arrive at the point of delivery.

When requested by the Contractor and approved by the Engineer in writing, material specified to be measured by the cubic yard (cubic meter) may be weighed, and such weights will be converted to cubic yards (cubic meters) for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the Engineer and shall be agreed to by the Contractor before such method of measurement of pay quantities is used.

Bituminous materials will be measured by the gallon (liter) or ton (kg). When measured by volume, such volumes will be measured at 60°F (16°C) or will be corrected to the volume at 60°F (16°C) using ASTM D1250 for asphalts or ASTM D633 for tars.
Net certified scale weights or weights based on certified volumes in the case of rail shipments will be used as a basis of measurement, subject to correction when bituminous material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work.

When bituminous materials are shipped by truck or transport, net certified weights by volume, subject to correction for loss or foaming, may be used for computing quantities.

Cement will be measured by the ton (kg) or hundredweight (km).

Timber will be measured by the thousand feet board measure (MFBM) actually incorporated in the structure. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.

The term “lump sum” when used as an item of payment will mean complete payment for the work described in the contract.

When a complete structure or structural unit (in effect, “lump sum” work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories.

Rental of equipment will be measured by time in hours of actual working time and necessary traveling time of the equipment within the limits of the work. Special equipment ordered by the Engineer in connection with force account work will be measured as agreed in the change order or supplemental agreement authorizing such force account work as provided in the subsection 90-05 titled PAYMENT FOR EXTRA WORK of this section.

When standard manufactured items are specified such as fence, wire, plates, rolled shapes, pipe conduit, etc., and these items are identified by gauge, unit weight, section dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerances in cited specifications, manufacturing tolerances established by the industries involved will be accepted.

Scales for weighing materials which are required to be proportioned or measured and paid for by weight shall be furnished, erected, and maintained by the Contractor, or be certified permanently installed commercial scales.

Scales shall be accurate within 1/2% of the correct weight throughout the range of use. The Contractor shall have the scales checked under the observation of the inspector before beginning work and at such other times as requested. The intervals shall be uniform in spacing throughout the graduated or marked length of the beam or dial and shall not exceed one-tenth of 1% of the nominal rated capacity of the scale, but not less than 1 pound (454 grams). The use of spring balances will not be permitted.

Beams, dials, platforms, and other scale equipment shall be so arranged that the operator and the inspector can safely and conveniently view them.

Scale installations shall have available ten standard 50-pound (2.3 km) weights for testing the weighing equipment or suitable weights and devices for other approved equipment.

Scales must be tested for accuracy and serviced before use at a new site. Platform scales shall be installed and maintained with the platform level and rigid bulkheads at each end.

Scales “overweighing” (indicating more than correct weight) will not be permitted to operate, and all materials received subsequent to the last previous correct weighting-accuracy test will be reduced by the percentage of error in excess of one-half of 1%.

In the event inspection reveals the scales have been underweighing (indicating less than correct weight), they shall be adjusted, and no additional payment to the Contractor will be allowed for materials previously weighed and recorded.
All costs in connection with furnishing, installing, certifying, testing, and maintaining scales; for furnishing check weights and scale house; and for all other items specified in this subsection, for the weighing of materials for proportioning or payment, shall be included in the unit contract prices for the various items of the project.

When the estimated quantities for a specific portion of the work are designated as the pay quantities in the contract, they shall be the final quantities for which payment for such specific portion of the work will be made, unless the dimensions of said portions of the work shown on the plans are revised by the Engineer. If revised dimensions result in an increase or decrease in the quantities of such work, the final quantities for payment will be revised in the amount represented by the authorized changes in the dimensions.

**90-02 Scope of payment.** The Contractor shall receive and accept compensation provided for in the contract as full payment for furnishing all materials, for performing all work under the contract in a complete and acceptable manner, and for all risk, loss, damage, or expense of whatever character arising out of the nature of the work or the execution thereof, subject to the provisions of the subsection 70-18 titled NO WAIVER OF LEGAL RIGHTS of Section 70.

When the “basis of payment” subsection of a technical specification requires that the contract price (price bid) include compensation for certain work or material essential to the item, this same work or material will not also be measured for payment under any other contract item which may appear elsewhere in the contract, plans, or specifications.

**90-03 Compensation for altered quantities.** When the accepted quantities of work vary from the quantities in the proposal, the Contractor shall accept as payment in full, so far as contract items are concerned, payment at the original contract price for the accepted quantities of work actually completed and accepted. No allowance, except as provided for in the subsection 40-02 titled ALTERATION OF WORK AND QUANTITIES of Section 40 will be made for any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor which results directly from such alterations or indirectly from his or her unbalanced allocation of overhead and profit among the contract items, or from any other cause.

**90-04 Payment for omitted items.** As specified in the subsection 40-03 titled OMITTED ITEMS of Section 40, the Engineer shall have the right to omit from the work (order nonperformance) any contract item, except major contract items, in the best interest of the Owner.

Should the Engineer omit or order nonperformance of a contract item or portion of such item from the work, the Contractor shall accept payment in full at the contract prices for any work actually completed and acceptable prior to the Engineer’s order to omit or non-perform such contract item.

Acceptable materials ordered by the Contractor or delivered on the work prior to the date of the Engineer’s order will be paid for at the actual cost to the Contractor and shall thereupon become the property of the Owner.

In addition to the reimbursement hereinbefore provided, the Contractor shall be reimbursed for all actual costs incurred for the purpose of performing the omitted contract item prior to the date of the Engineer’s order. Such additional costs incurred by the Contractor must be directly related to the deleted contract item and shall be supported by certified statements by the Contractor as to the nature the amount of such costs.

**90-05 Payment for extra work.** Extra work, performed in accordance with the subsection 40-04 titled EXTRA WORK of Section 40, will be paid for at the contract prices or agreed prices specified in the change order or supplemental agreement authorizing the extra work.

**90-06 Partial payments.** Partial payments will be made to the Contractor at least once each month as the work progresses. Said payments will be based upon estimates, prepared by the Engineer, of the value of the work performed and materials complete and in place, in accordance with the contract, plans, and
specifications. Such partial payments may also include the delivered actual cost of those materials stockpiled and stored in accordance with the subsection 90-07 titled PAYMENT FOR MATERIALS ON HAND of this section. No partial payment will be made when the amount due to the Contractor since the last estimate amounts to less than five hundred dollars.

The Contractor is required to pay all subcontractors for satisfactory performance of their contracts no later than 30 days after the Contractor has received a partial payment. A subcontractor’s work is satisfactorily completed when all the tasks called for in the subcontract have been accomplished and documented as required by the Owner. When the Owner has made an incremental acceptance of a portion of a prime contract, the work of a subcontractor covered by that acceptance is deemed to be satisfactorily completed.

Retainage will not be withheld on this project. No retainage will be withheld by the Owner from progress payments due the prime Contractor. Retainage by the prime or subcontractors is prohibited, and no retainage will be held by the prime from progress due subcontractors.

When at least 95% of the work has been completed, the Engineer shall, at the Owner’s discretion and with the consent of the surety, prepare estimates of both the contract value and the cost of the remaining work to be done.

It is understood and agreed that the Contractor shall not be entitled to demand or receive partial payment based on quantities of work in excess of those provided in the proposal or covered by approved change orders or supplemental agreements, except when such excess quantities have been determined by the Engineer to be a part of the final quantity for the item of work in question.

No partial payment shall bind the Owner to the acceptance of any materials or work in place as to quality or quantity. All partial payments are subject to correction at the time of final payment as provided in the subsection 90-09 titled ACCEPTANCE AND FINAL PAYMENT of this section.

The Contractor shall deliver to the Owner a complete release of all claims for labor and material arising out of this contract before the final payment is made. If any subcontractor or supplier fails to furnish such a release in full, the Contractor may furnish a bond or other collateral satisfactory to the Owner to indemnify the Owner against any potential lien or other such claim. The bond or collateral shall include all costs, expenses, and attorney fees the Owner may be compelled to pay in discharging any such lien or claim.

**90-07 Payment for materials on hand.** Partial payments may be made to the extent of the delivered cost of materials to be incorporated in the work, provided that such materials meet the requirements of the contract, plans, and specifications and are delivered to acceptable sites on the airport property or at other sites in the vicinity that are acceptable to the Owner. Such delivered costs of stored or stockpiled materials may be included in the next partial payment after the following conditions are met:

a. The material has been stored or stockpiled in a manner acceptable to the Engineer at or on an approved site.

b. The Contractor has furnished the Engineer with acceptable evidence of the quantity and quality of such stored or stockpiled materials.

c. The Contractor has furnished the Engineer with satisfactory evidence that the material and transportation costs have been paid.

d. The Contractor has furnished the Owner legal title (free of liens or encumbrances of any kind) to the material so stored or stockpiled.

e. The Contractor has furnished the Owner evidence that the material so stored or stockpiled is insured against loss by damage to or disappearance of such materials at any time prior to use in the work.
It is understood and agreed that the transfer of title and the Owner’s payment for such stored or stockpiled materials shall in no way relieve the Contractor of his or her responsibility for furnishing and placing such materials in accordance with the requirements of the contract, plans, and specifications.

In no case will the amount of partial payments for materials on hand exceed the contract price for such materials or the contract price for the contract item in which the material is intended to be used.

No partial payment will be made for stored or stockpiled living or perishable plant materials.

The Contractor shall bear all costs associated with the partial payment of stored or stockpiled materials in accordance with the provisions of this subsection.

**90-08 Payment of withheld funds.** At the Contractor’s option, if an Owner withholds retainage in accordance with the methods described in subsection 90-06 PARTIAL PAYMENTS, the Contractor may request that the Owner deposit the retainage into an escrow account. The Owner’s deposit of retainage into an escrow account is subject to the following conditions:

- **a.** The Contractor shall bear all expenses of establishing and maintaining an escrow account and escrow agreement acceptable to the Owner.
- **b.** The Contractor shall deposit to and maintain in such escrow only those securities or bank certificates of deposit as are acceptable to the Owner and having a value not less than the retainage that would otherwise be withheld from partial payment.
- **c.** The Contractor shall enter into an escrow agreement satisfactory to the Owner.
- **d.** The Contractor shall obtain the written consent of the surety to such agreement.

**90-09 Acceptance and final payment.** When the contract work has been accepted in accordance with the requirements of the subsection 50-15 titled FINAL ACCEPTANCE of Section 50, the Engineer will prepare the final estimate of the items of work actually performed. The Contractor shall approve the Engineer’s final estimate or advise the Engineer of the Contractor’s objections to the final estimate which are based on disputes in measurements or computations of the final quantities to be paid under the contract as amended by change order or supplemental agreement. The Contractor and the Engineer shall resolve all disputes (if any) in the measurement and computation of final quantities to be paid within 30 calendar days of the Contractor’s receipt of the Engineer’s final estimate. If, after such 30-day period, a dispute still exists, the Contractor may approve the Engineer’s estimate under protest of the quantities in dispute, and such disputed quantities shall be considered by the Owner as a claim in accordance with the subsection 50-16 titled CLAIMS FOR ADJUSTMENT AND DISPUTES of Section 50.

After the Contractor has approved, or approved under protest, the Engineer’s final estimate, and after the Engineer’s receipt of the project closeout documentation required in subsection 90-11 Project Closeout, final payment will be processed based on the entire sum, or the undisputed sum in case of approval under protest, determined to be due the Contractor less all previous payments and all amounts to be deducted under the provisions of the contract. All prior partial estimates and payments shall be subject to correction in the final estimate and payment.

If the Contractor has filed a claim for additional compensation under the provisions of the subsection 50-16 titled CLAIMS FOR ADJUSTMENTS AND DISPUTES of Section 50 or under the provisions of this subsection, such claims will be considered by the Owner in accordance with local laws or ordinances. Upon final adjudication of such claims, any additional payment determined to be due the Contractor will be paid pursuant to a supplemental final estimate.

**90-10 Construction warranty.**

- **a.** In addition to any other warranties in this contract, the Contractor warrants that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material,
workmanship, or design furnished, or performed by the Contractor or any subcontractor or supplier at any
tier.

b. This warranty shall continue for a period of one year from the date of final acceptance of the work. If the Owner takes possession of any part of the work before final acceptance, this warranty shall continue for a period of one year from the date the Owner takes possession. However, this will not relieve the Contractor from corrective items required by the final acceptance of the project work.

c. The Contractor shall remedy at the Contractor’s expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor’s expense any damage to Owner real or personal property, when that damage is the result of:

(1) The Contractor’s failure to conform to contract requirements; or

(2) Any defect of equipment, material, workmanship, or design furnished by the Contractor.

d. The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor’s warranty with respect to work repaired or replaced will run for one year from the date of repair or replacement.

e. The Owner will notify the Contractor, in writing, within seven (7) days after the discovery of any failure, defect, or damage.

f. If the Contractor fails to remedy any failure, defect, or damage within fourteen (14) days after receipt of notice, the Owner shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor’s expense.

g. With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall: (1) Obtain all warranties that would be given in normal commercial practice; (2) Require all warranties to be executed, in writing, for the benefit of the Owner, as directed by the Owner, and (3) Enforce all warranties for the benefit of the Owner.

h. This warranty shall not limit the Owner’s rights with respect to latent defects, gross mistakes, or fraud.

90-11 Project closeout. Approval of final payment to the Contractor is contingent upon completion and submittal of the items listed below. The final payment will not be approved until the Engineer approves the Contractor’s final submittal. The Contractor shall:

a. Provide two (2) copies of all manufacturers warranties specified for materials, equipment, and installations.

b. Provide weekly payroll records (not previously received) from the general Contractor and all subcontractors.

c. Complete final cleanup in accordance with subsection 40-08, FINAL CLEANUP.

d. Complete all punch list items identified during the Final Inspection.

e. Provide complete release of all claims for labor and material arising out of the Contract.

f. Provide a certified statement signed by the subcontractors, indicating actual amounts paid to the Disadvantaged Business Enterprise (DBE) subcontractors and/or suppliers associated with the project.

g. When applicable per state requirements, return copies of sales tax completion forms.

h. Manufacturer’s certifications for all items incorporated in the work.

i. All required record drawings, as-built drawings or as-constructed drawings.
l. Equipment commissioning documentation submitted, if required.

END OF SECTION 90
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Section 105 Mobilization

105-1 Description. This item shall consist of work and operations, but is not limited to, work and operations necessary for the movement of personnel, equipment, material and supplies to and from the project site for work on the project except as provided in the contract as separate pay items.

105-1.1 Posted notices. Not used.

105-2 Basis of measurement and payment. See section 01100 for additional information.

END OF SECTION 105
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PART 1 GENERAL

Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to Division 0 and Division 1 and other Sections of these Specifications.

1.01 SUMMARY

SUMMARY OF WORK

A. The "Project," of which the "Work" of this Contract is a part, is titled Airfield Maintenance Temporary Facility – Construction, MSCAA Project 14-1379-10-01.

B. The "Work" of this Contract is defined in the Contract Documents to include, but not be limited to, retrofitting the former bus barn to serve as the airfield maintenance heavy vehicle maintenance facility, renovating the former PSI building, improving the 2 metal buildings south of the bus barn for off-season snow equipment storage, and adding a fuel dispensing system outside of the bus barn. Larger vehicle doors will be added to the bus barn and an entire structural bay will be widened to include new footings, upsized steel beams, and strengthening of existing structure. Other work efforts include, but are not necessarily limited to, equipment relocation, gravel placement, concrete foundation and pad improvements, metal building renovations, lighting enhancements, trench drain additions, site/building utilities (including electrical, gas, water, sanitary sewer, and heating), demolition of interior stud walls, sheetrock and door installation, and other efforts as required.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01 PROJECT PHASING AND COMPLETION

A. This is a fixed-duration Contract required to be substantially completed within one hundred and twenty (120) calendar days from the Notice to Proceed (“NTP”) date. The project scope of work is as stated in Paragraphs 1.01 (A) and (B) above. Final Completion of the project shall be within forty-five (45) days of the Substantial Completion Date.

“Substantial Completion” of the project shall be defined as the stage of construction when work is substantially completed and excludes all punch list items, record drawings, O&M manuals, lien waivers, maintenance training, warranties, consent of surety to final payment, and all other required closeout documentation.

“Final Completion” of the project shall be defined as work that is 100% complete including all punch list items, record drawings, O&M manuals, lien waivers, maintenance training, warranties, consent of surety to final payment, and all other required closeout documentation. Final Completion shall include Demobilization.

“Demobilization” shall consist of all activities by the Contractor and subcontractors necessary for 100% completion of the work and final contract closeout as listed above and all cleanup work and operations, including but not limited to, removal of personnel, equipment, contractor-owned
stockpiles, supplies, and incidentals from the project site; cleanup of all offices, buildings, batch plant, staging/lay-down areas, and other facilities; and restoration of all areas to preconstruction condition or better or to other condition as stipulated in the project plans and specifications; completion and delivery to the Owner of all contract closeout documentation and any other documentation request by Owner, including but not limited to, Operations and Maintenance Manuals, Warranties, Final Lien-waivers, Owner Controlled Insurance Program closeout paperwork, DBE paperwork, Final Project Record Documents and finalization of any and all punch list items. The Demobilization lump sum amount becomes fixed and will not change for the duration of contract.

B. The actual NTP date will be negotiated and mutually agreed by both parties (Owner and Contractor) prior to issuance of the NTP. If mutual agreement cannot be reached between the parties, the Owner reserves the right to establish the actual Notice to Proceed date. The NTP letter will state the date on which the Contractor will begin construction and from which date contract time will be charged. Contractor shall be mobilized and on site ready for work on the date stated in the Notice to Proceed.

C. “Mobilization” shall consist of all preparatory work and operations needed to begin construction activities on the date mutually agreed including but not limited to, movement of personnel, equipment, stockpiles, supplies and incidentals to the project site; the establishment of all offices, buildings, batch plant, staging/lay-down areas and other facilities necessary for work on the project; all other work and operations which must be performed or costs incurred prior to beginning work on the various items on the project site, and utility services for all offices, buildings, batch plant, staging/lay-down areas, and other facilities. The Mobilization lump sum amount becomes fixed and will not change for the duration of contract.

D. All days are calendar days.

E. The work site will be available as described on the plans and applicable sections of these specifications. Work is permitted 24 hours per day, 7 days per week except that only non-noise producing activities shall be permitted between 11:00 PM and 6:00 AM, except with prior written approval of the Owner.

F. The Contractor shall proceed with the work at such rate of progress to ensure full completion within the specified duration. It is expressly understood and agreed, by and between the Contractor and the Owner, that the contract time for the completion of the work described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the work.

G. If the Contractor experiences weather related delays, he shall submit a report documenting the weather conditions and delays, if any, experienced during any calendar month.

H. If the Contractor is prevented from working due to any other legitimate reason he shall notify the Owner in writing as per the Lump Sum Construction Contract of the delay and request a corresponding increase in the number of contract days.

I. The Owner shall be the sole judge as to whether or not a request for a contract time extension is legitimate.

J. The Owner reserves the right to adjust limits of construction to accommodate the Owner’s requirements for maintenance of Airport Operations and Public Traffic with minimum interruption during the construction of this project. Any required adjustment of limits of construction will be at no additional cost to the Owner.
3.02 LIQUIDATED DAMAGES

A. The OWNER and the CONTRACTOR recognize that time is an essential element of this contract and that delay in completing this project will result in damages due to public inconvenience, obstruction to aviation and vehicular traffic, interference with businesses both on and off the airport, increased operational costs to airport users, and increased costs to the OWNER associated with engineering services, inspections, testing, and project administration. It is therefore agreed that in view of the difficulty of making a precise determination of such damages, the CONTRACTOR will pay the OWNER, sums of money in the amounts herein stipulated, not as a penalty, but as Liquidated Damages for not meeting the schedule for specific critical Project Milestones.

B. If the CONTRACTOR fails to deliver equipment or materials, or perform any services within the times and dates specified in this Contract to achieve the established Milestones, or any extensions granted in writing, the CONTRACTOR shall pay to the OWNER as Liquidated Damages, the sums specified in Table 1, below:

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Completion Date</th>
<th>Liquidated Damages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization &amp; Procurement Phase*</td>
<td>N/A</td>
<td>Due to the nature of the work, mobilization phase does not have any liquidated damages</td>
</tr>
<tr>
<td>Substantial Completion</td>
<td>120 days</td>
<td>$1,000 per Day or any portion thereof</td>
</tr>
<tr>
<td>Final Completion and Demobilization Phase</td>
<td>45 days</td>
<td>$500 per Day or any portion thereof</td>
</tr>
</tbody>
</table>

*A separate NTP for Mobilization & Procurement will be issued, if determined necessary by OWNER at OWNER’s sole discretion.

D. Application of Liquidated Damages is not a Change to the Contract. The application of any Liquidated Damages to one Milestone shall not effect a change in the subsequent Contract Milestone dates or relieve CONTRACTOR of his responsibility to meet all construction schedules. If multiple Milestone dates are missed, Liquidated Damages for more than one Milestone will be imposed concurrently.

E. If Liquidated Damages are imposed, the OWNER shall deduct the same from any amounts due the CONTRACTOR at the time Liquidated Damages are imposed. If sufficient amounts are not due to the CONTRACTOR to cover such Liquidated Damages, then the OWNER shall invoice the CONTRACTOR for the amounts due to the OWNER. Such invoices shall become due and payable immediately upon receipt by the CONTRACTOR.

F. Liquidated Damages are in addition to any other damages or penalties which may be assessed and withheld under other provisions of this contract.

3.03 COMPLETION BONUS

NO completion bonus has been budgeted for this project.

END OF SECTION 01100
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DIVISION 1 – SECTION 01210

ALLOWANCES

PART 1 GENERAL

1.01 SUMMARY

A. To provide adequate budget and bonding to cover items not precisely determined by the Owner prior to bidding, allow within the proposed Contract Sum the amounts described in this Section.

B. Related Work:

1. Documents affecting Work of this Section include, but are not necessarily limited to, Division 0, Division 1 and other Sections of these Specifications.

2. Other provisions concerning Allowances may be stated in other Sections of these Specifications.

1.02 SPECIFIC ALLOWANCES – The following cash allowances are included within this Contract:

A. **Lighting Repairs** – Due to not having power at the facilities prior to bidding the project, this allowance is established to compensate for lighting repairs that are needed after the utilities are reconnected. The cost of any authorized repair work will be paid through the cash allowance provided and must be submitted and approved before work is performed. If advance pricing is not possible, work will be authorized on a time and materials basis. This allowance will be used for lighting repair items only that not already specifically detailed in the contract documents. Other lighting repairs that are detailed in the contract documents shall be included in the base bid and will not be compensated under this allowance.

B. **Metal Building Repairs** – The metal siding of the buildings and some areas of the roofs have been damaged and require some level of patch/repair work. The cost of any authorized repair work will be paid through the cash allowance provided and must be submitted and approved before work is performed. If advance pricing is not possible, work will be authorized on a time and materials basis. This allowance will be used for repair items only that are not already specifically detailed in the contract documents and, will not include daily routine Contractor maintenance and cleanup activities. These daily activities are considered an incidental expense and will not be compensated under this allowance.

END OF 01210
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DIVISION 1 – SECTION 01250
AMENDMENT PROCEDURE

PART 1 GENERAL

1.01 SUMMARY

A. Make such changes in the Work, in the Contract Price, in the Contract Time, or any combination thereof, as are described in written Amendments signed by the Owner and the Contractor and issued after execution of the Construction Contract, in accordance with the provisions of this Section.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, Division 0, Division 1, and other Sections of these Specifications.

2. Any proposal for a change in the Work shall include DBE participation consistent with the required DBE percentage for this Contract. If the Contractor is unable to meet said DBE percentage, a written justification of the good faith efforts made shall be submitted along with the response to the Engineer’s or Owner’s proposal request.

3. Engineer or Owner supplemental instructions:

   a. From time to time during progress of the Work the Engineer or Owner may issue supplemental instructions, which interpret the Contract Documents or order minor changes in the Work without change in Contract Sum or Contract Time.

   b. Should the Contractor consider that a change in Contract Sum or Contract Time is required, he shall submit an itemized proposal to the Engineer or Owner immediately and before proceeding with the Work. If the proposal is found to be satisfactory and in proper order, the supplemental instructions in that event will be superseded by an Amendment.

4. Proposal requests:

   a. From time to time during progress of the Work the Engineer or Owner may issue a Request for Proposal (RFP) proposal request for an itemized quotation for changes in the Contract Price and/or Contract Time incidental to proposed modifications to the Contract Documents.

   b. This will not be an Amendment, and will not be a direction to proceed with the changes described therein.

1.02 QUALITY ASSURANCE

A. Include within the Contractor's quality assurance program such measures as are needed to assure familiarity of the Contractor's staff and employees with these procedures for processing Amendment data.
1.03 PROCESSING PROPOSAL REQUESTS

A. Make timely written reply to the Engineer or Owner in response to each proposal request. Proposal requests will be numbered in sequence and dated.

1. State proposed change in the Contract Sum, if any.
2. State proposed change in the Contract Time of Completion, if any.
3. Clearly describe other changes in the Work, if any, required by the proposed change or desirable therewith.
4. State amount of DBE participation applicable to the proposed changes.
5. Include full backup data such as subcontractor's letter of proposal or similar information.
6. Submit this response in single copy.

B. When cost or credit for the change has been agreed upon by the Owner and the Contractor, or the Owner has directed that cost or credit be determined in accordance with provisions of Division 0 and Division 1 Specifications, the Engineer or Owner will prepare an Amendment for execution by the Owner and Contractor.

1.04 PROCESSING AMENDMENTS

A. Amendments will be numbered in sequence, and dated.

1. The Amendment will describe the change or changes, will refer to the proposal requests or supplemental instructions involved, and will be signed by the Contractor and Owner, in sequence.

2. The Engineer or Owner will issue two copies of each Amendment to the Contractor.
   a. The Contractor shall promptly sign all copies and return all copies to the Engineer or Owner for further processing by the Owner.
   b. The Engineer or Owner will forward all copies to the Owner with a request for complete processing.
   c. The Owner will sign and return a copy to the Contractor for distribution.

END OF SECTION 01250
DIVISION 1 – SECTION 01310
PRECONSTRUCTION CONFERENCE & PROGRESS MEETINGS

PART 1 PRECONSTRUCTION CONFERENCE

1.01 SUMMARY

A. To help clarify construction contract administration procedures, the Engineer or Owner will schedule a Preconstruction Conference prior to start of the Work, as described in this Section.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, Division 0 and Division 1 Specification Sections.

1.02 AGENDA AND MEETING SUMMARIES

A. To the maximum extent practicable, advise the Engineer or Owner at least 24 hours in advance of the Conference as to items to be added to the agenda.

B. The Engineer or Owner will compile summaries of the Conference, and will furnish copies of the summaries to the Contractor. The Contractor may make and distribute such other copies as he wishes.

1.03 QUALITY ASSURANCE

A. For those persons designated by the Contractor, his subcontractors, and suppliers to attend the Preconstruction Conference, provide required authority to commit the entities they represent to schedules and solutions agreed upon in the Conference.

1.04 PRECONSTRUCTION CONFERENCE

A. The Conference will be held at a time and date established by the Engineer or Owner. If requested by the Engineer or Owner, additional conferences will be held.

B. Attendance:

1. Insure attendance by authorized representatives of the Contractor and major Subcontractors.

2. The Engineer or Owner will advise other interested parties, including the Owner, and request their attendance.

C. Minimum agenda:

1. Organizational arrangement of Contractor's forces and personnel and those of subcontractors, material suppliers, and the Engineer or Owner;

2. Channels and procedures for communications;

3. Construction schedule, including sequence of critical work;

4. Contract Documents, including distribution of required copies of Drawings and revisions;

5. Processing of Shop Drawings and other data submitted to the Engineer or Owner for
review;

6. Processing of field decisions and Change Orders;

7. Rules and regulations governing performance of the Work;

8. Procedures for safety and first aid, security, quality control, housekeeping, and related matters; and

9. Reports required and schedule for submittal.

10. Items requiring long lead time and special requirements.

PART 2 PROGRESS MEETINGS

2.01 DESCRIPTION

A. Work included: To enable orderly review during progress of the Work, and to provide for systematic discussion of problems, the Engineer or Owner will conduct project meetings throughout the construction period.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Provisions, and other Sections of these Specifications.

2. The Contractor's relations with his subcontractors and materials suppliers, and discussions relative thereto, are the Contractor's responsibility and normally are not part of project meetings content.

2.02 SUBMITTALS

A. Agenda items: To the maximum extent practicable, advise the Engineer or Owner at least 24 hours in advance of project meetings regarding items to be added to the agenda.

B. Summaries:

1. The Engineer or Owner will compile summaries of each project meeting, and will furnish copies to the Contractor and the Owner.

2. Recipients of copies may make and distribute such other copies as they wish.

2.03 QUALITY ASSURANCE

A. For those persons designated by the Contractor to attend and participate in project meetings, provide required authority to commit the Contractor to solutions agreed upon in the project meetings.

PART 3 EXECUTION

3.01 MEETING SCHEDULE

A. Project meetings will be held at times as determined by the Engineer or Owner.
B. Coordinate as necessary to establish a mutually acceptable schedule for meetings.

3.02 MEETING LOCATION

A. The Engineer or Owner will establish the meeting location.

3.03 PROJECT MEETINGS

A. Attendance:

1. To the maximum extent practicable, assign the same person or persons to represent the Contractor at project meetings throughout progress of the Work.

2. Subcontractors, materials suppliers, and others may be invited to attend those project meetings in which their aspect of the Work is involved.

B. Minimum agenda:

1. Review, revise as necessary, and approve summaries of previous meetings.

2. Review progress of the Work since last meeting, including status of outstanding submittals.

3. Identify problems which may impede planned progress.

4. Develop corrective measures and procedures to reestablish planned schedule.

5. Discuss other current business.

C. Revisions to summaries:

1. Unless published summaries are challenged in writing prior to the next regularly scheduled progress meeting, they will be accepted as properly stating the activities and decisions of the meeting.

2. Persons challenging published summaries shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of summaries.

3. Challenge to summaries shall be settled as priority portion of "old business" at the next regularly scheduled meeting.

END OF SECTION 01310
DIVISION 1 - SECTION 01320
SCHEDULES AND REPORTS

PART 1 GENERAL

1.01 SUMMARY

A. The work under this Contract shall be planned, scheduled and reported using computerized precedence diagram format of the Critical Path Method in calendar days, unless otherwise specifically provided in the Contract Documents. The Detailed Construction Schedule shall be developed by using the latest revision of Microsoft Project, or approved equal computer software.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, other Sections of these Specifications.

2. Other provisions concerning Schedules and Reports are stated in Specification Sections:
   - 01100 – Summary of Work, Sequence of Construction & Liquidated Damages
   - General Provision Section 60 - Control of Materials
   - General Provision Section 90 - Measurement and Payment

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. The Detailed Construction Schedule shall be developed by using the latest revision of Microsoft Project, or approved equal computer software that is compatible with Owner’s scheduling software.

B. The primary objectives of the requirements of this section are:

1. to insure adequate planning and execution of the Work by Contractor;

2. to assist Owner and Engineer in evaluating the progress of the Work;

3. to provide a mechanism or tool for use by the Owner, Engineer and Contractor in determining and monitoring any actions of the Contractor which may be required in order to comply with the requirements of the Contract relating to the timely completion of the various portions of the Work

C. The Detailed Construction Schedule, defined in Paragraph 3.04, shall represent the Contractor's commitment and intended plan for completion of the Work in compliance with the Contract. The Contractor will not:

1. Misrepresent to the Owner its planning, scheduling, and coordination of the work;

2. Utilize schedules different from those provided to the Owner and Engineer for the direction, execution and coordination of the work;

3. Utilize schedules which are not feasible or realistic; or
4. Prepare schedules, updates, revisions or reports which do not accurately reflect the Contractor's actual intent or the Contractor's reasonable and actual expectations as to: the sequences of activities, labor availability, productivity, or efficiency; expected or reasonably foreseeable inclement weather conditions; the percentage complete of any activity or path of activities; completion of any item of work or activity; projected dates of completion; delays, slippage, or problems encountered or expected and Subcontractor requests for time extensions.

D. Once approved by the Engineer or Owner, the Detailed Construction Schedule will become the Schedule of Record for coordinating the work, scheduling the work, monitoring the work, issuing progress payments, evaluating time extension requests, and all other objectives listed in Paragraph 3.01.B. The Contractor is required to employ whatever means he deems necessary to implement the Detailed Construction Schedule and to comply with the requirements of this Section. Updates shall be provided to the Engineer or Owner at each construction progress meeting or as requested by the Engineer or Owner. Updates shall be both electronic media and hard copy.

E. Contractor is responsible for determining the sequence of activities, the time estimates of the detailed construction activities and the means, methods, techniques and procedures to be employed. Each construction schedule shall represent the Contractor's best judgment of how he will prosecute the Work in compliance with the Contract.

F. Contractor shall consult with his Subcontractors and Suppliers (if any) relating to the preparation of each construction schedule. Subcontractors shall receive copies of each construction schedule and shall be continually advised of any updates or revisions to each construction schedule as the Work progresses.

G. When there are separate contractors working concurrently on Airport whose work must interface or be coordinated with the Work of Contractor, Contractor shall coordinate his activities with the activities of the separate contractors and shall, prior to the submission of any construction schedule to the Engineer or Owner, obtain written approval of his construction schedule by the separate contractors.

H. To carry out the intent of this Section, the Contractor agrees that the reasonable exercise of any rights under this Section by the Engineer or Owner shall not be grounds for any claim by Contractor or any of his Suppliers, Subcontractors or Sub-subcontractors of alleged interference, lack of cooperation, delay, disruption, negligence or hindrance by Owner or Engineer, and Contractor covenants not to sue therefor.

I. It is understood and agreed that the Detailed Construction Schedule, defined in Paragraph 3.04, is to represent Contractor's best plan and commitment for the Work; however, Contractor acknowledges that the Detailed Construction Schedule may have to be revised from time-to-time as progress proceeds. Contractor further acknowledges and agrees that the Owner and Engineer do not guarantee that:

1. Any changes, modifications or adjustments to any schedule by Contractor can only be made by the written approval of the Engineer or Owner.

J. It is understood and agreed that should the Engineer or Owner provide the Contractor, at Contractor's request, with any advice relating to the scheduling or coordination of the Work or any other matter that:

1. Owner and Engineer shall not be liable to Contractor for any errors, omissions, negligence or deficiencies which may in any way occur because of same;
2. Such advice is provided solely as aids in the development by Contractor of a
representation of Contractor's actual construction plan and schedule in accordance with the requirements of the Contract Documents, and Owner and Engineer shall not be liable to Contractor should Contractor rely on such advice or counsel to his detriment;

3. Such advice shall not relieve Contractor of any responsibility under Paragraph 3.01.E hereof for all construction means, methods techniques, sequences and procedures and for planning, scheduling and coordinating all portions of the Work; and

4. Any advice provided by the Engineer or Owner or the lack or alleged untimeliness thereof will not in any way take the place of or relieve the Contractor of full responsibility for compliance with all requirements of the Contract, including, but not limited to the obligations to complete the Work within the Contract.

K. Approval or acceptance by the Owner or Engineer of any Contractor's construction schedule, or any revisions or updates thereto, shall not relieve the Contractor of the responsibility for accomplishing the Work by the Project Substantial Completion date.

L. Contractor shall be solely responsible for expediting the delivery of all materials and equipment to be furnished by him so that the progress of construction shall be maintained according to the currently approved construction schedule for the Work. Contractor shall notify the Owner or Engineer in writing, and in a timely and reasonable manner, whenever Contractor determines or anticipates that the delivery date of any material or equipment to be furnished by Contractor will be later than the delivery date indicated by the currently approved construction schedule, or the current update thereof as herein provided.

3.02 NOT USED

3.03 DETAILED CONSTRUCTION SCHEDULE DRAFT

A. No later than two (2) weeks prior to estimated Notice to Proceed, the Contractor shall complete a draft of the Detailed Construction Schedule in accordance with the requirements of this Paragraph 3.03.

3.04 DETAILED CONSTRUCTION SCHEDULE

A. Prior to any monthly Application for Payment, the Contractor shall complete the Detailed Construction Schedule to the satisfaction of the Owner or Engineer.

B. The Detailed Construction Schedule shall represent the Contractor's commitment and intended plan for completion of the Work in compliance with the Contract.

C. The Owner/Engineer reserves the right to require the Contractor to furnish such manpower, materials facilities and equipment and shall work such hours, including additional shifts and overtime operations as may be necessary, to insure completion of the Work or specified portions thereof within the specific dates as set forth in the Contract Documents. If it becomes apparent to the Owner or Engineer that the work, or any required portion thereof, will not be completed by any such dates, the Contractor shall undertake the following actions, at no additional cost to the Owner, and comply with the requirements as set forth in Section 01320, 3.07 and 3.08, in order to ensure that it complies with all completion requirements:

1. Increase the quantity of manpower, materials, trades, crafts, and equipment and facilities on the site;

2. Increase the number of working hours per shift, shifts per working day, or any combination of the foregoing; and
3. Reschedule activities to achieve maximum activity accomplishment.

3.05 DETAILED CONSTRUCTION SCHEDULE CONTENT

A. The Detailed Construction Schedule shall consist of a time-scaled graphic representation of all activities, which are part of the Contractor's construction plan and an accompanying listing of each activity's dependencies and interrelationships.

B. The Contractor shall anticipate and account for, as a minimum, the potential loss of the number of calendar days listed below for each calendar month due to weather and shall schedule the work accordingly.

<table>
<thead>
<tr>
<th>Month</th>
<th>Loss of Days</th>
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<tbody>
<tr>
<td>January</td>
<td>8</td>
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<tr>
<td>February</td>
<td>8</td>
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<tr>
<td>March</td>
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<tr>
<td>November</td>
<td>6</td>
</tr>
<tr>
<td>December</td>
<td>8</td>
</tr>
</tbody>
</table>

The preceding days were derived from historical data provided by the National Climatic Data Center regarding rainfall at Memphis International Airport. They represent a number less than the actual number of days of measurable rainfall that can be expected to occur during a twenty-four (24) hour period for the months indicated. The Contractor shall make his own determination as to the likely impact of weather on his operation and shall include as part of the Detailed Construction Schedule submission an accounting of how the impact of anticipated weather was determined and accounted for in the schedule. These values listed above are the minimum number of weather related days the Contractor shall consider in developing his Detailed Construction Schedule. It is further understood that said calendar day period shall be derived through assuming that work will take place on a calendar day basis.

The Owner or Engineer will continually monitor the effects of weather and when found justified, grant time extensions, if required, at the end of the Contract. In the event less weather days are actually encountered than provided for in this section, those days will accrue to subsequent months of the phase or contract and be balanced against actual weather. In accordance with the Contract Documents weather days occurring during the extension beyond the original completion date will be compensated day for day, if justified. No weather days will be granted beyond the final Contract completion date as computed herein.

C. All activity durations shall be given in calendar days.

D. Contractor shall plan his operations and schedule the work to ensure that the critical path runs through on-site construction activities and that off-site procurement activities do not control the critical path of the Detailed Construction Schedule, unless approved in writing by the Owner or Engineer.

3.06 UPDATING OF CONSTRUCTION SCHEDULE/PROGRESS REPORTS

A. The Detailed Construction Schedule will be reviewed and updated as needed during each project progress meeting.

3.07 RECOVERY SCHEDULE

A. Should the updated Detailed Construction Schedule, at any time during Contractor's performance, show, in the sole opinion of the Owner or Engineer, that the Contractor is seven (7) or more days behind schedule for any location or category of work, or should Contractor be required to undertake actions under Paragraph 3.04.D hereof, the Contractor shall immediately prepare a
Recovery Schedule explaining and displaying how Contractor intends to reschedule his Work in order to regain compliance with the Approved Detailed Construction Schedule during the immediate subsequent pay period.

3.08 SCHEDULE REVISIONS

A. Should Contractor desire to or be otherwise required under the Contract to make modifications or changes in his method of operation, his sequence of Work or the durations of the activities in his Construction Schedule, he shall do so in accordance with Paragraph 3.04 of this specification. The approved Detailed Construction Schedule may only be revised by the written approval of the Owner or Engineer as provided herein.

END OF SECTION 01320
DIVISION 1 – SECTION 01321
CONSTRUCTION SURVEYING

PART 1 GENERAL

1.01 SUMMARY

A. This section describes the Owner’s airport survey grid and surveying requirements.

B. Related Work:
   1. Documents affecting work of this Section include, but are not necessarily limited to the General Provisions and other Sections of these Specifications.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTIONS

3.01 EXISTING SURVEY CONTROL MONUMENTS

A. The Owner has established an airport-wide survey grid consisting of both first order and second order survey monuments. The monuments are distributed both inside and outside the Air Operations Area fence.

B. The monuments are tied to the Tennessee State Plane Coordinate System in U.S. Survey feet with the North American Datum, 1983.

C. Survey control monuments typically, but not always, consist of aluminum disks stamped with identifying codes, set in concrete, and marked by orange witness posts.

D. The Contractor may obtain the current Survey Control Monument Manual from the Program Manager.

3.02 REQUIREMENTS

A. Contractor is responsible for all construction surveying.

B. Any deviations from the existing grades shall be immediately reported to the Program Manager.

C. Contractor shall tie the project to the survey grid as established by the monuments described in section 3.01.

D. Contractor shall protect all survey monuments within the vicinity of the project and all survey monuments used for survey while they are occupied.

E. The Contractor shall, at his expense, have a Tennessee Professional Land Surveyor replace any monument disturbed or destroyed by Contractor’s construction activities (using first order techniques); replaced monuments shall be located at least ten feet, but not more than fifty feet, from the location of the disturbed monument. New monuments shall consist of aluminum disks stamped with an identifying code, set in concrete using a procedure approved by Program Manager, and marked by an orange witness post. Replaced-monument survey information shall be provided to Owner in exact format as contained within Owner’s Survey Control Monument Manual.

END OF SECTION 01321
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DIVISION 1 – SECTION 01325

DELAYS AND EXTENSIONS OF TIME

1.01 DESCRIPTION

A. Work included:

1. Delays and extensions of time.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to the General Provisions, and other Sections of these Specifications.

1.02 OBLIGATION OF OWNER AND PROGRAM MANAGER

A. Neither the Owner nor the Program Manager shall be obligated or liable to the Contractor for any damages, cost or expenses of any type which the Contractor, its subcontractors, sub-subcontractors, or any other person may incur as a result of any disruption or delay from any cause, regardless of the actual source of delay, whether avoidable or unavoidable, it being understood and agreed that the Contractor’s sole and exclusive remedy in such event shall be an extension of the Contract Time, but in accordance with provisions of the Contract Documents.

B. Except for weather delays, any claim for extension of time shall be made in writing to the Program Manager not more than ten (10) days after commencement of such delay, otherwise, such claim will be waived. The Contractor shall provide an estimate of the probable effect of such delay on the progress of the Work.

C. The time during which the Contractor is delayed in performance of the work caused by the acts or omissions of the Owner, Program Manager or their employees or agents, or by acts of God, fires, floods, epidemics, quarantine restrictions, riots, civil commotions or freight embargoes, or other conditions beyond the Contractor’s control which the Contractor could not have reasonably foreseen and provided against shall be added to the Contract Time; however, the Contractor must submit his claim for such delays in accordance with the requirements of this Section and any other applicable provisions of these Contract Documents in order to be considered for an extension of time.

D. The Contract Time shall be adjusted only for changes in the work pursuant to GP-40, suspensions of the work, excusable delays or emergencies. Whenever the Contractor requests an extension of the Contract Time, the Contractor shall furnish such justification and supporting evidence as required by this section and such other and additional information as the Owner may deem necessary to determine whether the Contractor is entitled to an extension of the Contract Time. All such requests shall conform to all of the requirements of the Contract Documents, shall include evidence that the reasons for the requested Contract Time extension were beyond the control of the Contractor, and the Contractor shall bear the burden of substantiating and proving the necessity of an extension to the Contract Time. The Owner, with the assistance of the Program Manager, shall review all requests for Contract Time extensions and shall advise the Contractor of its decision and finding of fact in writing. If the Owner determines that the Contractor is entitled to an extension of the Contract Time, the length of the extension shall be based upon the currently approved detailed construction schedule and on all other relevant data, which data shall be incorporated into and from the basis for revision to the construction schedule.
The Contractor acknowledges and agrees that the actual delays due to said changes, suspension of the work, or excusable delays in activities which, according to the detailed construction schedule, do not affect the Contract Time, shall not affect the Contract Time, and therefore, cannot form the basis for an extension in the Contract Time or a change in the construction schedule.

E. The Contractor shall be entitled to an extension of the Contract Time but no increase in the Contract sum, for delays arising from unforeseeable causes beyond the control and without the fault of negligence of the Contractor or its Subcontractors as follows:

1. Acts of God, tornadoes, fires, blizzards, earthquakes, or floods that severely damages completed work or stored materials.

2. Acts of the public enemy; acts of the state, federal or local governments in their sovereign capacities; and acts of a separate contractor in the performance of a separate contract with the Owner relating to this or another project.

F. The Contractor shall not be entitled to any extension of Contract Time resulting from any condition or cause unless the Contractor strictly complies with the requirements of this Section and the Contractor must submit to the Program Manager within ten (10) days of the first instance of the delay a written request for an extension in the Contract Time which shall include the following information: (a) the nature of the delay; (b) the date of anticipated date of commencement of the delay; (c) activities on the schedule affected by the delay, and/or new activities created by the delay and their relationship with existing activities; (d) identification of persons or organizations or events responsible for the delay; and (e) recommended action to avoid or minimize the delay.

G. No claim for delay shall be allowed and the Contractor waives any such claim if the Contractor fails to furnish the written request, required by this or other sections, within the period of time specified therein.

END OF SECTION 01325
DIVISION 1 – SECTION 01330

SUBMITTALS

PART 1 GENERAL

1.01 SUMMARY

A. This section describes the process for handling Contractor submittals.
B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, Division 0, Division 1, and other Sections of these Specifications

1.02 SUBMITTALS

A. Except as otherwise specified below, as soon as practicable after contract award and without causing delay in the work, submit at least 7 bound copies of submittals of all items for which submittals are specified in other sections, and for all major submittal equipment whether specified in other sections or not. Alternatively, all Submittals may be submitted electronically in lieu of hard copies, if possible. Each submittal shall be clearly marked with the project name, dated, and accompanied by a letter of transmittal listing all items included in the submittal and referencing the project specification page and article numbers applicable to each item.

1. Submittals shall include all test results and/or certificate necessary to show that the item conforms to the standards specified. Such standards shall include ASTM, AASHTO, FAA, PCA, Federal Specifications or any other standard listed in these specifications.

1.03 QUALITY ASSURANCE

A. Before submission to the Engineer or Owner, the Contractor shall check the submittals of all items furnished directly by him, and the applicable Subcontractor shall check the submittals of all items furnished by the Subcontractor involved, as follows: check the submittal drawings for completeness and compliance with the contract documents; check and verify all dimensions, field conditions certifications relating to the submittals and certify in writing that these checks have been made.

1. The Engineer or Owner will return for resubmission, all submittals without the above specified approval and certification, and all submittals which in the Engineer’s or Owner’s opinion contain numerous discrepancies and/or have not been checked by the Contractor or Subcontractor.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01 SUBMITTAL REVIEW

A. After the Owner or Engineer has reviewed the submittals, except as otherwise specified below, submittals will be dated, and three sets will be returned to the Contractor. If submittals are rejected, four sets will be returned to the Contractor, with indications of the required corrections and changes made on one of the sets. Make such corrections and changes as indicated. Resubmit
submittals as specified above, as often as required by the Engineer or Owner to complete the review. No correction or change indicated on submittals shall be considered as an order for extra work.

B. Submittals reviewed by the Owner or Engineer will be a general review only, and acceptance will not relieve Contractor or Subcontractor of responsibility for accuracy of submittals, proper fitting, coordination, construction or work, and furnishing materials and work required by Contract but not indicated on submittals. Review of submittals shall not be construed as accepting departures from Contract requirements.

C. Any material ordered, or work performed prior to obtaining an approved submittal shall be at the Contractor’s risk and subject to rejection.

END OF SECTION 01330
DIVISION 1 – SECTION 01351

STORAGE AND PROTECTION

PART 1   GENERAL

1.01 SUMMARY

A. Protect products scheduled for use in the Work by all means including, but not necessarily limited to, those described in this Section.

B. Related Work:
   1. Documents affecting work of this Section include, but are not necessarily limited to, Division 0, and Division 1 of these Specifications.
   2. Additional procedures may also be prescribed in other Sections of these Specifications.

1.02 QUALITY ASSURANCE

A. Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

1.03 MANUFACTURERS' RECOMMENDATIONS

A. Except as otherwise approved by the Owner or Engineer, determine and comply with manufacturers' recommendations on product handling, storage, and protection.

1.04 PACKAGING

A. Deliver products to the job site in their manufacturer's original container, with labels intact and legible.
   1. Maintain packaged materials with seals unbroken and labels intact until time of use.
   2. Promptly remove damaged material and unsuitable items from the job site, and promptly replace same with material meeting the specified requirements, at no additional cost to the Owner.

B. The Owner or Engineer may reject as non-complying such material and products as do not bear identification satisfactory to the Owner or Engineer such as manufacturer, grade, quality, and other pertinent information.

1.05 PROTECTION

A. Protect finished surfaces, materials, trenches, earthwork, etc. from weather, construction operations, etc.

B. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the Owner.
1.06 REPAIRS AND REPLACEMENTS

A. In event of damage, promptly make replacements and repairs to the approval of the Owner or Engineer and at no additional cost to the Owner.

B. Additional time required to secure replacements and to make repairs will not be considered by the Owner or Engineer to justify an extension in the Substantial Completion Date.

END OF SECTION 01351
DIVISION 1 – SECTION 01352

NUCLEAR GAGES

01352-01 TESTING. When the specifications provide for nuclear gage acceptance testing of material for Items P-152, and P-209, the testing shall be performed in accordance with this section. At each sampling location, the field density shall be determined in accordance with ASTM D 6938 using the Direct Transmission Method. The nuclear gage shall be calibrated in accordance with ASTM D 6938. Calibration and operation of the gage shall be in accordance with the requirements of the manufacturer. The operator of the nuclear gage must show evidence of training and experience in the use of the instrument. The gage shall be standardized daily in accordance with ASTM standards.

When using the nuclear method, ASTM D 6938 shall be used to determine the moisture content of the material. The calibration curve furnished with the nuclear gauges shall be checked in accordance with ASTM standards. The calibration checks shall be made at the beginning of a job and at regular daily intervals.

The material shall be accepted on a lot basis. Each Lot shall be divided into eight (8) sublots when ASTM D 6938 is used.

01352-02-02 When PWL concepts are incorporated, compaction shall continue until a PWL of 90 percent or more is achieved using the lower specification tolerance limits (L) below.

The percentage of material within specification limits (PWL) shall be determined in accordance with the procedures specified in Section 110 of the General Provisions.

The lower specification tolerance limit (L) for density shall be:

<table>
<thead>
<tr>
<th>Specification Item Number</th>
<th>Specification Tolerance (L) for Density, (percent of laboratory maximum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item P-152</td>
<td>90.5 for cohesive material, 95.5 for non-cohesive</td>
</tr>
<tr>
<td>Item P-209</td>
<td>97.0</td>
</tr>
</tbody>
</table>

If the PWL is less than 90 percent, the lot shall be reworked and recompacted by the Contractor at the Contractor's expense. After reworking and recompaction, the lot shall be resampled and retested. Retest results for the lot shall be reevaluated for acceptance. This procedure shall continue until the PWL is 90 percent or greater.

01352-03 VERIFICATION TESTING. (For Item P-152 only.) The Program Manager will verify the maximum laboratory density of material placed in the field for each lot. A minimum of one test will be made for each lot of material at the site. The verification process will consist of; (1) compacting the material and determining the dry density and moisture-density in accordance with ASTM D 1557, and (2) comparing the result with the laboratory moisture-density curves for the material being placed. This verification process is commonly referred to as a "one-point Proctor".

If the material does not conform to the existing moisture-density curves, the Program Manager will establish the laboratory maximum density and optimum moisture content for the material in accordance with ASTM D 1557.

Additional verification tests will be made, if necessary, to properly classify all materials placed in the lot.

The percent compaction of each sampling location will be determined by dividing the field density of each sublot by the laboratory maximum density for the lot.

END OF SECTION 01352
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DIVISION 1 – SECTION 01455
QUALITY CONTROL AND QUALITY ASSURANCE TESTING PROGRAMS

PART 1  GENERAL

1.01  SUMMARY

A.  This Section describes quality control and quality assurance testing and inspections required to be provided by the Contractor and the Owner.

B.  Related work:

1.  Documents affecting work of this Section include, but are not necessarily limited to, Division 0, Division 1 and other Sections of these Specifications.

2.  Requirements for testing are described in various Sections of these Specifications.

1.02  QUALITY CONTROL and QUALITY ASSURANCE TESTING PROGRAMS

A.  Contractor Quality Control Testing: At his own expense, the Contractor shall make separate arrangements for and be fully responsible for all quality control testing as required by the technical specifications and General Provision Section 100.

B.  Owner Quality Assurance Testing: At no cost to the Contractor, the Owner will make arrangements for the services of an independent testing laboratory for quality assurance testing of work and materials. This testing is for the Owner's use only and will only be performed after the Contractor’s quality control testing program has tested and approved materials and workmanship to be in full compliance with the quality standards of the Specifications. The Owner Quality Assurance testing services shall in no way relieve the Contractor of the responsibility for providing the quality materials, workmanship and testing required for compliance with these specifications.

C.  Determination of Specification Compliance: In all cases of conflicting test results, the Owner's quality assurance test results shall govern. All retesting shall be conducted by Owner's testing laboratory at the Contractor's expense. The amount and location of any retesting shall be as directed by the Owner or Engineer. Unsatisfactory work or materials shall be retested as often as necessary until retests indicate that the failed work or materials have achieved conformity with the Plans and Specifications. The Owner or Engineer shall make the final determination as to whether any work or materials, which do not conform to the Plans and Specifications upon initial testing, are to be removed from the site or reworked. The Owner or Engineer shall also make the final determination as to whether the retesting indicates that work or materials initially rejected have been corrected to meet the requirements of the Plans and Specifications. All removal, replacement, rolling, watering, aeration, reworking, etc. required to bring rejected work or materials into conformance with the Plans and Specifications shall be at the Contractor's expense.

D.  Retesting Expense: The Owner will bear the expense of the initial quality assurance testing of certain items of work or materials as required by the technical specifications. Any retesting of these items of work or materials which upon initial testing fail to meet the standards specified or indicated on the plans shall be at the Contractor's expense.

E.  Laboratory Inspection and Testing: If this contract requires laboratory inspection, testing, and stamping of concrete pipe, concrete fittings, or any other material, the cost of that laboratory inspection, testing, and stamping shall be borne by the Contractor and included in the cost of the work.
F. Prior to starting concrete operations the Contractor shall name his source of supply for concrete materials and submit representative samples and reports of quality tests for approval.

G. The Owner shall engage and pay for the services of an independent testing laboratory to perform the following services:

1. Slump test, ASTM C143, shall be taken with every set of cylinders and as often as required to provide the specified consistency of concrete.

2. Determine air content with every set of cylinders, ASTM C231, or as required.

3. Cast and test a set of at least 6 cylinders for each day's pour or for each 100 cubic yards or fraction thereof for each class of concrete. Cylinders shall be made and cured, ASTM C31, and tested, ASTM C39, in accordance with ASTM specifications for control tests. Cylinders shall be tested at 7 and 28 days. The Contractor shall provide insulated storage room with heat when necessary to store control cylinders and a protected space for storage of "field" cylinders which approximates the condition of curing of the concrete being sampled. Cylinders designated as "field" cylinders shall be used to determine safe stripping and loading of members. On all pours in excess of 25 cubic yards, continuous laboratory inspection shall be provided at the job site for checking materials, deliveries and concrete consistencies.

H. The testing laboratory shall observe the materials and the manufacturer of concrete as specified and shall report to the Contractor and Designer the progress thereof. Also, when it appears that the material furnished and the work performed by the Contractor fails to fulfill the specified requirements and Contract, the testing laboratory shall direct the attention of the Contractor and Designer to such failure or infringement. Such observation shall not relieve the Contractor of any obligation to furnish acceptable materials or to provide the concrete quality in the structure that is in strict accordance with plans and specifications. The testing laboratory is not authorized to revoke, alter, relax, enlarge or release the requirements of the specifications, nor to issue instructions contrary to the plans and specifications; nor to approve or accept any portion of the work but in case of any dispute arising between the testing laboratory and the Contractor as to materials furnished or in the manner of performing the work, the testing laboratory shall have the authority to reject materials or suspend the work until the question at issue can be referred to the Designer. The testing laboratory shall not act as foreman or perform other duties for the Contractor. In no case shall any advice or oversight on the part of the testing laboratory relieve the Contractor of responsibility for completing the work in accordance with plans and specifications and the fulfillment of the Contract. The work will be observed as it progresses, but failure to report to the Designer any defective work or materials shall not in any way prevent later rejection when such a defect is discovered or obligate the Owner for final acceptance. Any expense incident to the investigation and determination of actual quality of any questionable material shall be borne by the Contractor.

I. In the event that concrete tests fail to meet strength requirements of these specifications the designer may require, at no additional cost to the Owner, tests in accordance with the "Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete", ASTM C42, or order load tests in accordance with Chapter 20 of the ACI Building Code 318, to be made on the portions of the structure containing questionable concrete. Suitable appliances and methods of loading the measuring shall be provided by the Contractor under the direction of the testing laboratory. The portions of the structure which are found by the Designer to contain defective concrete shall be removed and reconstructed in a satisfactory manner at the Contractor's expense. Concrete strength tests are to conform to Chapter 5 of the ACI Building Code 318.

J. The laboratory shall have free access to material stockpiles, batching and mixing plants, and job site. The Contractor shall provide adequate assistance to the laboratory in securing specified samples for tests.
K. Contractor shall give the Designer and laboratory reasonable notice before beginning any pours (at least 24 hours).

L. The laboratory shall supply a daily report of concrete and materials testing and inspection to the designer (two copies) and Contractor (one copy).

M. Concrete batched away from the job and delivered in mixer or agitator trucks shall conform to requirements of ASTM C94.

N. Sampling and Testing:
   1. All materials shall be sampled, tested in accordance with appropriate ASTM Standards, and approved before inclusion in any work on this project.
   2. Samples for testing shall be furnished by the Contractor.
   3. Rejected material shall be immediately removed from the site.

O. Standards: Comply with the following applicable standards:
   1. ACI 211.1R: "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete."
   2. ACI 211.2: "Standard Practice for Selecting Proportions for Structural Lightweight Concrete."
   3. ACI 301R: "Standard Specifications for Structural Concrete for Buildings".
   5. ACI 305R: "Hot Weather Concreting."
   6. ACI 306R: "Cold Weather Concreting."
   7. ACI 308R: "Standard Practice for Curing Concrete."
   8. ACI 318: "Building Code Requirements for Structural Concrete and Commentary."

P. Examine the substrate, formwork, and the conditions under which concrete reinforcement is to be placed, and correct conditions which would prevent proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

Q. Inspection: Before placement of concrete, the Owner's Representative shall observe the placement of all reinforcing and give his approval.

END OF SECTION 01455
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DIVISION 1 – SECTION 01500
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SUMMARY
A. This Section describes construction facilities and temporary controls required for the Work.
B. Related work:
   1. Documents affecting work of this Section include, but are not necessarily limited to, Division 0 and Division 1 Specifications,

1.02 REQUIREMENTS
A. Provide construction facilities and temporary controls needed for the Work including, but not necessarily limited to:
   1. Sanitary facilities;
   2. Temporary fencing of the construction site, if required.

1.03 DELIVERY, STORAGE, AND HANDLING
A. Maintain temporary facilities and controls in proper and safe condition throughout progress of the Work.

PART 2 PRODUCTS

2.01 UTILITIES
A. Water:
   1. Provide necessary temporary piping and water supply and, upon completion of the Work, remove such temporary facilities.
   2. Provide and pay for water used in construction.

B. Electricity:
   1. Provide necessary temporary wiring and, upon completion of the Work, remove such temporary facility.
   2. Provide area distribution boxes located so that the individual trades may furnish and use 100 ft maximum length extension cords to obtain power and lighting at points where needed for work, inspection, and safety.
   3. Provide and pay for electricity used in construction.

C. Heating: Provide, maintain and pay for heat necessary for proper conduct of operations needed in the Work.

D. Telephone:
1. Make necessary arrangements and pay costs for installation and operation of telephone service to the Contractor's office at the site.

2. Make the telephone available to the Program Manager for use in connection with the Work.

2.02 FIELD OFFICES AND SHEDS

A. Sanitary facilities:
   1. Provide temporary sanitary facilities in the quantity required for use by all personnel.
   2. Maintain in a sanitary condition at all times.

2.03 ENCLOSURES

A. Provide and maintain for the duration of construction all scaffolds, tarpaulins, canopies, warning signs, steps, platforms, bridges, and other temporary construction necessary for proper completion of the Work in compliance with pertinent safety and other regulations.

2.04 TEMPORARY FENCING

A. If indicated provide and maintain for the duration of construction a temporary fence of design and type needed to prevent entry onto the Work by the public.

2.05 REMOVING AND REPLACING FENCES, SOD, ETC.

A. Where required to install the Work, carefully remove and store all interfering fences, mailboxes, culverts, etc. After installation of work and backfilling, reinstall these items and restore them to at least the conditions, which existed prior to the commencement of work, using materials and workmanship to match those of the original construction and installation.

B. Carefully remove and store all interfering shrubbery, trees, sod, flowers, and other planting, sufficiently in advance of construction. After installation of work and backfilling, reset and restore these items to at least the conditions that existed prior to the commencement of work.

PART 3 EXECUTION

3.01 MAINTENANCE AND REMOVAL

A. Maintain temporary facilities and controls as long as needed for safe and proper completion of the Work.

B. Remove such temporary facilities and controls as rapidly as progress of the Work will permit, or as directed by the Owner or Engineer.

3.02 DUST CONTROL

A. During construction, haul roads and other disturbed construction areas shall be watered as required to prevent dust from damaging and/or becoming a nuisance to the terminal and other buildings, automobiles, aircraft, and residential and other built-up areas surrounding the project site.
DIVISION 1 - SECTION 01600

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings, Contract, Division 0 and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY
A. This Section specifies administrative and procedural requirements governing Contractor's selection of products for use in Project.
B. Related Sections: Following Sections contain requirements that relate to this Section:
   1. Division 1 Section "Reference Standards and Definitions" specifies the applicability of industry standards to products specified.
   2. Division 1 Section 01320 specifies requirements for submittal of the Contractor's Construction Schedule and the Submittal Schedule.
   3. Division 1 Section "Product Substitution Procedures" specifies administrative procedures for handling requests for substitutions made after award of the Contract.

1.3 DEFINITIONS
A. Definitions used in this Article are not intended to change meaning of other terms used in Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms such are self-explanatory and have well recognized meanings in construction industry.
   1. "Products" are items purchased for incorporation in Work, whether purchased for Project or taken from previously purchased stock. Term "product" includes terms "material," "equipment," "system," and terms of similar intent.
      a. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in manufacturer's published product literature, that is current as of date of Contract Documents.
      b. "Foreign Products," as distinguished from "domestic products," are items substantially manufactured (50% or more of value) outside of United States and its possessions; or produced or supplied by entities substantially owned (more than 50%) by persons who are not citizens of nor living within United States and its possessions.
   2. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form part of Work.
   3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.
1.4 SUBMITTALS

A. Product List: Prepare list showing products specified in tabular form acceptable to Program Manager. Include generic names of products required. Include manufacturer's name and proprietary product names for each item listed.

1. Coordinate product list with Contractor's Construction Schedule and Schedule of Submittals.

2. Form: Prepare product list with information on each item tabulated under following column headings:
   
   a. Related Specification Section number.
   b. Generic name used in Contract Documents.
   c. Proprietary name, model number and similar designations.
   d. Manufacturer's name and address.
   e. Supplier's name and address.
   f. Installer's name and address.
   g. Projected delivery date, or time span of delivery period.

3. Initial Submittal: Within 30 days after date of commencement of Work, submit 3 copies of an initial product list. Provide written explanation for omissions of data and for known variations from Contract requirements.

   a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

4. Completed List: Within 60 days after date of commencement of Work, submit 3 copies of completed product list. Provide written explanation for omissions of data and for known variations from Contract requirements.

5. Engineer’s Action: Engineer will review and the Program Manager will respond in writing to Contractor within 2 wks of receipt of completed product list. No response within this period constitutes no objection to listed manufacturers or products but does not constitute a waiver of the requirement that products comply with Contract Documents. Engineer’s review will include a list of unacceptable product selections, containing a brief explanation of reasons for this action.

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

1. When specified products are available only from sources that do not or cannot produce quantity adequate to complete project requirements in timely manner, consult with Program Manager for determination by the Engineer of most important product qualities before proceeding. Qualities may include attributes relating to visual appearance, strength, durability, or compatibility. When determination has been made, select products from sources that produce products that possess these qualities, to fullest extent possible.

C. Compatibility of Options: When Contractor is given option of selecting between 2 or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each Contractor is responsible for providing products and construction methods that are compatible with products and construction methods of other separate Contractors.

2. If dispute arises between Contractors over concurrently selectable, but incompatible products, Engineer will determine which products shall be retained and which are incompatible and must be replaced.

D. Foreign Product Limitations: Except under 1 or more of following conditions, provide domestic products, not foreign products, for inclusion in the Work:
1. No available domestic product complies with Contract Documents.
2. Domestic products that comply with Contract Document are only available at prices or terms that are substantially higher than foreign products that also comply with Contract Documents.

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

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

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

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

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle products according to manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

1. Schedule delivery to minimize long-term storage at 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 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 upon delivery to ensure compliance with Contract Documents, and to ensure that products are undamaged and properly protected.
5. Store products at site in manner that will facilitate inspection and measurement of quantity or counting of units.
6. Store heavy materials away from Project structure in manner that will not endanger supporting construction. Store products subject to damage by elements above ground, under cover in weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

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

1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for complete installation and for intended use and effect.
2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
B. Product Selection Procedures: Product selection is governed by Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:

   1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.
   2. Semiproprietary Specification Requirements: Where 2 or more products or manufacturers are named, provide 1 of the products indicated. No substitutions will be permitted.

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

   3. Compliance with Standards, Codes and Regulations: Where Specifications only require compliance with an imposed code, standard or regulation, select product that complies with standards, codes or regulations specified.
   4. Visual Matching: Where Specifications require matching an established Sample, Engineer's decision will be final on whether proposed product matches satisfactorily.

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

   5. Visual Selection: Where specified product requirements include phrase "...as selected from manufacturer's standard colors, patterns, textures..." or similar phrase, select product and manufacturer that complies with other specified requirements. Engineer will select color, pattern and texture from product line selected.
   6. Allowances: Refer to individual Specification Sections and "Allowance" provisions in Division 1 for allowances that control product selection, and for procedures required for processing such selections.

2.2 ASBESTOS-FREE REQUIREMENTS

   A. The Contractor shall not use any asbestos containing material (ACM) at any time during the Project. The Contractor shall verify that all materials used on the Project are asbestos-free materials.

   B. During the course of the Project, the Contractor shall routinely check products utilized on-site to ensure only asbestos-free products are utilized.

   C. If the Owner suspects the presence of asbestos, the Owner will sample the suspect material to verify that no ACM was utilized. This testing shall be performed at the expense of the Owner. If ACM is subsequently found during the sampling, the Contractor shall remove and replace the product or material at his/her sole expense. No adjustment of the Contract Schedule will be provided to account for delays associated with removal and/or replacement of ACM. The Contractor shall reimburse Owner for any and all costs associated with the original testing and/or any re-testing that may be necessary.

   D. Upon completion, a notarized certification statement shall be provided by the Contractor to the Owner certifying that all materials associated with this Project are asbestos free. See Specification 01771 Closeout Documents for certification document. If the Contractor does not submit the required asbestos-free certification, the Authority shall have a complete building survey performed by a qualified testing firm within the Project's location. The cost of the survey and any subsequent removal/replacement of any ACM shall be deducted from the Contractor's final payment at the sole discretion of the Owner.
PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS:

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

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

END OF SECTION 01600
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DIVISION 1 - SECTION 01630
PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings, Contract, Division 0 and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY
A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of Contract.
B. Contractor's Construction Schedule and Schedule of Submittals are included under Section 01320.
C. Standards: Refer to Section "Reference Standards and Definitions" for applicability of industry standards to products specified.
D. Procedural requirements governing Contractor's selection of products and product options are included under Section "Product Requirements."
E. Program Manager's policy is to reject requests for substitution unless paragraph "Substitutions" under Article "Definitions" applies.

1.3 DEFINITIONS
A. Definitions used in this Article are not intended to change or modify meaning of other terms used in Contract Documents.
B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by Contractor after award of Contract are considered requests for "substitutions." Following are not considered substitutions:
   1. Revisions to Contract Documents requested by Owner or Program Manager.
   2. Specified options of products and construction methods included in Contract Documents.
   3. Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

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

1. Submit 3 copies of each request for substitution for consideration. Submit requests on forms included at end of this Section.
2. Identify product, or fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with requirements for substitutions, and the following information, as appropriate:

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: Contractor's substitution request will be received and considered by Program Manager when one or more of following conditions are satisfied, as determined by Program Manager; otherwise requests will be returned without action except to record noncompliance with these requirements.

   1. Extensive revisions to Contract Documents are not required.
   2. Proposed changes are in keeping with general intent of Contract Documents.
   3. Request is timely, fully documented and properly submitted.
   4. Request is directly related to an "or equal" clause or similar language in Contract Documents.
   5. Specified product or method of construction cannot be provided within Contract Time. Request will not be considered if product or method cannot be provided as result of failure to pursue Work promptly or coordinate activities properly.
   6. Specified product or method of construction cannot receive necessary approval by governing authority, and requested substitution can be approved.
   7. Substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities Owner may be required to bear. Additional responsibilities for Owner may include additional compensation to Program Manager and Engineer for redesign and evaluation services, increased cost of other construction by Owner or separate Contractors, and similar considerations.
   8. Specified product or method of construction cannot be provided in manner that is compatible with other materials, and where Contractor certifies that substitution will overcome incompatibility.
   9. Specified product or method of construction cannot be coordinated with other materials, and where Contractor certifies that proposed substitution can be coordinated.
   10. Specified product or method of construction cannot provide warranty required by Contract Documents and where Contractor certifies that proposed substitution provide required warranty.
B. Contractor's submittal to the Program Manager and Engineer’s acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

C. See next page for “Request for Substation” form.
REQUEST FOR SUBSTITUTION

To:

Attention:

From: ____________________________
       Name of Company

_______________________________
       Address

_______________________________
       City, State, Zip Code

_______________________________
       Phone

Fully answer all information requested below. Failure to answer any item may cause rejection of request for substitution. If requested by Program Manager, submit information about manufacturer and vendor history, financial stability, distribution and support systems. Use one form for each product requested. Only first product listed will be considered on forms with more than one product listed.

Specification Section Number: ________  Drawing Number: ________
Para Number: ________________  Detail Number: ________________
Specified Product: _____________________________________________
Proposed Substitution: __________________________________________

Answer the following questions. Attach an explanation sheet on your company's letterhead when required.

Does the proposed substitution affect dimensions indicated on Drawings?
No   ___   Yes   ____ (If yes, explain below).
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

Does the proposed substitution require changes in Drawings and/or design or installation changes?
No   ____   Yes   _____

If yes, is the cost of these changes included in the proposed amount? No   ____  Yes   ____

Does the proposed substitution affect other trades? No   ____  Yes   ______
(If yes, explain who and how)

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

If the proposed product does affect the work of other trades, has the cost impact on their work been included in the price of the proposed substitution?

No   Yes

Does the proposed product's guarantee differ from that of the specified product's?

No   Yes   (If yes, explain below).

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Why is this proposal for substitution being submitted? List reasons below.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Attach a listing of 3 projects using proposed substitution completed within the past 5 yrs in geographic and climatic region of Project. One of applications shall have been in service for at least 3 yrs.

Attach product data/brochures and Vendor Qualification Form for the specified and substitute product.

Undersigned has examined Construction Documents, is familiar with specified product, understands indicated application of product, and understands design intent of Engineer. Undersigned states that proposed substitution complies with Construction Documents and will perform at least equally to specified product within limitations stated above. Undersigned accepts responsibility for coordinating application and installation of proposed substitution and waives all claims for additional costs resulting from incorporation of proposed substitution into Project or its subsequent failure to perform according to specified requirements.

Submitted By: ________________________________  ________________  ________________________________

Typed       Signature

Date: ________________________________

END OF SECTION 01630
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DIVISION 1 – SECTION 01700
FIELD ENGINEERING

PART 1 GENERAL

1.01 SUMMARY

A. Provide such field engineering services as are required for proper completion of the Work including, but not necessarily limited to:

1. Establishing and maintaining lines and levels;

2. Structural design of shores, forms, and similar items provided by the Contractor as part of his means and methods of construction.

All field engineering is incidental to the Item for which it applies. No direct pay will be made for field engineering.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, Division 0, Division 1 and other Sections of these Specifications.

2. Additional requirements for field engineering may be described in other Sections of these Specifications.

1.02 SUBMITTALS

A. Upon request of the Owner or Engineer, submit:

1. Data demonstrating qualifications of persons proposed to be engaged for field engineering services.

2. Documentation verifying accuracy of field engineering work.

3. Certification, signed by the Contractor's retained field engineer, certifying that elevations and locations of improvements are in conformance or nonconformance with requirements of the Contract Documents.

1.03 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.04 PROCEDURES

A. In addition to other procedures directed by the Contractor for proper performance of the Contractor's responsibilities:

1. Locate and protect control points before starting work on the site.

2. Preserve permanent reference points during progress of the Work.

3. Prior to commencing any work requiring location or grades, the Contractor shall establish
temporary bench marks (TBMs) at an interval not to exceed 1000 feet. TBMs are to be located in areas not anticipated to be disturbed by construction. Provide the Owner or Engineer copies of field notes, including peg test of level, and a listing of the adjusted coordinates and elevations of all TBMs.

4. Do not change or relocate reference points or items of the Work without specific approval from the Owner or Engineer.

5. Promptly advise the Owner or Engineer when a reference point is lost or destroyed, or requires relocation because of other changes in the Work.
   a. Upon direction of the Owner or Engineer, require the field engineer to replace reference stakes or markers.
   b. Locate such replacements according to the original survey control.

END OF SECTION 01700
DIVISION 1 – SECTION 01720
PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SUMMARY
A. Throughout progress of the Work, maintain an accurate record of changes in the Contract Documents, as described in paragraph 3.01 below and, upon completion of the Work, transfer the recorded changes to a set of Record Documents, as described in paragraph 3.02 below. This shall include Record Drawings.

B. Related work:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Provisions and the Technical Sections of these Specifications.
   2. Other requirements affecting Project Record Documents may appear in pertinent other Sections of these Specifications.

1.02 SUBMITTALS
A. The Program Manager’s review of the current status of Project Record Documents is a prerequisite to the Program Manager’s approval of requests for progress payments and request for final payment under the Contract.

B. Prior to submitting each Application for Payment, secure the Program Manager’s review of the current status of the Project Record Documents.

C. The final project Record Documents must be submitted to the Program Manager and secure approval before final payment for demobilization can occur.

1.03 QUALITY ASSURANCE
A. Delegate the responsibility for maintenance of Record Documents to one person on the Contractor’s staff as approved by the Program Manager.

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

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

1.04 DELIVERY, STORAGE, AND HANDLING
A. Maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the Work and transfer of all recorded data to the final Project Record Documents.
B. In the event of loss of recorded data, use any means necessary to again secure the data needed to comply with this section.

1. Such means shall include, if necessary in the opinion of the Program Manager, removal and replacement of concealing work or materials by Contractor at Contractor's expense.

PART 2 PRODUCTS

2.01 RECORD DOCUMENTS

A. Job set: Promptly following the Notice to Proceed secure from the Program Manager at no charge to the Contractor one complete set of all Documents comprising the Contract.

PART 3 EXECUTION

3.01 MAINTENANCE OF JOB SET

A. Immediately upon receipt of the job set described in Paragraph 2.01-A above, identify each of the Documents with the title, "RECORD DOCUMENTS - JOB SET."

B. Preservation:

1. Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out for new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set to the approval of the Program Manager.

2. Do not use the job set for any purpose except entry of new data and for review by the Program Manager, until start of transfer of data to final Project Record Documents.

3. Maintain the job set at the site of Work or at another site as designated by the Program Manager.

C. Making entries on Drawings:

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.

2. Date all entries.

3. Call attention to the entry by a "cloud" drawn around the area or areas affected.

4. In the event of overlapping changes, use different colors for the overlapping changes.

D. Make entries in the pertinent other Documents as approved by the Program Manager.

E. Drawings shall clearly show actual installed locations, depth, and sizes of:

1. Pipe work of all descriptions below ground outside of building and structures, including locations of culverts, storm & sewer lines, water lines, cleanouts, manholes, inlets, hydrants, and underground valves.

2. Underground electrical conduits, electrical ducts, and directly buried conductors light cables, FAA cables including locations of pull and junction boxes, electric manholes and handholes, pad mounted electrical equipment, utility poles, electrical outlets, and lighting fixtures.
3. All existing underground facilities unearthed by Contractors operations not accurately shown on the drawing.

F. Conversion of schematic layouts:

1. In some cases on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items, is shown schematically and is not intended to portray precise physical layout.
   a. Final physical arrangement is determined by the Contractor, subject to the Program Manager’s review.
   b. However, design of future modifications of the facility may require accurate information as to the final physical layout of items, which are shown only schematically, on the Drawings. This information will be provided by the Contractor.

2. Show on the job set of Record Drawings, by dimension accurate to within one half foot, the centerline of each run of items such as are described in subparagraph 3.01-E above.
   a. Clearly identify the item by accurate note such as "24 inch R.C. pipe drain", "4" conduit" and the like.
   b. Show, by symbol or note, the vertical location of the item ("36 inches deep"), "exposed," and the like.
   c. Make all descriptive identification so that it may be related reliably to the Specifications.

3. The Program Manager may waive the requirements for conversion of schematic layouts where, in the Program Manager’s judgment, conversion serves no useful purpose. However, do not rely upon waivers being issued except as specifically issued in writing by the Program Manager.

3.02 FINAL PROJECT RECORD DOCUMENTS

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

B. Approval of recorded data prior to transfer to Program Manager:

1. Secure the Program Manager’s review of all recorded data.

2. Make required revisions.

C. Transfer of data to other Documents:

1. If the Documents other than Drawings have been kept clean during progress of the Work, and if entries thereon have been orderly to the approval of the Program Manager, the job set of those Documents other than Drawings will be accepted as final Record Documents.

2. If any such Document is not so approved by the Program Manager, secure a new copy of that Document from the Program Manager at the Program Manager’s usual charge for reproduction and handling, and carefully transfer the change data to the new copy to the
approval of the Program Manager.

D. Review and submittal:

1. Submit the completed set of Project Record Documents to the Program Manager as described in Paragraph 1.02-C above.

2. Participate in review meetings as required.

3. Make required changes and promptly deliver the final Project Record Documents to the Program Manager.

3.03 CHANGES SUBSEQUENT TO ACCEPTANCE

A. The Contractor has no responsibility for recording changes in the Work subsequent to Final Completion, except for changes resulting from work performed under Warranty.

END OF SECTION 01720
DIVISION 1 – SECTION 01741

CLEANING

PART 1 GENERAL

1.01 SUMMARY

A. Throughout the construction period, maintain the site in a standard of cleanliness including mowing of grass as described in this Section. All demolition or construction debris (FOD) shall be confined within the work site at all times.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, Division 0, Division 1 and other Sections of these Specifications.

2. In addition to the standards described in this Section, comply with requirements for cleaning as described in pertinent other Sections of these Specifications.

3. In addition to the standards described in this Section, comply with pertinent requirements of governmental agencies having jurisdiction.

1.02 QUALITY ASSURANCE

A. Conduct a daily inspection, and more often if necessary, to verify that cleanliness requirements are being met.

B. In addition to the standards described in this Section, comply with pertinent requirements of governmental agencies having jurisdiction.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

A. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

B. In addition to the standards described in this Section, comply with pertinent requirements of governmental agencies having jurisdiction.

2.02 COMPATIBILITY

A. Use only cleaning materials and equipment compatible with the surface being cleaned and as recommended by the manufacturer of the material.

PART 3 EXECUTION

3.01 PROGRESS CLEANING

A. General:

1. Retain stored items in an orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing required protection of materials.
2. Do not allow accumulation of scrap, debris, waste material, and other items not required for construction of this Work.

3. Inspect all haul vehicles leaving the site to make sure no debris can fall from the vehicle during transportation.

4. Provide adequate storage for all items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology.

B. Site:

1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage. Contractor shall document all daily inspections.

2. Weekly, and more often if necessary, remove, completely, all accumulated scrap, debris, and waste material from the site.

3. Maintain the site in a neat and orderly condition at all times.

4. Mowing of grass within the construction limits is required at a minimum of every two (2) weeks during the active growing season, or as directed by the Engineer or Owner.

3.02 FINAL CLEANING

A. “Clean,” for the purpose of this section, and except as may be specifically provided otherwise, shall be interpreted as meaning the level of cleanliness generally provided by material sweepers and vacuums.

B. Prior to completion of the Work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described in Article 3.01 above.

C. Site:

1. Unless otherwise specifically directed by the Owner or Engineer, broom clean paved areas on the site and public paved areas adjacent to the site.

2. Completely remove resultant debris.

D. Schedule final cleaning as approved by the Owner or Engineer to enable the Owner to accept a completely clean Work.

3.03 CLEANING DURING OWNER’S OCCUPANCY

A. Should the Owner occupy the Work or any portion thereof, prior to its completion by the Contractor, and acceptance by the Owner, responsibilities for interim and final cleaning shall be as determined by the Engineer or Owner in accordance with the Division 0 and Division 1 Specifications.
3.04 INTERVENTION OF OWNER

A. If the Contractor fails to clean up any debris which is deposited as a result of construction/demolition operations, or fails to mow grass as stipulated, the Airport Authority will, after attempting one notification, immediately do so and the cost thereof will be charged to the Contractor at the rate of two hundred and fifty dollars ($250.00) per hour, per machine and per person additively. The Contractor shall assume full responsibility for failure to perform clean up operations required.

END OF SECTION 01741
DIVISION 1 - SECTION 01770
CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Procedures and requirements for closing out the Work.
   1. Closeout submittals.
   2. Final cleaning.
   3. Record Documents.
   4. Substantial completion.
   5. Final inspection.
   6. Final payment.
   7. Warranties.

1.02 RELATED REQUIREMENTS AND SECTIONS

A. Section 01100 - Summary of Work, Sequence of Construction & Liquidated Damages.

1.03 CLOSEOUT SUBMITTALS

A. Record documents of the constructed work.

B. Certificate of Occupancy.

C. Warranties: This Section and applicable Sections of these Specifications.

D. Contractors Affidavit of Payment of Debts and Claims and Contractors Affidavit of Release of Liens.

E. Consent of Surety to Final Payment.

F. Waivers of Lien from subcontractors: Form as provided in this Project Manual or as approved by Owner.

G. As-built drawings.

1.05 FINAL CLEANING

A. Clean work and storage areas free of trash. Broom clean and hose wash walks and pavements.

1.06 RECORD DOCUMENTS

A. Definition:
   1. Dimensioned drawings showing in-place components and systems measured as accurately as practicable.
   2. Product data and other documents clearly identifying proprietary product and equipment incorporated into the Work.

B. Maintain at job site one record copy of:
3. Addenda.
4. Approved shop drawings.
6. Field test records.
7. Meeting minutes (notes).

C. Make documents available at all times for inspection by Engineer and Owner.

D. Marking Devices:
   1. Use colored felt marking pens for marking prints and product data.

E. Label each document "PROJECT RECORD" in 1" high printed letters.

F. Record information concurrent with construction progress. Do not conceal any work until required information has been recorded.

G. Submittal of Record Documents:
   1. At completion of the Work, deliver Record Documents to Owner or Engineer with request for Final Payment.
   2. Accompany submittal with transmittal letter indicating:
      a. Date
      b. Project title
      c. Contractor's name and address
      d. Title and number of each record document
   3. Submit one reproducible copy and one electronic copy of Record Documents, and provide one copy of other Record Documents.
   4. Provide one AutoCAD Diskette

1.07 SUBSTANTIAL COMPLETION

A. When Contractor considers the Work to be substantially complete as defined in Conditions of the Contract, Contractor shall prepare and submit a list (punch list) of items to be completed or corrected. Upon receipt of Contractor's list, Owner or Engineer will decide if the Work is substantially complete and, if necessary, will prepare a supplemental list (punch list) of items to be completed or corrected.

B. Failure to include items on the punch list does not alter responsibility of Contractor to complete work according to Contract Documents.

C. Before Owner or Engineer issues a Certificate of Substantial Completion, Contractor shall provide certificate of Use and Occupancy and evidence of approval from applicable governing authorities.

1.08 FINAL INSPECTION

A. When Owner or Engineer receives written notice that the Work is ready for final inspection, and when final application for payment is received, Owner or Engineer shall promptly inspect to determine if the Work complies with the Contract Documents.

B. Provide Owner or Engineer with written status report of each punch list item before final inspection.
1.09 FINAL PAYMENT

A. Final payment will be made to contractor by Owner within 45 days after:

1. Completion of the Work.
2. Acceptance by Owner and Engineer of all work performed under the Contract.
3. Receipt of Project Record Documents.
4. Receipt of O & M data, manufacturer’s instructions, service manual, parts manual, warranties, and other closeout submittals specified. O & M data must include a list of recommended vendors for any non-standard replacement parts and must include a detailed Preventative Maintenance guide with a schedule of suggested efforts.
5. Preparation by Contractor and approval of Owner of final statement of cost of the completed Work. Final statement shall indicate:
   a. Original Contract Sum.
   b. Previous Change Orders.
   c. Deductions for liquidated damages.
   d. Other applicable adjustments to Contract Sum.
   e. Total Contract Sum as adjusted.
   f. Previous Payments.
   g. Final payment remaining due.
6. Upon completion by Contractor of work covered by Contract Documents, and before final payment to Contractor for work performed, Contractor shall deliver to Owner releases of liens and of rights to claim liens, in a form satisfactory to Owner, from material suppliers and sub-contractors furnishing labor and materials for the Work and an affidavit, indicating that all labor and material used on or for execution of the Work has been paid.

1.10 WARRANTIES

A. Provide duplicate notarized copies of warranties required by Contract Documents. Accumulate executed documents by subcontractors, suppliers, and manufacturers; provide table of contents and assemble in binder with durable plastic cover properly titled.

B. Warranties are in addition to and not a limitation of other rights Owner may have against Contractor under the Contract Documents.

C. Contractor shall bear costs of correcting work not complying with warranty requirements.

D. Duration of warranties required by individual Sections shall indicate minimum times and shall not relieve Contractor of obligations required under applicable statutes or other Conditions of the Contract.

1. Warranty period begins on date of Substantial Completion, except where modified by Conditions of the Contract.
2. Warranties are non-prorated unless stated otherwise in these Specifications.

E. Manufacturer's warranties shall be backed by assets of manufacturer and not a third party.

F. Warranties shall be transferable.

G. Submit warranties to Owner or Engineer for verification and submittal to Owner with Contractor's final Application for Payment.

H. Re-submit warranties that do not comply with Contract Documents.

PART 2 - PRODUCTS (not applicable)
PART 3 - EXECUTION (not applicable)

END OF SECTION 01770
DIVISION 1 – SECTION 01771

AFFIDAVIT OF CONTRACTOR

STATE OF ________________________________
COUNTY OF ________________________________

__________________________________________, being duly sworn according to Law,

(Name of Affiant)

deposes and says that he is the ________________________________ of

__________________________________________, the Contractor, in a

(Name of Contractor)

Construction contract entered into between the Contractor and Memphis-Shelby County Airport Authority, the Owner, for the construction of Airfield Maintenance Temporary Facility – Construction, MSCAA Project No. 14-1379-10-01, and that he is authorized to and does make this Affidavit on behalf of said Contractor in order to induce the Owner to make payment to the Contractor, in accordance with the provisions of the said Construction Contract.

Affiant further says that all persons who have furnished materials, labor, and equipment in connection with the construction of the facilities have been paid in full, that the names of all manufacturers, materialmen, subcontractors and D/M/WBE subcontractors that furnished any material and/or services in connection with such construction and the kind of kinds of material and/or services so furnished are as listed hereinafter; and that the Contractor has delivered to the Owner duplicate waivers and releases of liens executed by all such entities.

Affiant further certifies that he/she is familiar with the materials used in the construction of and incorporated into, the Project referenced above and attests that no asbestos-containing materials, either friable or otherwise, were used in the process of constructing or incorporated into the construction of the Project.

__________________________________________
(Signature of Affiant)

Sworn to and subscribed before me this __________ day of ______________________________ 20___.

__________________________________________
(Notary Public)

My commission expires: ________________________________
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END OF SECTION 01771

ISSUED FOR BID
DIVISION 1 – SECTION 01772

FINAL LIEN WAIVER AND RELEASE
PRIME CONTRACTOR

STATE OF TENNESSEE
COUNTY OF SHELBY

The undersigned _______________________________________ (hereinafter “Contractor”) has entered into a Contract with the Memphis-Shelby County Airport Authority (“Owner”) for the construction of improvements known as the:

Airfield Maintenance Temporary Facility – Construction
Memphis International Airport
MSCAA Project No. 14-1379-10-01 (hereinafter “the Project”).

Upon the receipt of the sum of $________________, the undersigned forever waives and releases any and all liens or claims of liens it has upon the foregoing described real property on account of labor, materials, equipment or services furnished for said Project. The undersigned certifies that all payments have been made for all work/materials performed to date for all subcontractors and suppliers with the exception of the amount due as a result of the payment amount shown above; and, that all subcontractors and suppliers will be paid all balances due upon receipt of the payment amount shown above. Further, the undersigned does hereby waive, release and relinquish any and all claims or demands against the Owner and Engineer of the above-described Project, the right to assert a mechanic’s and materialmen’s lien and/or any claim for quantum meruit or unjust enrichment, additional work, verbal agreements, increased cost, scheduling damages, including, but not limited to damages for delay, disruption, acceleration and/or interference, whether existing now or arising in the future.

The undersigned certifies and warrants that it has complied with all federal, state and local tax laws, including Social Security laws and Unemployment Compensation laws and workers’ compensation laws insofar as applicable to the performance of the Project. Further, the undersigned certifies and warrants that it has paid all of its subcontractors, vendors, and materialmen for services rendered in connection with the construction and improvement of the Project and that all labor, materials and equipment are free and clear of claims, security interests, indebtedness or encumbrances. The undersigned agrees to indemnify and hold harmless the Owner and the Engineer from and against any and all claims, damages, losses and expenses, including but not limited to, attorney’s fees, arising out of or resulting from any non-payment by the undersigned to any subcontractor, laborer, vendor or materialman for the Project.

As of this date, no mechanics’ or materialmen’s liens have been filed of record arising out of or related to the work performed by the undersigned.

Given under hand and seal this _____ day of ______________________, 20__________.

CONTRACTOR

________________________________________
By:_____________________________________
Title:____________________________________

ISSUED FOR BID

01772
Page 1
STATE OF TENNESSEE  
COUNTY OF SHELBY

Before me, a notary public of the state and county mentioned, personally appeared
________________________________, with whom I am personally acquainted, and who, upon oath, acknowledged
such person to be ____________________________, an officer authorized to execute the instrument, of
________________________________, the within named bargainor, a corporation, and that such officer, as such
________________, executed the foregoing instrument for the purposes therein contained, by personally signing the
name of the corporation as ____________________________.

Witness my hand and seal, at office, this _____ day of ___________________, 20 ____.  

__________________________________________________  
Notary Public

My Commission Expires:

________________________________________________________________________

END OF SECTION 01772
DIVISION 1 – SECTION 01773
FINAL LIEN WAIVER AND RELEASE
SUBCONTRACTOR

STATE OF TENNESSEE
COUNTY OF SHELBY

The undersigned subcontractor, vendor, mechanic and/or materialman has been employed by 
_____________________________ (hereinafter “Contractor”) to furnish ________________________________ 
(describe materials and/or labor furnished) for the construction of improvements known as the:

Airfield Maintenance Temporary Facility – Construction
Memphis International Airport
MSCAA Project No. 14-1379-10-01 (hereinafter “the Project”).

Upon the receipt of the sum of $______________, the undersigned forever waives and releases any and all 
liens or claims of liens it has upon the foregoing described real property on account of labor, materials, equipment or 
services furnished by the undersigned to or on account of said Contractor for said Project. The undersigned certifies 
that all payments have been made for all work/materials performed to date for all subcontractors and suppliers with 
the exception of the amount due as a result of the payment amount shown above: and, that all subcontractors and 
suppliers will be paid all balances due upon receipt of the payment amount shown above. Further, the undersigned 
does hereby forever waive, release, and relinquish any and all liens, claims or demands against the Memphis-Shelby 
County Airport Authority (“Owner”), Engineer and Contractor, the right to assert a mechanic’s and materialmen’s 
lien and/or any claim for quantum meruit or unjust enrichment, additional work, verbal agreements, increased cost, 
or scheduling damages, including but not limited to damages for delay, disruption, acceleration and/or interference, 
whether existing now or arising in the future.

The undersigned certifies and warrants that it has complied with all federal, state and local tax laws, 
including Social Security laws and Unemployment Compensation laws and workers’ compensation laws insofar as 
applicable to the performance of the Project. Further, the undersigned certifies and warrants that it has paid all of its 
subcontractors, vendors and materialmen for services rendered in connection with the construction and improvement 
of the Project and that all labor, materials and equipment are free and clear of claims, security interests, indebtedness 
or encumbrances. The undersigned agrees to indemnify and hold harmless the Owner, the Contractor and the 
Engineer from and against any and all claims, damages, losses and expenses, including, but not limited to, attorney’s 
fees, arising out of or resulting from any non-payment by the undersigned to any subcontractor, laborer, vendor or 
materialman for the Project.

As of this date, no mechanics’ or materialmen’s liens have been filed of record arising out of or related to the work 
performed by the undersigned.

Given under hand and seal this ______ day of __________________, 20____.

SUBCONTRACTOR/MATERIALMAN

__________________________________________

By:________________________________________

Title:______________________________________
STATE OF TENNESSEE
COUNTY OF SHELBY

Before me, a notary public of the state and county mentioned, personally appeared,

____________________________________, with whom I am personally acquainted, and who, upon oath, acknowledged such person to be, ______________________________________, an officer authorized to execute the instrument, of _________________________________, the within named bargainor, a corporation, and that such officer, as such _________________________________, executed the foregoing instrument for the purposes therein contained, by personally signing the name of the corporation as _________________________________.

Witness my hand and seal, at office, this __ day of ____________, 20____.

____________________________________
Notary Public

My Commission Expires:

____________________________________

END OF SECTION 01773
DIVISION 1 – SECTION 01774

CONTRACTOR WARRANTY FORM

PROJECT: MSCAA Project No. 14-1379-10-01, Airfield Maintenance Temporary Facility – Construction

LOCATION: Memphis International Airport, Shelby County, Tennessee

OWNER: Memphis-Shelby County Airport Authority

We ________________________________, Contractor for the above-reference project, do hereby warrant all labor and materials furnished and work performed are in accordance with the Contract Documents and authorized modifications thereto, and will be free from defects due to defective materials or workmanship for a period of one year.

This warranty commences on ________________ and expires on ________________.

This warranty covers that portion of the project described below:

ALL MATERIALS, LABOR, AND EQUIPMENT IN CONNECTION WITH THE CONSTRUCTION OF THE FACILITIES OF THE ABOVE REFERENCED CONTRACT.

The Contractor shall promptly correct all defective Work to comply with the Contract Documents whether observed before or after the substantial completion date and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting defective Work.

If, within one (1) year after the substantial completion date, or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee or warranty required by the Contract Documents, any of the Work is found to be defective and not in accordance with the Contract Documents, the Contractor shall correct it promptly after receipt of a written notice from the Owner, or the Engineer to do so.

All defective or non-conforming Work shall be removed from the site of the Work if necessary, and the Work shall be corrected to comply with the Contract Documents without cost to the Owner. The Contractor also shall bear the cost of making good all work of other contractors destroyed or damaged by removal or correction of the defective Work of Contractor.

If the Contractor fails to timely and properly correct defective Work, the Owner may correct it and hold the Contractor liable for all costs, expenses and damages, including attorney’s fees and litigation costs incurred by Owner in correcting it.

In addition to the foregoing warranty, a warranty period of one (1) year shall apply under the same terms and conditions as the original warranty, to any work, supplied in correction of defective work under warranty pursuant to the provisions of this Section 17.04 and the Contractor shall assign to the Owner any warranties, including extended warranties, which are available in connection with the performance of such correction of defective Work. The warranty period shall commence on the date the Owner accepts the corrective Work of the Contractor.

DATE: _________________________ FOR: ________________________________

(Company Name)

BY: ________________________________

TITLE: ________________________________

END OF SECTION 01774
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DIVISION 1 – SECTION 01775

CONSENT OF SURETY COMPANY TO FINAL PAYMENT

To: Memphis-Shelby County Airport Authority
2491 Winchester Road, Suite 113
Memphis, TN. 38116-3856

Regarding Contract for: Airfield Maintenance Temporary Facility – Construction

Project: 14-1379-10-01

Dated: ____________________________

CONTRACTOR: ______________________________________________________________________________

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the

______________________________, SURETY COMPANY,

on bond of ________________________________, CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not
relieve the Surety Company of any of its obligations to Memphis-Shelby County Airport Authority, OWNER.

IN WITNESS WHEREOF,

the Surety Company has hereunto set its hand this __________ day of __________________, 20____

______________________________

Surety Company

______________________________

Signature of Authorized Representative

Attest:
(Seal):
______________________________

Title

END OF SECTION 01775

ISSUED FOR BID

01775
Page 1
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DIVISION 1 – SECTION 01783

ELECTRICAL CHARACTERISTICS, CAPACITIES AND WIRING DIAGRAMS

PART 1 GENERAL

1.01 SUMMARY

A. This section describes the electrical characteristics, sizes, capacities, ratings and wiring diagrams required of electrically operated equipment.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to Division 0, Division 1 and other Sections of these Specifications.

1.02 SUBMITTALS

A. Furnish with each item of electrically operated equipment a wiring diagram showing all necessary electrical connections required to operate the equipment properly, in accordance with drawing and specification requirements.

B. Furnish a composite wiring diagram showing all necessary interlock and related wiring between the various items of electrically operated equipment and their controls, as required to operate interlocked equipment as specified in other sections of these specifications and as indicated.

1.03 CAPACITIES, RATINGS, SIZES, AND OTHER REQUIREMENTS NOT SPECIFIED:

A. For all items of material and/or equipment, the capacities, ratings, sizes, and other requirements thereof not specified shall be as indicated on the Contract drawings.

B. Where capacities, ratings, sizes, and other requirements for materials and/or equipment is neither specified nor indicated on the Contract drawings, refer each case to the Owner or Engineer before ordering the materials and/or equipment involved, or proceeding with the work involved. The Owner’s or Engineer’s decision shall govern.

1.04 ELECTRICAL CHARACTERISTICS AND SIZES OF ELECTRICALLY OPERATED EQUIPMENT

A. Each electrically operated item furnished under this contract shall operate properly on the electrical supply to which it is to be connected, as indicated on the electrical drawings.

B. All electrically operated equipment shall operate on a 60 hz alternating current supply, unless otherwise indicated. Prior to delivery to the job site, it shall be the joint responsibility of the Contractor under the applicable section and the equipment supplier to determine from the electrical drawings the characteristics of the electrical supply indicated to each individual electrically operated item, and to furnish each electrically operated item accordingly.

1. Where electrical characteristics are specified hereinafter, verify them from the electrical drawings. In the case of discrepancy between the specifications and the electrical drawings, the Electrical drawings shall govern.

2. Where electrical characteristics cannot be determined from the electrical drawings, refer each case to the Owner or Engineer, and the Owner’s or Engineer’s decision shall govern.

END OF SECTION 01783
DIVISION 1 – SECTION 01784

MANUFACTURER'S SUPERVISION

1.01 DESCRIPTION
A. Work included:
1. Furnishing Manufacturer's Supervision

B. Related Work:
1. Documents affecting work of this Section include, but are not necessarily limited to Division 0, Division 1, and other Sections of these Specifications.

1.02 SERVICES
A. Furnish the services of authorized qualified manufacturer's representatives as required to supervise the installation, testing, initial starting, adjusting, and initial operation of each equipment item or any other item designated by the Contract Documents and included in this Contract.

END OF SECTION 01784
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SECTION 02 40 00
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES
A. This Section includes the following:
   1. Minor demolition per the included drawings.

1.02 REFERENCE STANDARDS

1.03 MATERIAL OWNERSHIP
A. Except for materials indicated to remain Owner’s property, cleared materials shall become Contractor’s property and shall be removed from Project site.

1.04 JOB CONDITIONS
A. The Contractor shall visit the construction site so as to compare existing conditions with conditions shown on the drawings and stated in the specifications. No allowance will subsequently be made in behalf of the Contractor by reason of any omission on his part to include the cost of all items of work, either labor or material, which are required to attain the completed work.
B. Blasting and burning shall not be allowed under any circumstances.
C. All materials of demolition, except as hereinafter stated, to become property of Contractor and shall be removed from Owner’s property at no expense to Owner.
D. Comply with federal, state and local hauling and disposal regulations.
E. Take appropriate action to check the spread of dust to avoid the creation of a nuisance in the surrounding areas. Do not use water if it results in hazardous or objectionable conditions such as flooding or pollution. Comply with all dust regulations imposed by local air pollution agencies.

1.05 SUBMITTALS:
A. Submit for review a written dust control plan outlining the methods and means of verification. The Owner has the right to suspend work should dust control effect safety issues.
B. Prior to beginning any demolition work provide a video that depicts the present conditions of the facility to remain. This video will be used as the basis as to whether the features to remain have been defaced or damaged by the demolition operations.
1.06 PROTECTION

A. Protect existing utilities, fire mains, sewers, drainage structures, pavements and walks that are to remain in place.

B. Ensure safe passage of personnel around demolition area. Conduct operations so as to prevent damage to adjacent buildings, structures or other facilities as well as injury to persons.

C. Provide temporary barricades and security of the site to protect the general public from injury due to demolition work.

D. Conduct demolition operations and removal of debris to ensure minimum interface with streets, drives, walks and other adjacent facilities that are occupied or in use. Do not close or obstruct streets, drives, walks or other facilities that are occupied or in use without permission from authorities having jurisdiction. Provide alternate safe routes around closed or obstructed traffic ways if required by governing regulations.

1.07 CODES, REGULATIONS AND STANDARDS

A. Disposal of demolished materials off site shall comply with the applicable local, state and federal ordinances. All work shall be accomplished in a manner that conforms to the Applicable Provisions of the Occupational Safety and Health Act.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PREPARATION

A. Protect and maintain areas of building that are not being disturbed.

3.02 SALVAGE

A. Items of salvageable value to the Contractor may be removed from the structure as work progresses. The salvageable items shall be removed and transported from the site with no storage or sale of such items allowed on the site. No salvage items shall be solicited, sold, bartered or traded on or adjacent to during or after the demolition duration.

3.03 EXAMINATION

A. Verify existing site conditions prior to starting work. Any discrepancies shall be noted on the project record drawings and reported to the Owner and Engineer.

B. Verify survey benchmark and intended elevations for the Work area as indicated on Drawings.

3.04 PROTECTION

A. Locate, identify and protect utilities indicated to remain from damage.

B. Notify appropriate utility company to disconnect utilities.

C. Maintain and protect above and below grade utilities indicated to remain.
3.05 UTILITIES

A. The Contractor shall be responsible for all damage occasioned by his failure to exercise reasonable care to protect existing utilities designated to remain during all demolition and new construction.

B. If demolition of any other construction requires the planned disconnection of any utility service to areas being used by others, the utility outages shall be scheduled at least five work days in advance of service disconnection. Planned service disconnections shall be held to an absolute minimum.

C. Contractor shall coordinate with MSCAA the shutoff and disconnection of utilities to the site prior to the beginning of demolition. Do not interrupt existing utilities serving other facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities as acceptable to governing authorities.

D. Place markers to indicate location of disconnected services. Identify service lines and capping locations on As Built Record Drawings.

E. If demolition or any other construction results in the accidental disconnection of any utility service to areas being used by others, the service shall be immediately restored at the Contractor's expense and on a schedule agreed upon by the Consultant.

3.06 DEMOLITION

A. Pollution Controls:
   1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding or pollution.
   2. Clean adjacent structures and improvements of dust, dirt and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.

B. Filling Voids:
   1. Completely fill below grade areas and voids resulting from demolitions of structures.
   2. Use satisfactory soil materials for all fill and backfill materials.
   3. Prior to placement of fill materials, ensure that areas to be filled are free of standing water, trash or debris.
   4. Place fill material in horizontal layers and compact each layer to 95% standard proctor.

3.07 DAMAGE TO EXISTING STRUCTURES, UTILITIES, ETC.

A. All structures, utilities and adjacent materials disturbed or damaged as a result of construction work under this contract shall be repaired or replaced by the Contractor as soon as possible in a manner satisfactory to the Owner. All cost shall be borne by the Contractor.

3.08 DISPOSAL

A. Disposal: Remove surplus obstruction, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
3.09 CLEANUP

A. The Contractor shall, at all times during the progress of the work, remove and keep the area surrounding the site clear of all rubbish. All materials and debris shall be removed daily.

B. Remove and transport materials and debris in a manner that will prevent spillage on the site, streets or adjacent areas. If spillage does occur it must be cleaned up immediately.

C. Comply with federal, state and local hauling and disposal regulations.

END OF SECTION
SECTION 03 30 10
CONCRETE WORK

PART 1 GENERAL

1.1 EXTENT OF THE WORK

A. The extent of concrete work is shown on the Drawings.

1.2 QUALITY ASSURANCE

A. Comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
   1. ACI 301, Specifications for Structural Concrete for Buildings
   2. ACI 302, Guide for Concrete Floor and Slab Placement
   3. ACI 304, Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete
   4. ACI 305, Hot Weather Concreting
   5. ACI 306, Cold Weather Concreting
   6. ACI 308, Standard Practice for Curing Concrete
   7. ACI 315, Detailing Manual
   8. ACI 318, Building Code Requirements for Reinforced Concrete
   9. ACI 347, Recommended Practice for Concrete Formwork
   10. CRSI Manual of Standard Practice
   11. AASHTO TP 23, Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying

B. The Contractor is responsible for correcting concrete work that does not conform to the specified requirements, including requirements for strength, tolerances, and finishes. Correct deficient concrete as directed by the A/E.

C. Employ at the Contractor's expense a testing laboratory acceptable to the A/E to perform material evaluation tests and to design and review concrete mixes.

D. Testing Agency Qualification: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade I, according to ACI CP-01 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician – Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician- Grade II.

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

F. Test aggregates by the methods of sampling and testing outlined in ASTM C33.

G. For Portland cement, sample the cement and determine the properties by the methods of testing outlined in ASTM C150.

1.3 SUBMITTALS
A. Comply with applicable requirements of Section 01 30 00, Submittals.

B. For each material sampled and tested, submit written reports to the A/E prior to the start of work. Provide the project identification name and number, date of report, name of Contractor, name of concrete testing service, source of concrete aggregates, materials manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for the intended use.

C. Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing and sealing compounds, and others requested by the A/E.

D. Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with the ACI 315, Detailing Manual, showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Show on the shop drawings special reinforcement required and openings through concrete structures.

E. Submit mix design in accordance with ACI requirements. Provide for each mix design, the project name, city, general contractor, concrete strength, and it’s intended use.

F. Submit 2 copies of laboratory test reports with standard deviation analysis or trial batch data. All concrete materials shall be listed.

G. Submittals shall be approved by the Structural Engineer of Record prior to procurement or fabrication of materials.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Unless otherwise specified or shown on the Drawings, construct formwork for exposed concrete surfaces with plywood, metal, metal framed plywood, or other panel type materials acceptable to the A/E in order to provide exposed surfaces that are continuous, straight, and smooth. To minimize the number of joints and to conform to the joint system shown on the Drawings, furnish panels in the largest practicable sizes. Provide form material that is thick enough to withstand pressure of newly placed concrete without bowing or deflection.

B. Forms for Unexposed Finish Concrete: For surfaces that will be unexposed in the finished structure, form concrete with plywood, lumber, metal, or other material acceptable to the A/E. If lumber is used, it shall be dressed on at least two edges and one side for tight fit.

C. Form Coatings: Provide commercial formulation form coating compounds that will not bond with, stain, or adversely affect concrete surface and that will not impair subsequent treatments of concrete surfaces to be cured with water or curing compound.

2.2 REINFORCING MATERIALS

A. Reinforcing Bar: ASTM A706. Alternately, reinforcing shall comply with ASTM 615 Grade 60 with the following requirements:
   1. Actual yield strength based on mill tests does not exceed 78 ksi. Retests shall not exceed this value by more than an additional 3000 psi.
2.  $\frac{Fu}{Fy}$ shall not be less than 1.25. ($Fy$ – Actual yield tensile strength, $Fu$ – actual ultimate tensile strength.)


D.  Welded Deformed Steel Wire Fabric:  ASTM A497

E.  Supports for Reinforcement: Provide supports for reinforcement, including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Unless otherwise indicated on the Drawings, use wire type bar supports complying with CRSI recommendations. Wood, brick, and other devices will not be acceptable. Comply with the following:
1.  For slabs on grade, where wetted base material will not support chair legs, use supports with sand plates or horizontal runners.
2.  For concrete surfaces exposed to view, where leg supports are in contact with forms, provide supports with legs that are hot dip galvanized or protected by either plastic or stainless steel.

2.3  CONCRETE MATERIALS

A.  Portland Cement:  ASTM C150, Type I.  Use only one brand of cement throughout the project, unless otherwise acceptable to the A/E.

B.  Normal Weight Aggregates:  ASTM C33, and as specified below:
1.  Fine aggregate is to be clean, sharp, river sand or crushed gravel when used for vehicular wearing surfaces.  Manufactured sand may be used elsewhere provided the percentage passing a No. 200 sieve is less than 3 percent.
2.  Pea gravel may not be used as concrete aggregate, unless requested for a specific application by the contractor and approved for that application by the EOR.

C.  Coarse Aggregate:  Coarse aggregate shall consist of crushed limestone that is clean, uncoated, and processed from natural rock or stone and that contains no clay, mud, loam, or foreign matter.  Its maximum size shall be no larger than 1/5 of the narrowest dimension between sides of forms, 1/3 of the depth of slabs, or 3/4 of the minimum clear spacing between individual reinforcing bars or bundles of bars.

Combined aggregate gradation for slabs and other designated concrete shall be 8% - 18% for large top size aggregates (1-1/2") or 8% - 22% for smaller top size aggregates (1" or 3/4") retained on each sieve below the top size and above the No. 100.

D.  Under Slab Vapor Barrier:
1.  Vapor barrier shall have the minimum following properties:
   a.  Thickness:  Not less than 15 mils.
   b.  Water Vapor Retarders:  ASTM E-1745, meets or exceeds Class A or B.
   c.  Water Vapor Transmission Rate:  ASTM E-96, 0.006 gr./ft²/hr or lower.
   d.  Permeance Rate:  ASTM E-96, 0.01 gr./ft²/hr or lower.
   f.  Tensile Strength:  ASTM E-1745, minimum 45.0 lb. per inch.
2.  Provide Stego Wrap (15 mil) Vapor Barrier by Stego Industries LLC, Moistop Ultra "A" (15 Mil) by Fortifier Building Products Systems (1-800-773-4777) or approved substitute.
3.  Lap and tape all joints using minimum 4 inch wide high density polyethylene tape with pressure sensitive adhesive. Repair any tears.
4.  Construct pipe boots from vapor barrier material and pressure sensitive tape in accordance with manufacturer’s instructions.
E. **Water:** Clean, fresh, drinkable

F. **Admixtures**
   1. **Water Reducing Admixture:** Eucon WR-75, WR-91 or MR by the Euclid Chemical Company, Pozzolith 220-N by Master Builders, or WRDA 15 by W.R. Grace. The admixture shall conform to ASTM C494, Type A, and not contain more chloride ions than are present in municipal drinking water.
   2. **Water Reducing, Retarding Admixture:** Eucon Retarder-75 by the Euclid Chemical Company or Pozzolith 100 XR by Master Builders. The admixture shall conform to ASTM C494, Type D, and not contain more chloride ions than are present in municipal drinking water.
   3. **Mid-range Water Reducing Admixture:** Eucon MR or Plastol 341 by the Euclid Chemical Company, Polyheed 997 by Master Builders or Daracem SD by W.R. Grace. The admixture shall conform to ASTM C494 Type A.
   4. **Nonchloride Accelerator:** Accelguard 80, Accelguard 90 or NCA by the Euclid Chemical Company or Darex Set Accelerator by W. R. Grace. The admixture shall conform to ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water.
   5. **Air Entraining Admixture:** AEA-92 by Euclid Chemical Corporation, MB AE-90 by Master Builders, or Darex AEA by W.R. Grace. The admixture shall conform to ASTM C260.
   6. **Prohibited Admixtures:** Calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.
   8. **Certification:** Written conformance to the aforementioned requirements and the chloride ion content will be required from the admixture manufacturer prior to mix design review by the A/E.

2.4 **RELATED MATERIALS**

A. **Base Material Beneath Floor Slabs:** Base material shall be a granular material per the recommendation of the Project Geotechnical Investigation Report.

B. **Preformed Expansion Joint Fillers:** Sponge rubber, ASTM D1752, Type I

C. **Contraction/Construction Joint Filler:** The joint filler shall be a two (2) component 100% solids compound, with a minimum shore A hardness of 80. Products: Subject to compliance with requirements, provide “Euco 700 or QWIK Joint” by the Euclid Chemical Company, “Sikadur 51 SL” by Sika Chemical Corporation, or MM-80 by Metzer/McGuire.

D. **Moisture Retaining Covering:** One of the following, complying with ASTM C171:
   1. Waterproof paper
   2. Polyethylene film
   3. Polyethylene coated burlap

E. **Curing and Sealing Compound:** Kurez DR VOX or Kurez W VOX by the Euclid Chemical Company, Master Kure 200W by Master Builders or Kure-n-Seal by Sonneborn. The compound shall conform to FS TT-C-800A, 30 percent solids content minimum, and have test data from an independent laboratory indicating a maximum moisture loss of 0.030 gram per square centimeter when applied at a coverage rate of 300 square feet per gallon. Manufacturer’s certification is required.

F. **Bonding Compound:** Euco Weld by Euclid Chemical Company or Weldcrete by the Larsen Company. The compound shall be a polyvinyl acetate, rewettable type.
G. Epoxy Adhesive: Euco Epoxy No. 452 or No. 620 by Euclid Chemical Company, Sikadur Hi-Mod by Sika Chemical Corporation, or Epcon Ceramic 6 by ITW Ramset. The compound shall conform to ASTM C881, be a 2 component, 100 percent solids, 100 percent reactive compound suitable for use on dry or damp surfaces.

H. Nonshrink Grout: Euco NS by the Euclid Chemical Company or Masterflow 713 by Master Builders. The grout shall conform to CRD-C-621-80, "Corps of Engineers Specification for Nonshrink Grout."

2.5 MIX DESIGN

A. Preparation
1. Prepare design mixes for each type and strength of concrete in accordance with applicable provisions of ACI-318 and ASTM C94. Use an independent testing facility acceptable to the A/E for preparing and reporting proposed mix designs. The testing facility shall not be the same one used for field quality control testing unless this is acceptable to the A/E. Submit to the A/E written reports of each proposed mix for each class of concrete at least 15 days before the start of work. The mix designs shall be submitted on the mix design submittal form included at the end of this specification. Do not begin concrete production until the A/E reviews and approves the mixes.
2. The design mix shall provide normal weight concrete with compressive strength as indicated on the Drawings.

B. Water/Cementitious Ratio:
1. Interior slabs on grade, interior slabs on metal deck, and interior foundations shall have a maximum water/cement ratio of 0.50 (4000 psi).
2. All concrete subject to freezing and thawing shall have a maximum water/cement ratio of 0.45 (4500 psi at 28 days or more). This includes exterior footings, footings at the perimeter of the building, perimeter building walls, foundation walls, and retaining walls.
3. All concrete subjected to deicers and/or required to be watertight shall have a maximum water/cement ratio of 0.40 (5000 psi at 28 days or more). This includes exterior sidewalks and loading docks.

C. Admixtures
1. All concrete slabs placed at air temperatures below 50 degrees F shall contain the specified nonchloride accelerator.
2. All concrete required to be air entrained shall contain an approved air entraining admixture. Use an air entraining admixture in all concrete structures and slabs exposed to freezing and thawing or subjected to hydraulic pressure. This includes exterior footings, footings at the perimeter of the building, foundation walls, retaining walls, exterior sidewalks and loading docks.
   a. 5 percent for maximum 2 inches aggregate
   b. 6 percent for maximum 3/4 inch aggregate
   c. 7 percent for maximum 1/2 inch aggregate
3. All pumped concrete, grout, concrete for floor slabs, and concrete with a water/cement ratio below 0.50 shall contain the specified high range water reducing admixture (superplasticizer) or mid-range water reducing admixture.
4. Use the amounts of admixtures recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities and types of admixtures as required to maintain quality control.

D. Slump Limits
1. All concrete containing the high range water reducing admixture (superplasticizer) shall have a maximum slump of 6 inches unless otherwise approved by the A/E. The
concrete shall arrive at the job site at a slump of 2 inches to 3 inches and be verified; then the high range water reducing admixture shall be added to increase the slump to the approved level.

2. All other concrete shall have a maximum slump of 3 inches for slabs and 4 inches for other members.

2.6 PROPORTIONING

A. Job Site Mixing

1. Mix materials for concrete in an acceptable drum type batch machine mixer. For mixers with a capacity of one cubic yard or less, continue mixing at least 1-1/2 minutes but not more than 5 minutes after all ingredients are in the mixer before any part of the batch is released. For mixers with a capacity of more than one cubic yard, increase the minimum mixing time of 1-1/2 minutes by 15 seconds for each additional cubic yard of capacity or fraction thereof.

2. For each batch discharged and used in the work, provide a batch ticket indicating the project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

B. Ready Mix Concrete

1. Comply with the requirements of ASTM C94 and of these specifications.

2. During hot weather or under conditions that contribute to rapid setting of concrete, a shorter mixing time than that specified in ASTM C94 may be required. When the air temperature is between 85 degrees and 90 degrees F, reduce the mixing and delivery time from 1-1/2 hours to 75 minutes; when the air temperature is above 90 degrees F, reduce the mixing time to 60 minutes.

3. Each load of concrete arriving at the job shall be accompanied by a delivery ticket that shall be collected by the Contractor and submitted to the A/E and shall contain the following information:
   a. The design mix and strength of mix of concrete being delivered
   b. The exact time the cement, aggregate, and water were discharged into the delivery truck

2.7 SLAB-ON-GRADE TOLERANCES

A. Concrete Floor Flatness/Levelness

1. Flatness/Levelness Tolerance: All slabs shall conform to the following tolerances:

   Floated or Broomed Surfaces: \( F_{20}/F_{17} \) overall
   \( F_{15}/F_{13} \) minimum Local value

   Trowel Finish: \( F_{35}/F_{25} \) overall
   \( F_{20}/F_{17} \) minimum Local value

2. General Conformity to Design Grade: The entire floor shall fall within a 1/2 inch of the floor elevations shown on the Drawings.

3. Expectations and Modifications: All floor tolerance measurements shall be referenced to the as-built design grades shown on the Drawings, even when (as with slopes-to-drain and pre-deflection cambers) such grades are not horizontal.

4. Floor Tolerance Measurements: Floor flatness and levelness tests on the random traffic floor shall be conducted in accordance with the provisions set forth in ASTM E 1155-96 using a Dipstick® Floor Profiler manufactured by Face Construction Technologies, Norfolk, VA or F-Meter by Allen Face Associates, Wilmington, NC. Floor tolerance measurements shall be made by the Owner within 16 hours after completion of the final troweling operation – and in all cases before forms and/or shores have been removed. Results of all floor tolerance tests, including a written
notice of acceptance or rejection of the work, shall be provided to the Contractor within 24 hours after data collection.

NOTE: Weekends and holidays shall be ignored when computing the testing and reporting deadlines specified above.

5. Remedy for Out-Of Tolerance Work: All floor sections measuring at or above both of the specified Minimum Local F-Numbers shall be accepted for tolerance compliance as constructed. All floor sections measuring below either (or both) of the specified Minimum Local F-Numbers shall be repaired if possible or removed at the direction of the A/E.

PART 3 EXECUTION

3.1 FORMS

A. Design, erect, support, brace, and maintain formwork to support any vertical and lateral loads that may be applied until such loads can be supported by the concrete structure. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation, and position. Design and construction of formwork shall be the responsibility of the Contractor.

B. Design formwork so that it can be readily removed without impact, shock, or damage to cast in place concrete surfaces and adjacent materials.

C. Construct forms complying with ACI 347 and ACI SP-4 to the sizes, shapes, lines, and dimensions shown on the Drawings so that in the finished structures the work will be level and plumb and have accurate alignment, location, and grade within the tolerance limits of ACI 301. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features that the work requires. Use selected materials to obtain the required finishes. Butt joints solidly, and provide backup at joints to prevent leakage of cement paste.

D. Fabricate forms so that they can be easily removed without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep for the concrete to be placed with bottom forms only. To form keyways, reglets, recesses, and the like, kerf wood inserts to prevent swelling and to permit easy removal.

E. Where the interior area of formwork is not accessible for cleanout, provide temporary openings to permit concrete placement and inspection before the concrete is placed. Brace temporary openings securely and set them tightly to forms to prevent the loss of concrete mortar. Position temporary openings on forms at inconspicuous locations.

F. Chamfer exposed corners and edges as shown on the Drawings, using wood, metal, PVC, or rubber chamfer strips fabricated to produce smooth, uniform lines and tight edge joints.

G. Use metal form ties that are factory made, adjustable in length, designed to prevent form deflection, and either removable or snap-off and that will prevent the concrete surface’s being spalled when the ties are removed. If snap-off ties are used, the portion remaining within the concrete after removal must be at least 1-1/2 inches inside the concrete and be provided with a waterproofing washer unless the Drawings indicate otherwise.

H. Unless the Drawings indicate otherwise, provide form ties that will not leave holes larger than 1-1/2 inches in diameter in the concrete surface.
I. Provide openings in concrete formwork to accommodate the work of other trades. Determine the size and location of openings, recesses, and chases from the trades providing such work. Accurately place and securely support items built into forms.

J. Clean thoroughly forms and adjacent surfaces that are to receive concrete. Remove chips, wood, sawdust, dirt, sediment, and any other debris just before the concrete is placed. After concrete placement, retighten forms if necessary to eliminate mortar leaks.

K. Earth forming may be permitted when conditions allow, provided prior approval is obtained with the Engineer of Record.

3.2 PLACING REINFORCEMENT

A. For details and methods of placing reinforcement and supports, comply with the specified codes and standards, the recommended practice of the CRSI as outlined in "Placing Reinforcing Bars," and these specifications.

B. Clean reinforcement to remove loose rust and mill scale, earth, ice, and other materials that reduce or destroy the bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcement with metal chairs, runners, bolsters, spacers, and hangers as required for security.

D. Place reinforcement to obtain at least the minimum coverage for concrete protection as required by ACI 318 and ACI 350 as applicable. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so that ends are directed into the concrete, not toward exposed concrete surfaces.

E. Do not place reinforcing bars more than 2 inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment or similar construction loads.

F. Install welded wire fabric in lengths that are as long as practicable. Lap adjoining pieces at least one full mesh plus 6", and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction. Welded wire fabric shall be lapped 10" minimum.

3.3 JOINTS

A. Locate and install construction joints (which may not be shown on the Drawings) as approved by the A/E so that the strength and appearance of the structure will not be impaired.

B. Provide keyways at least 1-1/2 inches deep in construction joints that are in walls and slabs or between walls and footings. Bulkheads designed for this purpose may be used if accepted by the A/E. Omit keyway where steel waterstops are shown between walls and footings.

C. Construct isolation joints in slabs on the ground wherever there is contact between slabs on the ground and vertical surfaces and wherever else indicated on the Drawings.

D. Install joint filler and sealant materials as specified by the manufacturer.

E. Construct contraction (control) joints in slabs on ground to form panels of patterns as shown. The soff-cut saw system shall be used immediately after final finishing and to a depth of 1/3 slab thickness. A conventional saw shall be used as soon as possible without dislodging
aggregate and to a depth of 1/3 slab thickness, if the initial soff-cut did not achieve the 1/3 depth.

F. Install semi-rigid joint filler or joint sealant in accordance with the direction of the manufacturer.

G. The maximum joint spacing (in feet) of slabs on grade shall be 30 times the slab thickness (in inches) unless otherwise shown on the drawings.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. Set and build into the work anchoring devices and other embedded items required for other work that are to be attached to or supported by cast in place concrete. Use setting drawings, diagrams, instructions, and directions provided by the suppliers of the items to be attached thereto.

B. Set edge forms or bulkheads and intermediate screed strips for slabs in order to provide the elevations and contours in the finished slab surface required by the Drawings. Provide units strong enough to support the types of screed strips used, and secure with strike-off templates or compacting screeds accepted by the A/E.

3.5 PREPARATION OF FORM SURFACES

A. Before placing reinforcement, coat the contact surfaces of forms with a form coating compound.

B. Thin the form coating compound only with the amount and type of thinning agent and only under the conditions recommended by the compound manufacturer. Do not allow excess form coating material to accumulate in the forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply the form coating compound in compliance with the manufacturer's instructions.

C. Coat steel forms with a nonstaining, rust preventive form oil, or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades that the formwork is complete so that they may then install their work; cooperate with other trades in setting such work. Wherever form coatings are not used, wet wood thoroughly just before placing concrete.

B. Coordinate the installation of joint materials and moisture barriers with the placement of forms and reinforcing steel.

C. Deposit concrete either continuously or in layers thick enough to prevent its being placed on concrete that has hardened enough to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as close to its final location as practicable in order to avoid segregation due to rehandling or flowing.

D. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner that avoids inclined construction joints. Where placement consists of several layers, avoid cold joints by placing each layer while the preceding one is still plastic.
E. Use mechanical vibrating equipment supplemented by hand spading, rodding, or tamping to consolidate placed concrete. The equipment and procedures used to consolidate the concrete shall comply with the recommended practices of ACI 309 and suit both the type of concrete and project conditions.

F. Do not use vibrators to transport concrete once it is inside the forms. Insert and withdraw vibrators vertically at uniformly spaced locations no further apart than the visible horizontal effectiveness of the machine. Limit layer heights so that the vibrator is effective into 6 inches of the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete, and complete embedment of reinforcement and other embedded items without causing segregation of the mix. Lower frequency vibrators may be used with “flowing” concrete.

G. Until the placing of a panel or section is completed, deposit and consolidate concrete slabs in a continuous operation within construction joints.

H. Consolidate concrete during placing operations so that it is thoroughly worked around reinforcement and other embedded items and into corners.

I. Bring slab surfaces to the correct level with a straightedge and strike off. Use highway bull floats or darbies to smooth the surface, leaving it free from humps and hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces before starting finishing operations.

J. Maintain reinforcement in the proper position during placement operations.

K. Cold Weather Placement
   1. Comply with ACI 306 and the requirements herein specified to protect concrete work from physical damage or reduced strength due to frost, freezing, or low temperatures.
   2. When the air temperature has fallen or is expected to fall below 40 degrees F, heat all water and aggregates uniformly before mixing so that the concrete, at point of placement, will have a temperature of not less than 50 degrees nor more than 80 degrees F.
   3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   4. Use only the specified nonchloride accelerator. Do not use calcium chloride or admixtures containing more than 0.05 percent chloride ions.

L. Hot Weather Placement
   1. When the weather is hot enough to impair seriously the concrete’s quality and strength, place the concrete as specified herein and in ACI 305.
   2. Cool ingredients before mixing so that when the concrete is placed, its temperature is below 90 degrees F. Mixing water may be chilled, or else a portion of the water may be in the form of chopped ice.
   3. If reinforcing steel becomes hotter than the ambient air temperature, cool it with water soaked burlap so that its temperature will not exceed the ambient air temperature.
   4. When high temperatures and/or placing or humidity conditions dictate, the mix may be initially retarded by use of the water reducing, retarding formulation (Type D) of the specified water reducing admixture (Type A).

3.7 FINISH OF FORMED SURFACES
A. Rough Form Finishes: For formed concrete surfaces not exposed to view in the finished work or covered by other construction, use a rough form finish unless otherwise indicated by the Drawings. Repair and patch tie holes and defective areas, and rub down or chip off fins and other projections more than 1/4 inch high.

B. Smooth Form Finish: For formed concrete surfaces that are exposed to view or to be covered with a coating or covering material applied directly to the concrete or a covering material bonded to the concrete (e.g., waterproofing, dampproofing, painting, etc.), use a smooth form finish. This is the as-cast finish obtained on the concrete surface when the selected form facing material is regularly and symmetrically arranged with a minimum of seams. Repair and patch defective areas so that all fins and other projections are completely removed and smoothed.

C. Rubbed Finish: At all formed surfaces exposed inside and outside the building, apply rubbed finish as follows:
   1. Surface irregularities shall not exceed 1/8 inch in 5 feet for gradual irregularities nor 1/16 inch for abrupt irregularities. Fill over any air pockets or voids over 1/8 inch in width, and surface smoothly.
   2. Perform finishing after all required patching and corrections of major imperfections have been completed, and complete within 24 hours after forms are stripped.
   3. Thoroughly wet the surfaces, and begin finishing while they are still damp.
   4. The mortar shall consist of 1 part cement, 2 parts sand (by dry volume) passing a No. 16 screen, the bonding admixture SBR Latex by the Euclid Chemical Company, and enough water to produce a mortar the consistency of thick paint.
   5. Apply the mortar by rubbing thoroughly over the surface, using burlap or a sponge rubber float, to fill all pits thoroughly. While the mortar in the pits is still plastic, rub over the surface with a dry mix of the above proportions and material to remove the excess material and to stiffen the mortar in the pits. After the mortar has thoroughly hardened, wipe it with clean burlap to remove all surface mortar completely. The entire operation for any area must be completed the day it is started.

D. Related Uniform Finishes:
   1. At the tops of walls, horizontal offsets, and similar unformed surfaces that are next to formed surfaces, strike off smooth and finish with a texture that matches the adjacent formed surfaces. Unless otherwise shown on the Drawings, continue the final surface treatment of formed surfaces uniformly across adjacent unformed finishes.

E. Float Finish
   1. Apply float finish to monolithic slab surfaces that are to receive a trowel finish or other finishes specified hereinafter; to slab surfaces that are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand bed terrazzo; and as otherwise indicated by the Drawings or schedules.
   2. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened enough to permit the operation of power driven floats or by hand floating if the area is small or inaccessible to power units. Check and level the surface plane so that the surface conforms to the specified Ff/Ff17 tolerance.

F. Trowel Finish
   1. Apply a trowel finish to monolithic slab surfaces that are to be exposed to view, unless otherwise indicated by the Drawings, and to slab surfaces that are to be covered with resilient flooring, paint, or other thinfilm finish coating.
   2. After the slab has received a floated finish, begin first trowel finish operation using a power driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over it. Surface shall be troweded until it is free of trowel marks, is uniform in texture and has a smooth dense appearance, and
achieves an F\(r_{30}/F_{25}\) tolerance. Grind smooth any surface defects that would telegraph through the applied floor covering.

G. Non-slip Broom Finish
1. Apply non-slip broom finish to exterior concrete platforms, steps, and ramps and elsewhere as indicated by the Drawings or schedules.
2. Immediately after float finishing, roughen the concrete surface slightly by brooming perpendicular to the main traffic route with a fiber bristle broom. Texture shall be as approved by A/E from sample panels.

H. Non-slip Finish: Where the contract documents require a non-slip finish, give the surface a “dry shake” application of crushed ceramically bonded aluminum oxide or other specified selected abrasive particles. The rate of application of such material shall be not less than 25 pounds per 100 SF.

I. Sealer/Dustproofer Finish: Apply a second coat of the specified curing and sealing compound to interior concrete floors, not subject to vehicular traffic, where shown on the Drawings or in schedules. The compound shall be applied in strict accordance with the directions of the manufacturer and just prior to completion of construction.

J. Fine Broom Finish
1. Apply fine broom finish to interior concrete pads scheduled to receive ceramic tile or quarry tile.

3.8 CURING

A. After placing and finishing the concrete, start initial curing of concrete as soon as free water has disappeared from concrete surface. Keep continuously moist for not less than 7 days.

B. Begin final curing immediately after final finishing. Continue final curing for at least 7 days in accordance with ACI 301 and ACI 308. Avoid rapid drying at the end of the final curing period.

C. Cure concrete by moist curing, moisture retaining cover curing, membrane curing, or combinations of these methods, as specified herein and ACI 308.

D. Provide moisture curing by one of the following methods:
1. Keep concrete surface continuously wet by covering with water.
2. Spray it continuously with a water fog.
3. Cover the concrete surface with the specified absorptive cover, thoroughly saturating the cover with water and keeping it wet; position the absorptive cover so that it covers the concrete surface and edges and laps adjacent absorptive covers by 4 inches.

E. Provide moisture cover curing by covering concrete surfaces with a moisture retaining cover designed for curing concrete. Place the cover in the widest practicable width of material with sides and ends of the material lapped at least 3 inches and sealed by waterproof tape or adhesive. Repair immediately any holes or tears that occur during the curing period with identical cover material and waterproof tape.

F. Provide membrane curing to slabs as follows: All interior slabs that have resilient tile or carpet or are left exposed and all exterior slabs, sidewalks, curbs, etc., shall be cured with the specified clear curing and sealing compound. The compound shall be applied immediately after final finishing operations are completed. Apply uniformly in a continuous operation by power spray or roller in accordance with the manufacturer’s directions. Areas that are
subjected to heavy rainfall within 3 hours after initial application shall be recoated. Maintain continuity of coating, and repair damage during the curing period.

G. Cure formed concrete surfaces (including undersides of beams, supported slabs, and other similar surfaces) by moist curing with forms in place for the full curing period or until the forms are removed. If forms are removed, continue curing by the methods specified above, as applicable.

H. Cure unformed surfaces such as slabs, floor topping, and other flat surfaces by the application of the specified curing and sealing compound, strippable curing compound or by a moist curing method approved by the A/E.

3.9 REMOVAL AND REUSE OF FORMS

A. Formwork not supporting weight of concrete (e.g., sides of beams, walls, columns, and similar parts of the work) may be removed after curing at a temperature of not less than 50 degrees F 24 hours after the concrete is placed, provided the concrete is hard enough not to be damaged by form removal operations and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete (e.g., beam soffits, joints, slabs, and other structural elements) may not be removed for at least 14 days nor until the concrete has attained a design minimum compressive strength of 28 days. Determine the potential compressive strength of in-place concrete by testing the field cured specimens representative of the concrete location or members.

C. Form facing material may be removed 4 days after concrete placement only if shores and other vertical supports have been arranged to permit it to be removed without loosening or disturbing shores and supports.

D. Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact form surfaces as specified above for new formwork.

E. When forms are extended for successive concrete placement, clean surfaces thoroughly, remove fins and laitance, and tighten forms to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces, except as acceptable to the A/E.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Unless the Drawings show otherwise or the A/E directs, fill in holes and openings left in concrete structures for the work of other trades once that work is in place. Mix, place, and cure concrete as specified herein to blend with in-place construction. Provide other miscellaneous concrete filling shown on the Drawings or necessary to complete the work.

B. Nonshrink Grout: All column base plates, equipment bases, and other locations noted on the structural drawings shall be grouted with the specified nonshrink grout. All exposed grout shall be of the specified nonmetallic type.


3.11 CONCRETE SURFACE REPAIRS
A. Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to the A/E.

B. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete, but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Before placing cement mortar, thoroughly clean, dampen with water, and apply the specified bonding compound. The cement mortar shall be placed after the bonding compound has dried.

C. Remove and replace concrete with defective surfaces if these effects cannot be repaired to the satisfaction of the A/E. Such surface defects include irregularities of color and texture, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, and fill with dry pack mortar or with precast cement cone plugs secured in place with bonding agent.

D. Where possible, repair concealed formed surfaces that contain defects which adversely affect the durability of the concrete. If such defects cannot be repaired, remove and replace the concrete.

E. Test unformed surfaces such as monolithic slabs for smoothness and to verify that the surface plane meets the tolerances specified for each surface and finish. Correct low and high areas as specified herein. Test unformed surfaces sloped to provide drainage for both trueness of slope and smoothness with a template of the slope specified on the Drawings.

F. Repair finished unformed surfaces that contain defects which adversely affect durability of the concrete. Such surface defects include crazing, spalling, pop-outs, honeycomb, rock pockets, cracks that are more than 0.01 inch wide or that, regardless of width, penetrate either to reinforcement or completely through unreinforced sections, and other objectionable conditions.

G. After the concrete has cured at least 14 days, correct high areas in unformed surfaces by grinding.

H. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting them out and refilling with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the A/E.

I. Repair defective areas (except for random cracks and single holes not more than 1 inch in diameter) by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete, and apply the specified bonding compound. Place patching concrete after the bonding compound has dried. Mix patching concrete of the same materials to provide concrete of the same type or class as the original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

J. Repair isolated random cracks and single holes not over 1 inch in diameter by the dry pack method. Groove top of cracks, cut out holes until sound concrete is reached, and clean to remove dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply the specified bonding compound. Place dry pack after the bonding compound has dried. Dry pack shall consist of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve. Mix with no more water than is necessary for handling and placing. Compact dry pack mixture in place, and finish to match adjacent concrete. Keep patched area continuously moist for no less than 72 hours.
K. All structural repairs shall be made, with prior approval of the A/E as to the method and procedure, using the specified epoxy adhesive and/or epoxy mortar.

L. Repair methods not specified above may be used, subject to acceptance by the A/E.

3.12 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. The Owner will employ a testing laboratory to perform any or all of the tests specified below and to submit reports on these tests. Sampling and testing for quality control during the placement of concrete may include the following, as directed by the A/E:

1. Sampling Fresh Concrete: ASTM C172, but modified for slump to comply with ASTM C94
2. Slump: ASTM C143; one test for each concrete load at point of discharge and one test of each set of compressive strength test specimens
3. Air Content: ASTM C173 volumetric method for lightweight concrete; ASTM C231 pressure method for normal weight concrete; one test for each set of compressive strength test specimens
4. Water Content: The water content of freshly mixed concrete will be tested each time cylinders are made and as directed by the Engineer in accordance with AASHTO TP 23, Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying.
5. Concrete Temperature: Test hourly when air temperature is 40 degrees F and below or when 80 degrees F and above and each time a set of compression test specimens is made.
6. Compression Test Specimen: ASTM C31; one set of 6 standard cylinders for each compressive strength test, unless otherwise directed by the A/E. Mold and store cylinders of laboratory cured test specimens except when the A/E requires field cured test specimens.
7. Compressive Strength Tests: ASTM C39; one set for each 100 cubic yards or fraction thereof of each concrete class placed in any one day or one set for each 5,000 square feet of surface area placed; 2 specimens tested at 7 days, 2 specimens tested at 28 days, and 2 specimens retained in reserve for later testing, if needed.

B. When the frequency of testing provides less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or, if fewer than 5 are used, from each batch.

C. The strength level shall be considered satisfactory as long as the averages of all sets of 3 consecutive strength test results equal or exceed the specified strength f'c, and no individual test result falls below the specified strength f'c by more than 500 psi.

D. When the strength of field cured cylinders is less than 85 percent of companion laboratory cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

E. Test results will be reported to the A/E and Contractor in writing on the same day that the test is made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in the structure, design compressive strength at 28 days, concrete mix proportions and materials, and compressive breaking strength and type of break for both 7 day tests and 28 day tests.

G. Non-Compliant Test Reports: All test reports indicating non-compliance should be faxed immediately to all parties on the test report distribution list. Copies shall be on different colored paper.
H. The testing service will make additional tests of in-place concrete when the test results indicate that the required strength level has not been achieved and other characteristics have not been attained in the structure, as directed by the A/E. The testing service may conduct tests to determine the adequacy of concrete by cored cylinders that comply with ASTM C42 or by such other methods as are directed by the A/E. The Contractor shall pay for such tests and any additional testing that may be required when concrete is verified to be unacceptable.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. Furnishing of, and paying for, all labor, materials, services, appliances, and equipment necessary for the execution, installation, and completion of all work specified herein.

B. Work Included:

1. Fabrication and erection of all structural steel, as shown on drawings and/or specified herein, including but not necessarily limited to the following all structural steel rolled sections, such as beams, girders, columns, purlins, channels, angles, anchor plates, bearing plates, brackets, braces, loose lintels, shelf angles, anchor bolts, sleeves, bearing plates, inserts, and/or other items incidental to construction, or as normally required to complete the erection and support of all structural steel work specified herein.

2. Loose lintels, shelf angles, anchor bolts, sleeves, bearing plates, inserts, wedge inserts, expansion joint plates, and other incidental items of structural and/or miscellaneous steel as required to be built into concrete or masonry must be provided as indicated on drawings or as specified. At the proper time, these will be furnished to the respective contractor, where applicable, including instructions or templates for installation within masonry and/or concrete construction.

3. All miscellaneous steel members supporting penetrations of roof deck.

4. All connections, erection fittings, and devices required to complete this work.

5. Shop painting and field touch-up painting.

6. All miscellaneous steel angles, beams, rods, and/or braces to be furnished and/or installed for support or bracing of door frames, operable walls, and as shown on the drawings.

7. All other miscellaneous steel appearance items complete with brackets, etc. for complete installation.

C. Work Furnished but Installed Under Other Sections:

a. Section 03 30 10 - Cast in Concrete; anchorages cast in concrete.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Shop drawings, product data, and samples - General Conditions, Article 4, paragraph 4.12 and Section 01 34 00 - Submittals of this Project Manual.

B. Testing laboratory services - General Conditions, Article 7, paragraph 7.7 and Section 01 45 00 - Quality Control of this Project Manual.

C. Cast-in-place concrete, including grouting of base plates and bearing plates - Section 03 30 10 - Cast-In-Place Concrete of this Project Manual.

D. Metal fabrications - Section 05 50 00 - Miscellaneous Metal Fabrications of this Project Manual.
E. Finish painting – 09 91 00 Exterior Painting and 09920 Interior Painting of this Project Manual.

1.03 RELATED DOCUMENTS:

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions, and DIVISION 1 - GENERAL REQUIREMENTS apply to the work of this section.

B. Use this specification in conjunction with the General Notes and specific directives on the Contract Drawings.

1.04 REFERENCE STANDARDS:

Perform work in accordance with the AISC Specifications and Code of Standard Practice, except as modified herein.

A. American Institute of Steel Construction (AISC):


4. AISC Quality Certification Program.

B. American Welding Society (AWS):


2. Guide for the Non-destructive Inspection of Welds (ANSI/AWS B1.0 [80]).


C. Research Council on Structural Connections of Engineering Foundation:


D. American Society for Testing and Materials (ASTM):

1. ASTM A6-84 General Regulations for Delivery of Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use.

2. See materials specifications listed under Part 2 - Products of this section of the Project Manual.

E. Steel Structures Painting Council (SSPC):

A Guide to the Shop Painting of Structural Steel, SSPC AISC.
F. Industrial Fasteners Institute:

Handbook for Bolt, Nut, and Rivet Standards.

G. American Society for Non-Destructive Testing (ASNT):

Recommended Practice, (SNT-TC-1A).

H. No provision of any referenced standard specification, manual, or code (whether or not specifically incorporated by reference in the Contract Documents) will be effective to change the duties and responsibilities of the OWNER, CONTRACTOR, or ENGINEER, or any of their consultants, agents or employees from those set forth in the Contract Documents, nor will it be effective to assign the ENGINEER, or anyone of authority, to supervise or direct the furnishing or performance of the work or any duty or authority to undertake responsibility contrary to the provisions of these Contract Documents.

1.05 QUALIFICATIONS:

A. Fabricator and erector must have completed a project of similar scope and must have adequate facilities, personnel, and equipment to meet production and quality requirements and to maintain proper job progress. Certification by the AISC Quality Certification Program will provide satisfactory evidence of compliance.

B. Welding procedures, welders, welding operations, and tack welders must be qualified in accordance with the AWS Structural Welding Code, Section 5.

1.06 RESPONSIBILITY FOR DESIGN:

A. Where connections are not shown on drawings, the connections must comply with the requirements of the AISC Specifications, paragraph 3.1.3. Where reactions and/or moments are shown on drawings, connections must be designed to accommodate these, subject to review and approval by the Engineer.

B. Substitutions of member sizes due to non-availability of materials must be of equivalent strength and rigidity to that specified; must be compatible with the design and must be approved by the Engineer after being specifically called to his attention in writing.

1.07 SUBMITTALS:

A. Submit shop drawings in accordance with Section 01340 - Submittals and the AISC Code, Division 4 clearly indicating profiles, sizes, spacing, and locations of structural members, connections, attachments, anchorages, framed openings larger than eighteen [18"] inches square, size and type of fasteners, cambers, and all other details required for the fabrication and erection of the structural steel.

B. Submit descriptive data to illustrate the structural steel erection procedure, including the sequence of erection and temporary staying and bracing.

C. Indicate welded connections using standard AWS welding symbols. Clearly indicate net weld lengths. Submit written description, as required, to illustrate each welding procedure to be performed.

D. Submit descriptive data for field welding equipment including type, voltage, and amperage.
E. Submit the following for proof of material compliance:

1. Reports of ladle analysis for all steels.

2. Reports of tensile properties and bend tests for steel shapes, bars, and plates.

3. Certified mill test reports required by applicable ASTM Material Specifications (AISC Code, Division 5). All high-strength steels exceeding 36,000 psi yield point (ASTM A36) must be identified in accordance with the Recommended Procedures for Identification of High-Strength Steels During Fabrication, as adopted by the AISC, (see AISC Code, Section 6.1, "Identification of Material").

4. Submit Certificates of Conformance for:
   a. Structural steel tubing.
   b. Shear studs in accordance with AWS Building Code, Article 4.27.
   c. Filler material for welding.

5. Reports of mechanical properties of headed-stud type shear connectors.

6. Reports of mechanical tests for high-strength threaded fasteners.

F. Submit manufacturer's literature describing each type of welding stud and arc shield.

G. Submit inspection and test reports according to article 1.08 below.

H. Certification of Quality Assurance Program (see 1.08 below).

1.08 QUALITY ASSURANCE:

A. See Section 01 45 00 - Quality Control of this Project Manual; AISC Code, Section 8 and AISC Specification Section 1.26. Both the fabricator and the erector must maintain a quality assurance program to assure that all work is performed in accordance with these specifications and the AISC Code and Specifications. Certification under the AISC Quality Certification Program will suffice. The AISC Quality Criteria and Inspection Standards, 1971, will establish acceptable practice, unless otherwise provided by this specification.

B. It is the responsibility of the Contractor to maintain control of the quality of the materials and workmanship and conformance to the project specifications.

C. Fabrication/erection inspection and testing of weldments must be provided by the Contractor in accordance with AWS D1.1-83, Section 6. The fabrication/erection inspector(s) must be AWS certified welding inspector(s) in accordance with the provisions of AWS QCI, Standard for Qualifications and Certification of Welding Inspectors.

D. Provide certification that welding inspectors, welders, welding operators, and tack welders performing the work have satisfactorily passed AWS qualification tests within the previous twelve [12] months prior to starting the work. If re-certification of welders is required, it will be the Contractor's responsibility to ensure compliance. Each welder working on the project must mark his identification symbol at each weldment completed, whether in the shop or field.

E. The fabrication and erection of structural steel (per AWS D1.1, Section 6) will be subject to verification, testing, and inspection by the Owner or his representative, the Engineer, and/or the testing laboratory specified in Section 01 45 00 - Quality Control. Such verification
inspections do not relieve the Contractor and his supplier of responsibility for conforming to the Contract Document requirements.

F. The testing agency (see Section 01 45 00 - Quality Control) will inspect or test structural steel at the fabricating plant before shipment to the project as follows:

1. Base Material:
   a. Verify chemical composition of all steel.
   b. Verify mechanical properties of all steel (ASTM A370).

2. Fabrication:
   a. Verify qualification of shop procedures for type of steel construction specified or elected by fabricator.
   b. Inspect shop-fabricated structural steel members and assemblies for conformance with the requirements specified.
   c. Test requirements for materials specified herein or incorporated in referenced documents may be waived provided certified copies of mill test or test reports from approved laboratories, performed on previously manufactured materials, are submitted and approved. Test reports must be accompanied by notarized certificates from the manufacturer certifying that the tested material was of the same type, quality, and manufacturer as that being supplied for this project. Tests must have been conducted no more that one [1] year prior to the date such materials are submitted for approval. Proper steels must be maintained throughout the fabricating process.
   d. Inspection of shop welds must be in accordance with Sections 6 and 8.15 of the AWS Structural Welding Code and as follows:
      I. Visual inspection of all shop welds in accordance with AWS D1.1, 6.5.
      II. All full penetration welds shall be tested with non-destructive testing methods. The non-destructive testing rate for welds made by an individual welder is permitted to be reduced to 25% of the welds provided the weld inspection reject rate is 5% or less and a minimum of 10% of the total welds are tested. A representative sample of twenty-five percent of all full penetration welds and all questionable quality, full penetration welds must be non-destructive tested by one of the following as appropriate:
         aa. Liquid penetrate inspection of the shop welds in accordance with AWS D1.1, 6.5 (ASTM E165).
         bb. Magnetic particle inspection of the shop welds in accordance with AWS D1.1, 6.7.5 (ASTM E105).
         cc. Radiographic inspection of the shop welds in accordance with AWS D1.1, Part C, Chapter 6, “Inspection” (ASTM E94 and E99).
         dd. Ultrasonic inspection of the shop welds indicated in accordance with AWS D1.1, Part C, Chapter 6, "Inspection" (ASTM E164).
      III. Stud welding inspection of shop welded studs must be in accordance
with AWS D1.1, 4.26.

IV. Five percent (5%) of all fillet welds shall be tested by an approved non-destructive testing method.

e. Inspection of Shop Painting:

I. Surface preparation prior to painting must be visually evaluated for degree of cleaning by comparison with SSPC pictorial standards.

II. Measurement of dry film thickness of each coat of shop-applied paint must be in accordance with ASTM D1005-72.

G. Erection verification inspection and testing to be provided by the testing agency.

1. Verification of qualifications of field procedures and personnel.

2. Inspection of erected structural steel work for conformance with the requirements specified.

3. Inspection of field-assembled high-strength, bolted construction must be in accordance with AISC Specification for Structural Joints, Section 6, using ASTM A325 or A490 bolts.

4. Inspection of field welds must be in accordance with AWS Structural Welding Code, Section 6, and paragraph 1.7.7.2D above.

5. Perform non-destructive testing as appropriate for all field welds of questionable quality (or replace weld) and test ten [10%] percent of all full penetration field welds.

6. The fabricator, erector, architects, and structural engineer of record shall receive copies of all inspection reports.

H. The Contractor must correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor’s expense, as may be necessary to reconfirm any non-compliance of original work and as may be necessary to show compliance of corrected work.

1.09 PRODUCT HANDLING:

A. Delivery of materials to be installed under other sections:

1. Anchor bolts and other anchorage devices which are embedded in cast-in-place concrete or masonry construction must be delivered to the project site in time to be installed before the start of cast-in-place concrete operations or masonry work.

2. Provide setting drawings, templates, and directions for the installation of the anchor bolts and other devices.

B. Storage of Materials:

1. Structural steel members which are stored at the project site must be above ground on platforms, skids, or other supports so they are kept out of the mud.

2. Steel must be protected from corrosion.
3. Other materials must be stored in a weather-tight and dry place until ready for use in the work.

4. Packaged materials must be stored in their original, unbroken packages or containers.

PART 2 - PRODUCTS

2.01 MATERIALS AND COMPONENTS:

A. Refer to AISC Specifications, Section 1.4, "Materials." See structural drawings and General Notes for specific requirements, unless modified or specified hereafter.

B. Structural steel must conform to ASTM standards as specified on drawings. See AISC Specifications, Section 1.4.1 for other grades of steel shown on the drawings.

C. Bolts must conform to AISC Specifications, Section 1.4.4.
   1. Unfinished bolts must conform to ASTM A307.
   2. High-strength bolts must conform to ASTM A325, A490, or A449.
   3. Anchor bolts and nuts must conform to ASTM A36/A36M.
   4. High-strength anchor bolts must conform to ASTM 449.

D. Filler metal and flux for welding must conform to AISC Specifications, Section 1.4.5.
   1. AWS A5.1, E70 or E80 unless otherwise approved. Electrodes must be compatible with the base material being welded. Manufacturer's certification must constitute evidence of conformance.

E. Non-shrink grout for columns and other bearing plates must comply with Section 03 30 00 - Cast-in-Place Concrete of this Project Manual.

F. This contractor is to furnish male portion of all wedge inserts to be inserted within female section of inserts furnished under Section 03300 - Cast-in-Place Concrete for support of steel members specified herein. Furnish all shims as required for alignment for all members.

G. Shop paint primer must conform to AISC Code, Section 6.5 and A Guide to Shop Painting of Structural Steel, AISC-SSPC.
   1. Dry interior where steel is embedded in concrete, encased in masonry, or protected by membrane or contact type fireproofing are to be left unpainted.
   2. Interiors permanently exposed to view, normally dry must conform to SSPC-PS 7.01-64T, "One-Coat Shop Paint System" (SSPC Paint 13).
   3. Exteriors permanently exposed to weather must conform to SSPC-PS 1.01 or 1.03-64T, "Oil Base Paint System" (SSPC Paint 14).
   4. The Volatile Organic Compounds (VOC) content of all Paint must conform to Tennessee Sustainability Guidelines
      a. Finish Paint VOC limit is 50 g/L less water
      b. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates VOC limit is 250 g/L less water
H. Headed Stud-Type Shear Connectors: ASTM A-08 Grade 1015 or 1020, cold finished carbon steel with dimensions complying with AISC Specifications

I. Other materials must conform to the applicable current specifications of the ASTM.

2.02 FABRICATION AND DELIVERY:

A. Conform to AISC Code, Section 6 and AISC Specifications, Section 1.23.

B. Fabricate and assemble structural assemblies in the shop to the greatest extent possible. Fabricate items of structural steel in accordance with the approved shop drawings. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials. Verify all dimensions prior to fabrication.

C. Dimensional and straightness tolerances must conform to ASIC Code, Section 6.4.

D. Provide openings in structural members for other building components as shown on drawings. Locate holes so as not to cause any appreciable reduction in strength of members and reinforce openings with steel plates and/or angles sized and welded in place to restore members to original strength as approved by the Engineer.

E. All openings through steel floor and roof deck larger than eighteen [18"] inches square are to receive supplemental steel framing by this section of the work.

F. Cut and mill column ends and bearing plates accurately to ensure full contact of bearing surfaces prior to welding.

G. Camber horizontal members to accommodate dead load deflections as indicated on the Contract Drawings. See General Notes on structural drawings, AISC Specifications, Section 1.19 and AISC Code, paragraph 6.4.4.

H. Clean, prepare, and shop prime structural steel members. Do not prime surfaces to be field-welded or to be bolted or in contact with concrete.

I. Shop and field connections must be bolted, welded, or a combination of these as required to conform to AISC Specifications.

1. Field Connections:

   a. Bolted in accordance with AISC Specifications, except where welded connections are required or selected.

   b. High-strength threaded fasteners must be used for bolted connections, except where standard threaded fasteners are permitted.

   c. Welded connections must conform to AWS D1.1. Non-destructive testing will be required on ten [25%] percent of all full-penetration welds. Welding materials must be of the type required for materials being welded and conform to applicable AWS Specifications.

J. Bearing Plates must be provided under beams, closures, and girders resting on footings, piers, and walls as shown on the drawings with anchorage devices. Bearing plates must either be attached or loose as required for erection.

K. Metal Framing Appearance Items:
1. Form members to manufacturer’s standard shapes meeting design criteria.

2. Cut right angle connections of framing components to fit squarely against abutting members as shown on the drawings. Weld or bolt as shown.

3. Grind smooth all welds and holes cut in structural members exposed to view after fabricating.

4. All items are to be square, straight, and true to detail in all respects.

5. Fabricate all items as shown on drawings and specified herein. All must present smooth surface for use and appearance.

L. Shear Connectors: Prepare steel surfaces as recommended by Manufacturer of shear connectors. Weld shear connectors in field, spaced as shown on drawings, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer’s printed instructions.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Examine areas and conditions under which structural steel work is to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of the work.

B. Do not proceed with work until unsatisfactory conditions have been corrected in an acceptable matter.

3.02 ERECTION:

A. Check elevations of concrete and masonry bearing surfaces and locations of anchor bolts and similar devices before erection work proceeds and report discrepancies to Contractor and Engineer.

B. Do not proceed with erection until corrections have been made or until compensating adjustments to structural steel work have been agreed upon with the Designer.

C. Erect structural steel in accordance with the drawings and as provided in AISC Code, Section 7 and AISC Specifications, Section 1.25, except as hereinafter specified.

D. Field Assembly:

1. Steel frames and/or members must be assembled accurately to the lines and elevations indicated and within the erection tolerances specified in AISC Code, Section 7.11.

2. The various members forming parts of a complete frame or structure after being assembled must be aligned and adjusted accurately before being fastened.

3. Fastening of splices of compression members must be done after the abutting surfaces have been brought completely into contact.

4. Bearing surfaces and surfaces which will be in permanent contact must be cleaned before the members are assembled.
5. Splices will be permitted only where indicated or approved in writing.

E. Bearing plates for columns, beams, and similar structural members must be aligned with wedges or shims before grouting.

F. Make adequate provisions for all erection loads and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of necessary permanent bracing.

G. Do not field-cut or alter structural members without the written approval of the Engineer.

H. Provide temporary shoring and bracing members and connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

I. Provide temporary planking and working platforms as necessary to complete work effectively.

J. Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work. Furnish templates and other devices as necessary for pre-setting bolts and other anchors to accurate locations. Refer to Section 03 30 00 - Cast-in-Place Concrete of this Project Manual for anchor bolt installation in concrete and for masonry installations.

K. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface or baseplates and bearing plates. Set loose and attached baseplates and bearing plates for structural members on wedges or other adjusting devices.

L. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of baseplate or bearing plate prior to packing with grout.

M. On exposed, welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.

N. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds. Do not enlarge holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes which must be enlarged to admit bolts.

O. Do not use gas cutting torches in field for correcting fabrication errors in structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Engineer. Finish gas-cut sections equal to a sheared appearance when permitted.

3.03 PROTECTION:

A. Do not use structural units for storage or working platforms until permanently secured into position.

B. Ensure that construction loads do not exceed carrying capacity of structure.

3.04 FIELD PAINTING TOUCH-UP:

A. After the erection of all structural and miscellaneous steel members, touch-up paint all
abrasions and unpainted areas with the same paint used for the shop painting.

B. All shelf angles and lintels which will have any part exposed to weather after completion of work will receive prior to erection one [1] finish paint coat by Section 09 90 00 - Painting.

3.05 CLEAN-UP:

Remove all debris caused by the subcontract from the work site.

END OF SECTION
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SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Shop fabricated ferrous metal items, galvanized or prime painted.
   B. Ductile iron items.

1.02 RELATED SECTIONS
   A. Section 05 11 90   Structural Steel: Structural steel column anchor bolts.
   B. Section 09 90 00   Painting: Paint finish.

1.03 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION
   A. Section 03 30 10 – Concrete Work: Placement of metal fabrications in concrete.

1.04 REFERENCES
   A. ANSI A14.3   Ladders, Fixed, Safety Requirements
   B. ASTM A36   Structural Steel.
   C. ASTM A53   Hot Dipped, Zinc coated Welded and Seamless Steel Pipe.
   D. ASTM A123   Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
   E. ASTM A153   Zinc Coating (Hot Dip) on Iron and Steel Hardware.
   F. ASTM A283   Carbon Steel Plates, Shapes, and Bars.
   G. ASTM A500   Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
   H. AWS A2.0   Standard Welding Symbols.
   I. AWS D1.1   Structural Welding Code.
   J. SSPC (Steel Structures Painting Council) Steel Structures Painting Manual.

1.05 SUBMITTALS FOR REVIEW
   A. Section 01 30 00   Submittals: Procedures for submittals.
   B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   C. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

1.06 QUALIFICATIONS
   A. Prepare Shop Drawings by a firm experienced in producing metal fabrications similar to those indicated for this project and with a record of successful in-service performance.
   B. Welders Certificates: Submit under provisions of Section 01 30 00, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.07 PROJECT CONDITIONS
   A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on shop
1.08 CORDINATION
   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 item to Project site in time for installation.

PART 2 PRODUCTS

2.01 METALS, GENERAL
   A. Metal surfaces, General: For metal fabrications 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.

2.02 MATERIALS – STEEL
   A. Structural Steel and Miscellaneous Sections not otherwise specified: ASTM A36.
   B. Steel Tubing: ASTM A500, Grade B.
   C. Plates: ASTM A283.
   D. Pipe: ASTM A53, Grade B, Schedule 40
   E. Fasteners: Galvanized.
   F. Bolts, Nuts, and Washers: ASTM A325 or A307; galvanized to ASTM A153 for galvanized components.
   G. Welding Materials: AWS D1.1; type required for materials being welded.
   H. Ladders: ANSI A14.3.
   I. Shop and Touch Up Primer: Alkyd red oxide primer with 44 percent solids by volume.

2.03 INTERIOR STEEL LADDERS - SHOP FABRICATED
   A. All Structural Sections: ASTM A36 Structural Steel.
   B. Design Load: 100 pounds/SF, applicable to all members and connections.
   C. All Connections: Welded joints, continuous.
   D. All Weld Joints: Dressed to form smooth, flat surface.
   E. Prime paint using specified primer.
   F. Finish Coats: Job applied under Section 09900 - Painting.

2.04 MISCELLANEOUS METAL - SHOP FABRICATED
   A. Furnish and install all miscellaneous steel or decorative items as noted or detailed on the Drawings.
   B. All Steel not otherwise specified: ASTM A36
   C. Ferrous Metal Items:
      1. Interior: Shop primed with specified primer.
      2. Exterior: Hot-dipped galvanized after fabrication.
   D. Ferrous and aluminum items shall not be in contact.
   E. Bolts and anchors of a compatible or similar nature to the material anchored or supported shall be used throughout.
2.05  **FABRICATION**

A. Fit and shop assemble items in largest practical sections, for delivery to site.
B. Fabricate items with joints tightly fitted and secured.
C. Continuously seal joined members by continuous welds.
D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.06  **FABRICATION TOLERANCES**

A. Squareness: 1/8 inch maximum difference in diagonal measurements.
B. Maximum Offset Between Faces: 1/16 inch.
C. Maximum Misalignment of Adjacent Members: 1/16 inch.
D. Maximum Bow: 1/8 inch in 48 inches.
E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

2.07  **FINISHES – STEEL**

A. Prepare surfaces to be primed in accordance with SSPC SP 2.
B. Do not prime surfaces in direct contact with concrete or where field welding is required.
C. Prime paint items with 1 coat.
D. Steel Members: Galvanize after fabrication to ASTM A123. Provide minimum 1.25 oz/sq ft galvanized coating where indicated.

2.08  **DOWNSPOUT SHOES - (RAINWATER LEADERS)**

B. Type: R4925-R Type B, offset, 5x7. No substitutions. Where discharged into storm water system.
C. Size: Throat size as required to accommodate downspout plus approximately 1/4 inch clearance all sides.
D. Height: 32 inches minimum. Actual height will vary according to stock dimensions.

**PART 3 EXECUTION**

3.01  **EXAMINATION**

A. Verify that field conditions are acceptable and are ready to receive work.
B. Verify that structural supporting elements are completed and that dimensions correspond to the manufactured product.
C. Check that embedded anchorage is complete.
D. Assure that fabricated items are within allowable tolerances.
E. Secure to structure following manufacturer's recommended procedures for pre-fabricated items.

3.02  **PREPARATION**

A. Clean and strip primed steel items to bare metal where site welding is required.
B. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.03 INSTALLATION
A. Install items plumb and level, accurately fitted, free from distortion or defects.
B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
C. Field weld components indicated on Drawings or shop drawings.
D. Perform field welding in accordance with AWS D1.1.
E. Obtain approval prior to site cutting or making adjustments not scheduled.
F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.
G. Touchup mars to match original finish.

3.04 ERECTION TOLERANCES
A. Maximum Variation From Plumb: 1/8 inch per story, non cumulative.
B. Maximum Offset From True Alignment: 1/8 inch.
C. Maximum Out of Position: 1/8 inch.

3.05 SCHEDULE OF ITEMS
Supply and install metal fabrications listed herein, complete with anchorage and attachments necessary for installations.
A. Downspout Shoe
B. Steel Ladders
   1. Provide and install steel ladders as detailed. Ship ladder(s) in prime coat, finish painting shall be as specified in section 09900 - Painting.
C. Exterior Door Bumper Post
   1. Provide and install 4”x4” steel tube, 6’-0” long at each exterior door leaf. Door Bumper by Division 08 Hardware. Bumper post shall be positioned to allow door leaf to swing 110 degrees.
D. Cable Hook Assembly
   1. Fabricate cable hook assembly from 2” wide x ¼” thick flat iron stock, as detailed on drawings. Cable hooks shall be mounted on 4’-0” centers maximum. See electrical drawings for location.
E. Steel angles, beams and miscellaneous iron not otherwise specified but shown on drawings shall conform to ASTM A36.
   1. Pipe hangar support angles are included.
   2. Lintels at masonry wall penetrations
   3. Roof opening angles over eighteen inches square.

END OF SECTION
SECTION 08 11 13
STEEL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Non-fire-rated steel doors and frames.
E. Steel glazing frames.
F. Accessories, including glazing.

1.02 RELATED REQUIREMENTS
A. Section 08 71 00 – Finish Hardware & Schedule.
B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.
C. Section 09 90 00 - Painting and Coating: Field painting.

1.03 REFERENCE STANDARDS
H. ASTM E 413 - Classification for Rating Sound Insulation; 2004.
J. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2006.

R. UBC Std 7-2, Part II - Test Standard for Smoke- and Draft-control Assemblies; International Conference of Building Officials; 1997.


1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 5 years documented experience.

B. Maintain at the project site a copy of all reference standards dealing with installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with NAAMM HMMA 840.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Doors and Frames:

2.02 DOORS AND FRAMES

A. Requirements for All Doors and Frames:
   2. Door Top Closures: Flush with top of faces and edges.
   3. Door Edge Profile: Beveled on both edges.
   5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
   6. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
   7. Finish: Factory primed, for field finishing.
B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 STEEL DOORS

A. Exterior Doors:
1. Grade: NAAMM HMMA 861, physical performance Level A.
3. Core: Polystyrene foam.
5. Insulating Value: U-value of 0.14, when tested in accordance with ASTM C 1363.

B. Interior Doors, Non-Fire-Rated:
1. Grade: NAAMM HMMA 860, physical performance Level A.
3. Core: Cardboard honeycomb.

C. Interior Doors, Fire-Rated:
1. Grade: NAAMM HMMA 861, physical performance Level A.
2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").
   a. Provide units listed and labeled by UL.
   b. Attach fire rating label to each fire rated unit.
3. Core: Mineral fiberboard.

D. Interior Smoke and Draft Control Doors: Same construction as fire-rated doors with indicated fire rating, plus:
1. Maximum Air Leakage: 3.0 cfm per sq ft of door opening at 0.10 inch w.g. pressure, when tested in accordance with UL 1784 at both ambient and elevated temperatures.
2. Gasketing: Provide additional gasketing or edge sealing if necessary to achieve leakage limit.
3. Label: UL "S" label.

E. Interior Doors, Sound-Rated:
1. Grade: NAAMM HMMA 865.
2. STC Rating of Assembled Door, Frame, and Seals: 35, calculated in accordance with ASTM E413, tested in accordance with ASTM E90 or ASTM E1408.
3. Core: Polyurethane.
4. Sound Seals: Integral, concealed in door or frame.
5. Force to Open and Close and Latch: Not more than 5 pounds.

F. Stairwell Doors Fire Rated
1. Doors opening into rated egress stairs shall be 250 degree max. temp. rise, solid mineral fiber, rigid slab bonded to both face sheets.

2.04 STEEL FRAMES

A. General:
1. Comply with the requirements of grade specified for corresponding door.
   a. ANSI A250.8 Level 1 Doors: 16 gage frames.
2. Finish: Same as for door.
3. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
4. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
5. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.
7. All exterior frames and any interior frame over 3'-0" nom width shall be 14 ga. steel.

B. Exterior Door Frames: Face welded, seamless with joints filled.
1. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
2. Weatherstripping: required.

C. Interior Door Frames, Non-Fire-Rated: face welded, seamless

D. Interior Door Frames, Fire-Rated: face welded, seamless
1. Fire Rating: Same as door, labeled.

E. Sound-Rated Door Frames: face welded, seamless

F. Frames for Interior Glazing or Borrowed Lights: Construction and face dimensions to match door frames, and as indicated on drawings.

G. Transom Bars: Fixed, of profile same as jamb and head.

2.05 ACCESSORY MATERIALS

A. Glazing: As specified in Section 08 80 00, factory installed.

B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

C. Astragals for Double Doors:
1. Exterior Doors: Steel, Z-shaped.
2. Fire-Rated Doors: Steel, shape as required to accomplish fire rating.

D. Grout for Frames: Portland cement grout of maximum 4-inch slump for hand troweling; thinner pumpable grout is prohibited.

E. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

F. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.06 FINISH MATERIALS

A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.

B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.
3.02 PREPARATION
   A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.
   B. Coat inside of other frames with bituminous coating to a thickness of 1/16 inch.

3.03 INSTALLATION
   A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.
   B. In addition, install fire rated units in accordance with NFPA 80.
   C. Coordinate frame anchor placement with wall construction.
   D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
   E. Coordinate installation of hardware.
   F. Coordinate installation of glazing.
   G. Coordinate installation of electrical connections to electrical hardware items.
   H. Touch up damaged factory finishes.

3.04 ERECTION TOLERANCES
   A. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.05 ADJUSTING
   A. Adjust for smooth and balanced door movement.
   B. Adjust sound control doors so that seals are fully engaged when door is closed.

END OF SECTION
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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:


1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated. Coordinate design with Metal Building System.

B. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.


   2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

C. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.4 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:

   1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.

   2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Show locations of replaceable fusible links.
3. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For overhead coiling doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Detail fabrication and assembly of seismic restraints.
   2. Summary of forces and loads on walls and jambs.

1.5 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For qualified Installer.
   B. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.

1.6 CLOSEOUT SUBMITTALS
   A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.7 QUALITY ASSURANCE
   A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
   B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
      1. Obtain operators and controls from overhead coiling door manufacturer.
   C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 DOOR CURTAIN MATERIALS AND CONSTRUCTION
   A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

OVERHEAD COILING DOORS
1. **Steel Door Curtain Slats:** Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch (0.71 mm) and as required to meet requirements.

2. **Vision-Panel Glazing:** Manufacturer’s standard clear glazing, fabricated from transparent acrylic sheet or fire-protection rated glass as required for type of door; set in glazing channel secured to curtain slats.

3. **Insulation:** Fill slats for insulated doors with manufacturer’s standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.

4. **Metal Interior Curtain-Slat Facing:** Match metal of exterior curtain-slat face.

5. **Gasket Seal:** Provide insulated slats with manufacturer’s standard interior-to-exterior thermal break or with continuous gaskets between slats.

B. **Endlocks and Windlocks for Service Doors:** Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

C. **Bottom Bar for Service Doors:** Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from manufacturer’s standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.

D. **Curtain Jamb Guides:** Manufacturer’s standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

### 2.2 HOOD

A. **General:** Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. **Galvanized Steel:** Nominal 0.028-inch- (0.71-mm-) thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.

### 2.3 LOCKING DEVICES

A. **Chain Lock Keeper:** Suitable for padlock.

B. **Safety Interlock Switch:** Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

### 2.4 CURTAIN ACCESSORIES

A. **Weatherseals:** Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.
1. At door head, use 1/8-inch- (3-mm-) thick, replaceable, continuous sheet secured to inside of hood.

2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- (3-mm-) thick seals of flexible vinyl, rubber, or neoprene.

B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

   1. Provide pull-down straps or pole hooks for doors more than 84 inches (2130 mm) high.

2.5 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.

C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.6 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

   1. Comply with NFPA 70.

   2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 110513 "Common Motor Requirements for Equipment" unless otherwise indicated.
1. Electrical Characteristics:
   a. Phase: Three phase.
   b. Volts: 208 V.
   c. Hertz: 60.

2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.

3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.

4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer’s standard unless otherwise indicated.

5. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

D. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

E. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
   1. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
      a. Self-Monitoring Type: Four-wire configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.

F. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
   1. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
   2. Exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.


H. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

I. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

J. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with
regulatory requirements for accessibility.

K. Radio-Control System: Consisting of the following:
   1. Multifunction remote control.

2.7 DOOR ASSEMBLY

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      2. :
         a. Cookson Company.
         b. Cornell Iron Works, Inc.
         c. McKeon Rolling Steel Door Company, Inc.
         d. Overhead Door Corporation.
         e. Raynor.
         f. Wayne-Dalton Corp.

B. Operation Cycles: Not less than 100,000.
   1. Include tamperproof cycle counter.

C. Curtain R-Value: R-7.

D. Door Curtain Material: Galvanized steel.

E. Door Curtain Slats: Curved profile slats of 1-7/8-inch (48-mm) center-to-center height.
   1. Vision Panels: Approximately 10- by 1-5/8-inch (254- by 41-mm) openings spaced approximately 2 inches (51 mm) apart and beginning 12 inches (305 mm) from end guides; in three rows of slats at height indicated on Drawings; installed with insulated vision-panel glazing.
   2. Insulated-Slat Interior Facing: Metal.

F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

G. Hood: Match curtain material and finish.
   1. Mounting: Face of wall.

H. Locking Devices: Equip door with chain lock keeper.
   1. Locking Device Assembly: Cremone type, both jamb sides, locking bars, operable from inside with thumb turn.

I. Electric Door Operator:
   1. Usage Classification: Heavy duty, 60 to 90 cycles per hour.
4. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.
5. Remote-Control Station: Interior.
6. Other Equipment: Radio-control system.

J. Door Finish:
   1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
   2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

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. 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 STEEL AND GALVANIZED-STEEL FINISHES

A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.
C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide weathertight fit around entire perimeter.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323
SECTION 08 71 00
FINISH HARDWARE AND SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES
   A. Door Hardware.

1.2 PRODUCTS FURNISHED, BUT NOT INSTALLED UNDER THIS SECTION
   A. Section 08 11 00 - Steel Doors and Frames: Furnish templates for frame preparation.

1.3 RELATED SECTION
   A. Section 28 31 00 – Fire Alarm System: Electrical connection to activate door closers and magnetic holders. Card access system and hook-up by section 16720.

1.4 REFERENCES
   B. ADA - American’s with Disability Act, current edition including latest amendments.
   C. AWI - Architectural Woodwork Institute – Quality Standards
   D. NFPA 80 - Fire doors and Windows.
   F. NFPA 252 - Fire Tests of Door Assemblies.
   G. UL 10B - Fire Tests of Door Assemblies.
   H. UL 305 - Panic Hardware.

1.5 SUBMITTALS
   A. Submit under provisions of Section 01 30 00.
   B. Hardware Schedule:
      1. All schedules shall be typewritten and prepared of the “vertical” type as opposed to the “horizontal” type.
      2. Provide hardware schedule listing hardware by set numbers giving the following information:
         a. List each architectural door number.
         b. Door location, size, hand, door and frame material.
         c. List each hardware item giving:
            1) Manufacturer’s name.
            2) Catalog number with product data index number.
            3) Hardware size (if required), and finish type.
         d. Provide “Door Index” with hardware schedule listing each architectural door number in chronological order giving the respective hardware set number, item number (if used) and keyset number.
   C. Product Data: Provide manufacturer’s cut sheets on each different hardware item proposed and index it, with the use of numerals or letters or a combination of both, with the hardware schedule. The index numbers/letters are to be in the right hand column on the same line as the manufacturer’s number. All manufacturers’ numbers shall be indexed even when appearing more than once.
   D. Samples: The Designer may request samples illustrating style, color and finish of any or all materials proposed to be furnished and they will remain in his possession until the project is completed.
   E. After submittals have been approved, this supplier shall make all corrections and resubmit for final approval.
1.6 OPERATION AND MAINTENANCE DATA
   A. Submit under provisions of Section 01 70 00.
   B. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.7 QUALITY ASSURANCE
   A. Perform work in accordance with the following requirements:

1.8 QUALIFICATIONS
   A. Hardware supplier must employ a qualified Architectural Hardware Consultant (AHC). This individual to be the primary supplier contact.

1.9 REGULATORY REQUIREMENTS
   A. Fire Labeled Openings:
      1. Door hardware for all labeled fire openings shall comply in all respects to the National Board of Fire Underwriter’s requirements for the rating of the opening called for on the drawings. All locking and latching devices, closers and closer arms shall bear visible evidence of UL approval.
   B. Americans with Disabilities Act:
      1. Door openings, through which the disabled will pass or have access to, shall be in full compliance with Government codes and regulations.
         a. A lever handle shall operate all passage latches and locksets.
         b. The force required to open a door shall not exceed five foot pounds for interior doors and eight foot pounds for exterior doors. The opening force may vary depending on the type of HVAC system and the weather conditions.
         c. Thresholds may not extend more than ½” above the finished floor.

1.10 DELIVERY, STORAGE AND HANDLING
   A. Deliver, store, protect and handle products to site as per manufacturer’s recommendations.
   B. Package hardware items individually; label and identify package with door opening code to match hardware schedule.
   C. Deliver all change and master keys as directed by Designer.
   D. Protect hardware from theft by cataloging and storing in a secure area.

1.11 COORDINATION
   A. This contractor shall cooperate and coordinate with other sections of this specification that are affected by the finish hardware and he shall be capable of interpreting all documents. During the construction period, this contractor shall make as many visits as may be required to consult with the various contractors, suppliers and trades concerning the proper installation of materials under this section.

1.12 WARRANTY
   A. Hardware will remain free from all defects and blemishes; and shall perform satisfactorily for minimum of one (1) year from date of Substantial Completion; and that failure to provide such performance will constitute repair or replacement and reinstallation to satisfaction of the Owner at no additional cost.
PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Lockset Manufacturer:
   1. Yale; 6-pin lockset. Finish – US 10B

B. Hinges:
   1. All butts to be size 4-1/2” x 4-1/2” except as noted otherwise. Hinges to be 0.180 inch thick, four ball bearings on exterior doors, metal doors, doors over 3'-0” wide. Furnish 3 hinges per door leaf up to, but not including 7'-6” in height and add one additional hinge for each 2'-6” or fraction thereof of height of door.
   2. All hinges on exterior doors and doors with closers to have Non-Removable Pins (NRP). Hinges on exterior doors shall have nonferrous base metal and shall have stainless steel pins.
   3. Approved Manufacturer: Stanley FBB 179 - 4.5 x 4.5 x USP x NRP.

C. Mortise Locks and Trim:
   1. For use on all exterior doors and other specialty doors where indicated on schedule.
   2. Shall be ANSI Grade 1, and shall have a heavy wrought steel case 5-7/8” high x 4-1/4” deep x 1”: wide, one (1) throw dead bolt with two steel insert, 0.750 inch throw solid brass three-piece mechanical anti-friction latch bolt, 2.750 inch backset and with an armored front size 8” x 1.250”.
   3. Lock Trim: Lever to be cast brass with plug only to show cylinder and through-bolted to the door with no exposed screws on the exterior.
   4. Cylinder to be machined from solid brass/bronze bar stock and with additional security provided by a setscrew mounted diagonally into the cylinder wall to prevent unauthorized removal of the cylinder.
   5. Mortise locks to be Yale as per sets- No substitution.

D. Cylindrical Locks and Trim:
   1. Standard Door Locking Hardware: Yale; 6-pin lockset - PB5407LN 694x497; Finish: US 10B.

E. Exit Devices:
   1. Single Non-Label Assemblies:
      a. Single non-labeled doors shall be equipped with a rim exit device and operated by a lever handle from the pull side.
      b. Approved Manufacturer: LCN - No Substitution.
      c. LCN model 4041, arm RW/PA, finish to match existing areas adjustment size 1-6 PC 23.

F. Door Closers:
   1. All door closers shall be fastened to metal door using Phillips head machine screws. Furnish all-thread wood screws for fastening closers to wood doors. Fasten closers to metal frame using Phillips head machine screws.
   2. Door closers shall have high strength cast alum. Cylinders and one piece forged alum. pistons. Main arm shall be forged steel for interior doors and forged steel “CUSH-N-STOP” main and fore arm on exterior doors. Furnish a smooth molded cover for closer body. Use full size cover.
   3. Door closers shall have two separately adjustable non-critical valves for closing speed and latching speed. There shall be two additional valves for adjusting the hydraulic back check.
   4. Parallel arm shall be used where closer is to be concealed from public view.
   5. Door closers to be LCN as per sets- No substitution.
G. Kick Plates:
   1. Kick plates shall be 10” high x door width minus 2”. Restroom doors and certain other doors shall have kick plates on both sides of the door.
   2. All plates shall be 0.050” thick.

H. Door Stops:
   1. Wall mounted stops: Where possible, use wall mounted doorstops. Fasten to the wall with a toggler.
      a. The diameter of the wall stop should be approximately 2-5/8”, having a concave rubber bumper projecting ¾”.
   2. Floor Stops: Where it is not possible to use a wall stop, the use of a floor stop is permitted. Fasten to the floor with a ¼-20 Machine Screw and Expansion Shield (MSES).
      a. The projection of the stop from the floor should be great enough for the door to strike approximately ½” of the top of the stop.

I. Thresholds, Weather-strip, Drip Cap, Astragals
   1. Thresholds: Shall be as detailed on the drawings or as listed in the Hardware Group numbers. Furnish all thresholds with 1-1/4-20 Machine Screws and Expansion Shields (MSES).
      a. Thresholds shall be manufactured from extruded aluminum of commercial quality and shall meet the ADA regulations.
      b. Type: #896S (Silicone Bumper) x ½-20 MSES, National Guard Products.
   2. Weather-strip: Shall be UL approved for use on fire door assemblies and shall be made from a very good grade of neoprene.
      a. Series 110NA, National Guard Products.
   3. Drip Caps: Shall be mounted to the head of exterior frames on the exterior side and shall extend the full width of the frame head and is to clear the top of the door approximately 1-1/4” maximum. Caulk between the cap and the head to prevent seepage of moisture.
      a. Shall be extruded from aluminum and be fastened to the frame head using sheet metal screws.
      b. Series 16AD.
   4. Silencers: Besides the door silencers that are shipped with the hollow metal frames, furnish door silencer as listed under this Section of the Specifications.
   5. Substitutions: Under provisions of Section 01600, certain items above are marked “No Substitution” and do not qualify under “Substitutions”. Substitution for other manufacturer’s products must be received in writing five (5) working days before the bid date.

2.2 KEYING
   1. System to be factory computer generated 3-level Grand Master Key System.
   2. Keyways: 6-pin IC Cores with SA keyway.
   3. Exact system specifics to be determined in pre-construction “Keying meeting” with owner representative.

PART 3 EXECUTION
3.1 EXAMINATION
   A. Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.
   B. Verify that power supply is available to power operated devices.
   C. Beginning installation means acceptance of existing conditions.
3.2 INSTALLATION
   A. Deadlocks/Deadbolts: 48” from finished floor to center of cylinder.
   B. Exit Devices: 36” C/L from finished floor.

3.3 FIELD QUALITY CONTROL
   A. Architectural Hardware Supplier shall inspect complete installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer’s instructions and as specified.
   B. Provide certification. Reference Section 01700.

3.4 ADJUSTMENT
   A. Check all hardware for correct hand and correct operation. Adjust all spring-loaded devices for operation against wind or draft conditions, friction from door coordinators and latch friction. Leave the complete hardware installation operating in conformity with the manufacturer’s design intent.

3.5 PROTECTION OF FINISHED WORK
   A. Protect finished work before, during and after installation as required.
   B. Do not permit adjacent work to damage hardware or finish

PART 4 HARDWARE SETS

Note: Provide electric strike for card access doors where indicated on drawings.

HW1
Office Door
3 ea Hinges
1 Office Lockset. Yale 5408LN (F86).
1 Floor/Wall Stop
1 Silencers

HW2
Conference / Training Door
3 ea Hinges
1 Lockset. Yale 5405LN (F86).
1 Floor/Wall Stop
1 Silencers
1 Dummy Handle Yale 455 LN
1 Concealed floor & Head Bolt
1 Push Plate

HW3
Storage / File Room Door
3 ea Hinges
1 Storeroom Lockset. Yale 5405LN (F86).
1 Floor/Wall Stop
HW4

Exterior Entry Door

3 ea  Hinges
1    Lockset. Yale 5405LN (F86).
1    Floor Stop
1    Silencer
1    Closer. LCN 4014

END OF SECTION
SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass.
B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 – Steel Doors and Frames: Glazed doors and borrowed lites.

1.03 REFERENCE STANDARDS

M. GANA (GM) - GANA Glazing Manual; Glass Association of North America; 2009.
N. GANA (SM) - FGMA Sealant Manual; Glass Association of North America; 2008.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Convene a pre-installation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. Samples: Submit two samples 12x12 inch in size of glass units, showing coloration and design.

E. Certificates: Certify that products meet or exceed specified requirements.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE


B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.07 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

A. See Section 01 70 00 – Contract Closeout, for additional warranty requirements.

B. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

C. Laminated Glass: Provide a five (5) year warranty to include coverage for delamination, including replacement of failed units.

PART 2 PRODUCTS

2.01 GLAZING TYPES

A. Fire-Rated Safety Glazing:
   1. Applications: Provide this type of glazing in the following locations:
      a. Glazed lites in fire doors.
      b. Fire windows.
      c. Sidelights, borrow lites, and other glazed openings in partitions indicated as having an hourly fire rating.
      d. Other locations indicated on the drawings.
   2. Fire Rating: As indicated on the drawings.
   3. Type: Glass-ceramic safety glazing.
   4. Thickness: 1/4 inch.
   5. Glazing Method: As required for fire rating.

B. Single Safety Glazing: Non-fire-rated.
   1. Applications: Provide this type of glazing in the following locations:
      a. Glazed lites in doors, except fire doors.
      b. Glazed sidelights to doors, except in fire-rated walls and partitions.
      c. Other locations required by applicable federal, state, and local codes and regulations.
      d. Other locations indicated on the drawings.
   2. Type: Fully tempered float glass as specified.
   3. Tint: Clear.
4. Thickness:  1/4 inch.
5. Glazing Method:  Gasket glazing.

   1. Application:  Locations indicated on the drawings.
   2. Performance:
      a. Forced Entry:

2.03 GLASS MATERIALS

A. Float Glass Manufacturers:
   5. Substitutions:  Refer to Section 01 60 00 - Product Requirements.

B. Float Glass:  All glazing is to be float glass unless otherwise indicated.
   1. Annealed Type:  ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
   3. Tinted Types:  Color and performance characteristics as indicated.
   4. Thicknesses:  As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.

2.04 SEALED INSULATING GLASS UNITS

A. Manufacturers:
   1. Any of the manufacturers specified for float glass.
   2. Substitutions:  Refer to Section 01 60 00 - Product Requirements.

B. Sealed Insulating Glass Units:  Types as indicated.
   1. Locations: Exterior, except as otherwise indicated.
   2. Durability:  Certified by an independent testing agency to comply with ASTM E2190.
   3. Edge Spacers:  Aluminum, bent and soldered corners.
   4. Edge Seal:  Glass to elastomer with supplementary silicone sealant.
   5. Purge interpane space with dry hermetic air.

2.05 GLAZING COMPOUNDS

A. Manufacturers:
   5. Substitutions:  Refer to Section 01 60 00 - Product Requirements.

B. Glazing Putty:  Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; TBD color.

C. Butyl Sealant:  Single component; ASTM C 920, Grade NS, Class 12-1/2, Uses M and A; Shore A hardness of 10 to 20; submit manufacturer's color chart; non-skinning.

D. Acrylic Sealant:  Single component, solvent curing, non-bleeding; ASTM C 920, Type S, Grade NS, Class 12-1/2, Uses M and A; cured Shore A hardness of 15 to 25; TBD color.

E. Silicone Sealant:  Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C 920, Type S, Grade NS, Class 25, Uses M, A, and G; cured Shore A hardness of 15 to 25; TBD color.
2.06 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C 864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness, ASTM C 864 Option I. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self-adhesive on one face.

C. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C 864 Option I; match window frame color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

D. Install sealants in accordance with ASTM C1193 and FGMA Sealant Manual.

E. Install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)

A. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.04 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.05 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

END OF SECTION
SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Performance criteria for gypsum board assemblies.
   B. Metal stud wall framing.
   C. Metal channel ceiling framing.
   D. Acoustic insulation.
   E. Gypsum wallboard.
   F. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS
   A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
   B. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.
   C. Section 07 21 00 - Thermal Insulation: Acoustic insulation.
   D. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire rated walls.
   E. Section 07 90 05 - Joint Sealers: Acoustic sealant.

1.03 REFERENCE STANDARDS
   A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)
   B. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2009a.
   I. ASTM C 954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2007.
X. ASTM E 413 - Classification for Rating Sound Insulation; 2004.
Y. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2010.

1.04 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
E. Test Reports: For all stud framing products that do not comply with ASTM C645 or C 754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.
F. Samples: Submit two samples of predecorated gypsum board, 4x4 inches square in size, illustrating finish color and texture.

1.05 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 5 years of documented experience.
PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
   1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
   2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

D. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. Fire Rated Partitions: UL listed assembly No. UL U-432; 1 hour rating.
   2. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL Fire Resistance Directory.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
   1. Studs: "C" shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.
   3. Ceiling Channels: C shaped.

C. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
   1. Manufacturers - Shaft Wall Studs and Accessories:
      a. Same manufacturer as other framing materials.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

E. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
   3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on drawings.
   4. Deflection and Firestop Track:
      a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.
2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
8. Substitutions:  See Section 01 60 00 - Product Requirements.

B. Impact-Rated Wallboard: Tested to Level 3 soft-body and hard-body impact in accordance with ASTM C1629.
1. Application: All interior vertical surface areas where finished gypsum board is used.
2. Mold Resistance:  Score of 10, when tested in accordance with ASTM D3273.
3. Paper-Faced Type:  Gypsum wallboard as defined in ASTM C1396/C1396M.
4. Unfaced Type:  Interior fiber-reinforced gypsum panels as defined in ASTM 1278/C1278M.
5. Type:  Fire-resistance rated Type X, UL or WH listed.
8. Products:
   b. Temple-Inland Inc; ComfortGuard AR Abuse Resistant.
   c. Temple-Inland Inc; ComfortGuard IR Impact Resistant.
   d. USG Corporation; Fiberock Brand Panels--VHI Abuse-Resistant.
   e. Substitutions:  See Section 01 60 00 - Product Requirements.

C. Ceiling Board: Special sag-resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
2. Thickness:  1/2 inch.
4. Products:
   a. American Gypsum; Interior Ceiling Board.
   b. CertainTeed Corporation; ProRoc Interior Ceiling.
   c. Georgia-Pacific Gypsum LLC; ToughRock CD Ceiling Board.
   d. Lafarge North America Inc; Sagcheck.
   e. National Gypsum Company; High Strength Brand Ceiling Board.
   f. Pacific Coast Building Products, Inc; PABCO Ceiling Board.
   g. Temple-Inland Inc; Span24 Ceiling Board.
   h. USG Corporation; Sheetrock Brand Sag-Resistant Interior Gypsum Ceiling Board.
   i. Substitutions:  See Section 01 60 00 - Product Requirements.

D. Shaftwall and Coreboard:  Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
1. Paper Faced Type:  Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
2. Mold Resistance:  Score of 10, when tested in accordance with ASTM D3273.
3. Products:
   a. American Gypsum; M-Bloc Shaft Liner.
   b. Georgia-Pacific Gypsum LLC; DensGlass Ultra Shaftliner (mold-resistant).
   c. National Gypsum Company; Gold Bond Brand 1" Fire-Shield Shaftliner XP (mold-resistant).
   d. National Gypsum Company; Gold Bond Brand e2XP Extended Exposure Shaftliner.
   e. Temple-Inland Inc; GreenGlass Liner Panel.
   f. USG Corporation; Sheetrock Gypsum Liner Panels--Enhanced (mold-resistant).
   g. Substitutions:  See Section 01 60 00 - Product Requirements.
2.04 ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness to fill entire stud cavity, stud sizes vary, see plans.

B. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

C. Water-Resistive Barrier: No. 15 asphalt felt.

D. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.

E. Screws for Attachment to Steel Members Less Than 0.03 inch In Thickness, to Wood Members, and to Gypsum Board: ASTM C1002; self-piercing tapping type; cadmium-plated for exterior locations.

F. Screws for Attachment to Steel Members From 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws for application of gypsum board to loadbearing steel studs.

G. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

H. Exterior Soffit Vents: One piece, perforated, ASTM B 221 6063 T5 alloy aluminum, with edge suitable for direct application to gypsum board and manufactured especially for soffit application. Provide continuous vent.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
   1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.
   2. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.
   1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
   2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as permitted by standard.
   1. Level ceiling system to a tolerance of 1/1200.
   2. Laterally brace entire suspension system.

C. Studs: Space studs as permitted by standard.
   1. Extend partition framing to structure where indicated and as otherwise detailed in the construction drawings.
   2. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
E. Furring for Fire Ratings: Install as required for fire resistance ratings indicated and to GA-600 requirements.

F. Blocking: Install wood blocking for support of:
   1. Framed openings.
   2. Wall mounted cabinets.
   3. Plumbing fixtures.
   4. Toilet partitions.
   5. Toilet accessories.
   6. Wall mounted door hardware.

3.04 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. In non-fire-rated construction, seal around all penetrations by conduit, pipe, ducts, and rough-in boxes.

3.05 BOARD INSTALLATION

A. Comply with ASTM C 840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.

E. Exterior Soffit Board: Install perpendicular to framing, with staggered end joints over framing members or other solid backing.

F. Installation on Metal Framing: Use screws for attachment of all gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.

G. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

D. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations shown on the drawings. Provide vent area shown on drawings.

3.07 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

3.08 TOLERANCES

   A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION
SECTION 09 90 00
PAINTING AND COATING

PART 1  GENERAL

1.01  SECTION INCLUDES

A. Surface preparation.
B. Field application of paints, stains, and other coatings.

1.02  RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
B. Section 05 51 00 - Metal Stairs: Shop-primed items.

1.03  DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04  REFERENCE STANDARDS


1.05  DEFINITIONS

A. Conform to ASTM D 16 for interpretation of terms used in this section.

1.06  SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on all finishing products, including VOC content.
C. Samples: Submit two paper chip samples, 6 x 6 in size illustrating range of colors and textures available for each surface finishing product scheduled.

1.07  QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
B. Applicator Qualifications: Company specializing in performing the work of this section with minimum 3 years experience.

1.08  REGULATORY REQUIREMENTS

A. Conform to applicable code for flame and smoke rating requirements for products and finishes.

1.09  MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.
B. Provide panel, 4 feet long by 4 feet wide, illustrating coating color, texture, and finish.
C. Provide door and frame assembly illustrating paint coating color, texture, and finish.
D. Mock-up may remain as part of the Work.
1.10 DELIVERY, STORAGE, AND HANDLING
   A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
   B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
   C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.11 ENVIRONMENTAL REQUIREMENTS
   A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
   B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
   C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
   D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
   E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
   F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.12 EXTRA MATERIALS
   A. See Section 01 60 00 - Product Requirements, for additional provisions.
   B. Supply 1 gallon of each color; store where directed.
   C. Label each container with color in addition to the manufacturer's label.

PART 2 PRODUCTS
2.01 MANUFACTURERS
   A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
   B. Provide all paint and coating products from the same manufacturer.
   C. Reference Finish Schedule.
   D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL
   A. Paints and Coatings: Ready mixed, except field-catalyzed coatings. Prepare pigments:
      1. To a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.
   B. Volatile Organic Compound (VOC) Content:
      1. Provide coatings that comply with the most stringent requirements specified in the following:
      2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
2.03 ACCESSORY MATERIALS

A. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of coatings until substrates have been properly prepared.

B. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Plaster and Gypsum Wallboard: 12 percent.
   2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   3. Concrete Floors: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing coatings that exhibit surface defects.

D. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

E. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

F. Marks: Seal with shellac those which may bleed through surface finishes.

G. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

H. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

I. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

J. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
K. Asphalt, Creosote, or Bituminous Surfaces to be Painted: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.

L. Insulated Coverings to be Painted: Remove dirt, grease, and oil from canvas and cotton.

M. Concrete Floors to be Painted: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

N. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

O. Copper Surfaces to be Painted: Remove contamination by steam, high pressure water, or solvent washing. Apply vinyl etch primer immediately following cleaning.

P. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

Q. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-PC 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

R. Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

S. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

T. Interior Wood Items to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

U. Interior Wood Items to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

V. Exterior Wood to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

W. Exterior Wood to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior calking compound after sealer has been applied. Prime concealed surfaces.

X. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

Y. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

Z. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
C. Apply products in accordance with manufacturer's instructions.
D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
F. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
G. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
H. Sand wood and metal surfaces lightly between coats to achieve required finish.
I. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
J. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
K. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT
A. Refer to Section 22 05 53 and Section 26 05 53 for schedule of color coding of equipment, duct work, piping, and conduit.
B. Paint shop-primed equipment, where indicated.
C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
D. Finish equipment, piping, conduit, and exposed duct work in utility areas in colors according to the color coding scheme indicated.
E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 FIELD QUALITY CONTROL
A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.
B. Contractor will provide field inspection.

3.06 CLEANING
A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.07 PROTECTION
A. Protect finished coatings until completion of project.
B. Touch-up damaged coatings after Substantial Completion.

3.08 SCHEDULE - SURFACES TO BE FINISHED
A. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically noted.
   2. Fire rating labels, equipment serial number and capacity labels.
B. Paint the surfaces described below under Schedule - Paint Systems.
C. Mechanical and Electrical: Use paint systems defined for the substrates to be finished.
   1. Paint all insulated and exposed pipes occurring in finished areas to match background surfaces, unless otherwise indicated.
   2. Paint all equipment, including that which is factory-finished, exposed to weather or to view on the roof and outdoors.
   3. Paint shop-primed items occurring in finished areas.
   4. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
   5. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

D. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

END OF SECTION
SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Fire extinguishers.
B. Accessories.

1.02 RELATED REQUIREMENTS
A. Section 09 90 00 - Painting and Coating: Field paint finish.

1.03 REFERENCE STANDARDS
B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, “Portable Fire Extinguishers.”
C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.04 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS
A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Fire Extinguishers and Accessories:
   2. Substitutions: See Section 01630 - Product Substitution Procedures.

2.02 FIRE EXTINGUISHERS
A. Multipurpose Dry-Chemical Type: UL-rated 2A-10B:C. Monoammonium phosphate-based dry chemical in manufacturer’s standard enameled container.
B. Nominal Capacity: 5 lbs.

2.04 ACCESSORIES
A. Extinguisher Brackets: Formed steel, chrome-plated. Bracket to be by fire extinguisher manufacturer and compatible with the specified extinguisher.
PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify existing conditions before starting work.

3.02 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Secure rigidly in place.

END OF SECTION
SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARv

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.

1.2 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 requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet 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.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:
   1. Motors Smaller than 15 HP: Manufacturer’s standard starting characteristic.

J. 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.

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 220513
SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.

1.2 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.


E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 **GROUT**

A. **Standard:** ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. **Characteristics:** Nonshrink; recommended for interior and exterior applications.

C. **Design Mix:** 5000-psi (34.5-MPa), 28-day compressive strength.

D. **Packaging:** Premixed and factory packaged.

**PART 3 - EXECUTION**

3.1 **SLEEVE INSTALLATION**

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

   1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

   1. Cut sleeves to length for mounting flush with both surfaces.

      a. **Exception:** Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

   2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

   1. Cut sleeves to length for mounting flush with both surfaces.

   2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.

   3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

E. **Fire-BARRIER Penetrations:** Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 **SLEEVE-SEAL-SYSTEM INSTALLATION**

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:
   a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel wall sleeves.

2. Exterior Concrete Walls below Grade:
   a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:
   a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

4. Interior Partitions:

END OF SECTION 220517
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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Liquid-in-glass thermometers.
   2. Thermowells.
   3. Dial-type pressure gages.
   4. Gage attachments.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.
   B. Product certificates.
   C. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Flo Fab Inc.
      b. Miljoco Corporation.
      d. Tel-Tru Manufacturing Company.
      e. Trerice, H. O. Co.
      f. Weiss Instruments, Inc.
      g. Winters Instruments - U.S.
   3. Case: Cast aluminum; 7-inch (178-mm) nominal size unless otherwise indicated.
   4. Case Form: Back angle unless otherwise indicated.
   5. Tube: Glass with magnifying lens and blue or red organic liquid.
   6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C).
   7. Window: Glass.
   8. Stem: Aluminum and of length to suit installation.
      a. Design for Thermowell Installation: Bare stem.
   10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
2.2 THERMOWELLS

A. Thermowells:

2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AMETEK, Inc.; U.S. Gauge.
   b. Ashcroft Inc.
   c. Ernst Flow Industries.
   d. Flo Fab Inc.
   e. Marsh Bellofram.
   f. Miljoco Corporation.
   g. Noshok.
   h. Palmer Wahl Instrumentation Group.
   i. REOTEMP Instrument Corporation.
   j. Tel-Tru Manufacturing Company.
   k. Trerice, H. O. Co.
   l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   m. Weiss Instruments, Inc.
   n. WIKA Instrument Corporation - USA.
   o. Winters Instruments - U.S.

3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated is psi and kPa.
11. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.
2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gage for fluids.

H. Install thermometers in the following locations:
   1. Inlet and outlet of each water heater.

I. Install pressure gages in the following locations:
   1. Building water service entrance into building.
   2. Inlet and outlet of each pressure-reducing valve.
   3. Suction and discharge of each domestic water pump.

J. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

K. Adjust faces of meters and gages to proper angle for best visibility.

3.2 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be the following:
   1. Industrial-style, liquid-in-glass type.

B. Thermometer stems shall be of length to match thermowell insertion length.

3.3 THERMOMETER SCALE-RANGE SCHEDULE
A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F and minus 20 to plus 50 deg C.

B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F and 0 to 150 deg C.

3.4 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be one of the following:
   1. Liquid-filled, direct-mounted, metal case.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:
   1. Liquid-filled, direct-mounted, metal case.
   2. Sealed, direct-mounted, plastic case.

C. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:
   1. Liquid-filled, direct-mounted, metal case.
   2. Sealed, direct-mounted, plastic case.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 100 psi and 0 to 600 kPa.

B. Scale Range for Domestic Water Piping: 0 to 100 psi and 0 to 600 kPa.

END OF SECTION 220519
SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Brass ball valves.
   2. Bronze ball valves.
   4. Bronze gate valves.
   5. Bronze globe valves.

B. Related Sections:
   1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
   2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
   3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.2 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:
   1. Handwheel: For valves other than quarter-turn types.
   2. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller.

E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Jenkins Valves.
   c. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
   d. Hammond Valve.
   e. Jomar International, LTD.
   f. Kitz Corporation.
   g. Legend Valve.
   h. Milwaukee Valve Company.
   i. NIBCO INC.
   j. Red-White Valve Corporation.

2. Description:
   b. SWP Rating: 150 psig (1035 kPa).
   c. CWP Rating: 600 psig (4140 kPa).
   d. Body Design: Two piece.
   e. Body Material: Forged brass.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.
   h. Stem: Brass.
   i. Ball: Chrome-plated brass.
   j. Port: Full.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Valve, Inc.
   b. Conbraco Industries, Inc.; Apollo Valves.
   c. Crane Co.; Crane Valve Group; Crane Valves.
   d. Hammond Valve.
   e. Legend Valve.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Red-White Valve Corporation.
i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Red-White Valve Corporation.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Horizontal flow.
e. Ends: Threaded.
f. Disc: Bronze.

2.5 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Red-White Valve Corporation.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 1.
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, bronze, or aluminum.

2.6 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. Kitz Corporation.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Red-White Valve Corporation.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig (1380 kPa).
d. Ends: Threaded or solder joint.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.2 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.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or gate valves.
2. Throttling Service: Globe or ball valves.
3. Pump-Discharge Check Valves:
   a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze disc.
   b. NPS 2-1/2 (DN 65) and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring.

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. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.4 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG (1035 kPa) OR LESS)

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, brass or bronze with brass trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.
4. Bronze Gate Valves: Class 125, NRS.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2-1/2 (DN 65) and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, bronze disc.
3. Ball Valves: Two piece, full port, brass or bronze with brass trim.
4. Bronze Swing Check Valves: Class 125, bronze disc.
5. Bronze Gate Valves: Class 125, NRS.
END OF SECTION 220523
SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE POSITIONING SYSTEMS
A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick 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.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.

F. Install hangers and supports complete with necessary attachments, 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. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:
   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 allowed by ASME B31.9 for building services piping.
   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.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
   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. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.
3.3 METAL FABRICATIONS
A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
C. Field Welding: Comply with AWS D1.1/D1.1M 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 so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING
A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.5 PAINTING
A. Touchup: 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.
   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE
A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system 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).
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
4. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
5. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
6. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system 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.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. 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:
8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system 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 in writing by manufacturer to prevent crushing insulation.
   3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
   2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
   3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

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SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Pipe labels.

1.2 SUBMITTAL

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:
   1. Material and Thickness: Aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
   3. Minimum Letter Size: 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.
   5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: Red.

C. Background Color: White.
D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 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.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches (38 mm) high.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."
B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed 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 inaccessible 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.

C. Pipe Label Color Schedule:

1. Compressed-Air Piping:
   a. Background Color: Green.

2. Domestic Water Piping:
   b. Letter Color: Green.
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SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:
   1. Domestic hot-water piping.
   2. Domestic recirculating hot-water piping.
   3. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:
   1. Division 22 Section "Plumbing Equipment Insulation."

1.2 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail attachment and covering of heat tracing inside insulation.
   3. Detail insulation application at pipe expansion joints for each type of insulation.
   4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   5. Detail removable insulation at piping specialties, equipment connections, and access panels.
   6. Detail application of field-applied jackets.
   7. Detail application at linkages of control devices.

C. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 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.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
PART 2 - PRODUCTS

2.1 INSULATION MATERIALS


B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. 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.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. 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. Pittsburgh Corning Corporation; Foamglas.

2. Special-Shaped Insulation: ASTM C 552, Type III.

3. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.

4. Preformed Pipe Insulation with Factory-Applied [ASJ] [ASJ-SSL]: Comply with ASTM C 552, Type II, Class 2.

5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

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. Aeroflex USA, Inc.; Aerocel.
   b. Armacell LLC; AP Armaflex.
   c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

H. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Fibrex Insulations Inc.; Coreplus 1200.
   b. Johns Manville; Micro-Lok.
   c. Knauf Insulation; 1000-Degree Pipe Insulation.
   d. Manson Insulation Inc.; Alley-K.
   e. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.

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. Armacell LLC; Tubolit.
   b. Nomaco Insulation; IMCOLOCK and NOMALOCK.

2.2 INSULATING CEMENTS


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. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 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. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

2. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements provide one of the following:
   a. Aeroflex USA, Inc.; Aerosesal.
   b. Armacell LLC; Armaflex 520 Adhesive.
   d. K-Flex USA; R-373 Contact Adhesive.

2. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.
D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:
   b. Eagle Bridges - Marathon Industries; 225.
   d. Mon-Eco Industries, Inc.; 22-25.

2. Use adhesive that complies with the testing and product requirements of the California Department of Health Services’ "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.


1. Products: Subject to compliance with requirements, provide one of the following:
   b. Eagle Bridges - Marathon Industries; 225.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services’ "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.4 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 50 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. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   b. Vimasco Corporation; 749.

2. 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.

3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
   b. Eagle Bridges - Marathon Industries; 550.
   e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.

2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   b. Eagle Bridges - Marathon Industries; 405.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
5. Color: White or gray.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   b. Eagle Bridges - Marathon Industries; 405.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.6 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for pipe.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   b. Vimasco Corporation; Elastafab 894.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

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. ABI, Ideal Tape Division; 428 AWF ASJ.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
   c. Compac Corporation; 104 and 105.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

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. ABI, Ideal Tape Division; 491 AWF FSK.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
   c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.

FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

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. ABI, Ideal Tape Division; 488 AWF.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   c. Compac Corporation; 120.
   d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.8 SECUREMENTS

A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, [1/2 inch (13 mm)] [3/4 inch (19 mm)] wide with wing seal or closed seal.

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. ITW Insulation Systems; Gerrard Strapping and Seals.
   b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

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.

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:

2.9 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers,

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Engineered Brass Company.
b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
c. McGuire Manufacturing.
d. Plumberex.
e. Truebro; a brand of IPS Corporation.
f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

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 piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe 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. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. 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.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. 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). Install insulation with longitudinal seams at bottom of pipe. 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 pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. 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.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
   4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
   1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
   3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
   4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
   5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket.
Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.

4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
3.7 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
   4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
   4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
   3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   4. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Seal split-tube longitudinal seams and end joints with manufacturer’s recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 FINISHES
A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL
A. Perform tests and inspections.
B. Tests and Inspections:
1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.
3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch (25 mm) thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
3. Polyolefin: 1 inch (25 mm) thick.

END OF SECTION 220719
SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
   2. Specialty valves.
   3. Flexible connectors.
   4. Water meters furnished by utility company for installation by Contractor.

B. Related Section:
   1. Division 22 Section "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
C. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.
4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
5. Copper Pressure-Seal-Joint Fittings:
   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) Elkhart Products Corporation; Industrial Division.
      2) NIBCO INC.
      3) Viega; Plumbing and Heating Systems.
   b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
   c. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) and ASTM B 88, Type L (ASTM B 88M, Type B) water tube, annealed temper.
   2. Copper Pressure-Seal-Joint Fittings:
      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) Elkhart Products Corporation; Industrial Division.
         2) NIBCO INC.
         3) Viega; Plumbing and Heating Systems.
      b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.

2.3 CPVC PIPING

2.4 PIPING JOINING MATERIALS
   A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
   B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
   C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
   D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
   E. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
1. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.5 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

C. CPVC Union Ball Valves:
   1. Description:
      b. Pressure Rating: 125 psig (860 kPa) at 73 deg F (23 deg C).
      c. Body Material: CPVC.
      d. Body Design: Union type.
      e. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket.
      f. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged.
      g. Ball: CPVC; full port.
      h. Seals: PTFE or EPDM-rubber O-rings.
      i. Handle: Tee shaped.

D. CPVC Ball Check Valves:
   1. Description:
      a. Pressure Rating: 125 psig (860 kPa) at 73 deg F (23 deg C).
      b. Body Material: CPVC.
      c. Body Design: Union-type ball check.
      d. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket.
      e. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged.
      f. Ball: CPVC.
      g. Seals: EPDM- or FKM-rubber O-rings.

E. CPVC Gate Valves:
   1. Description:
      a. Pressure Rating: 125 psig (860 kPa) at 73 deg F (23 deg C).
      b. Body Material: CPVC.
      c. Body Design: Nonrising stem.
      d. End Connections for Valves NPS 2 (DN 50) and Smaller: Socket.
      e. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Socket.
      f. Gate and Stem: Plastic.
g. Seals: EPDM rubber.
h. Handle: Wheel.

2.6 TRANSITION FITTINGS

A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

B. Sleeve-Type Transition Coupling: AWWA C219.

C. Plastic-to-Metal Transition Fittings:
   1. Description: CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket end.

D. Plastic-to-Metal Transition Unions:
   1. Description: CPVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint plastic end, rubber O-ring, and union nut.

2.7 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:
   1. Description:
      a. Pressure Rating: 150 psig (1035 kPa) at 180 deg F (82 deg C).
      b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
   1. Description:
      a. Factory-fabricated, bolted, companion-flange assembly.
      b. Pressure Rating: 150 psig (1035 kPa).
      c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:
   1. Description:
      a. Nonconducting materials for field assembly of companion flanges.
      b. Pressure Rating: 150 psig (1035 kPa).
      c. Gasket: Neoprene or phenolic.
      d. Bolt Sleeves: Phenolic or polyethylene.
      e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:
   1. Description:
a. Electroplated steel nipple.
b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
c. End Connections: Male threaded or grooved.
d. Lining: Inert and noncorrosive, propylene.

2.8 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
   1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
   2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
   3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
   1. Working-Pressure Rating: Minimum 200 psig (1380 kPa) [250 psig (1725 kPa)].
   2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
   3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA’s "Copper Tube Handbook."

C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

D. Install shutoff valve immediately upstream of each dielectric fitting.

E. Install domestic water piping level without pitch and plumb.

F. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
H. 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.

I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

J. Install piping adjacent to equipment and specialties to allow service and maintenance.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

P. Install thermometers on outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, 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.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

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. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.

3.5 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
2. NPS 2 (DN 50) and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings or unions.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.

3.7 FLEXIBLE CONNECTOR INSTALLATION
A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

B. Install bronze-hose flexible connectors in copper domestic water tubing.

C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.8 WATER METER INSTALLATION

A. Rough-in domestic water piping for water meter installation, according to utility company's requirements.

B. Water meters will be furnished and installed by utility company.

3.9 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:
   a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.

3. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

E. 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.
4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.

F. Install supports for vertical copper tubing every 10 feet (3 m).

G. 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.
4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.

H. Install supports for vertical steel piping every 15 feet (4.5 m).

I. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.

J. Install supports for vertical CPVC piping every 60 inches (1500 mm) for NPS 1 (DN 25) and smaller, and every 72 inches (1800 mm) for NPS 1-1/4 (DN 32) and larger.

K. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.10 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.
D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
   2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
   3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.11 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
B. Label pressure piping with system operating pressure.

3.12 FIELD QUALITY CONTROL

A. Perform tests and inspections.
B. Piping Inspections:
   1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   2. During installation, notify authorities having jurisdiction at least one day 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 final inspection for 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 tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:
1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. 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 a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. 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.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.13 CLEANING

A. Clean and disinfect potable and non-potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures 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.
3.14 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water, building service piping, NPS 3 (DN 80) and smaller, shall be one of the following:
   1. Soft copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal fittings; and pressure-sealed joints.
   2. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.

D. Aboveground, domestic water piping, NPS 2 (DN 50) and smaller, shall be one of the following:
   1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal-joint fittings; and pressure-sealed joints.
   2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast- or wrought-copper solder-joint fittings; and soldered joints.
   3. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints.

3.15 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Shutoff Duty: Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
   2. Throttling Duty: Use ball or globe valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

D. CPVC valves matching piping materials may be used.

END OF SECTION 221116
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SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following domestic water piping specialties:
   1. Vacuum breakers.
   2. Backflow preventers.
   3. Strainers.
   4. Hose bibbs.
   5. Wall hydrants.
   6. Drain valves.
   7. Water hammer arresters.

B. See Division 22 Section "Domestic Water Piping" for water meters.

C. See Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties:  125 psig (860 kPa), unless otherwise indicated.

1.3 SUBMITTALS

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

B. Field quality-control test reports.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. NSF Compliance:
   2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Ames Co.
b. Cash Acme.
c. Conbraco Industries, Inc.
d. FEBCO; SPX Valves & Controls.
e. Rain Bird Corporation.
f. Toro Company (The); Irrigation Div.
g. Watts Industries, Inc.; Water Products Div.
h. Zurn Plumbing Products Group; Wilkins Div.

3. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
5. Inlet and Outlet Connections: Threaded.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Arrowhead Brass Products, Inc.
   b. Cash Acme.
   c. Conbraco Industries, Inc.
   d. Legend Valve.
   e. MIFAB, Inc.
   f. Prier Products, Inc.
   g. Watts Industries, Inc.; Water Products Div.
   h. Woodford Manufacturing Company.
   i. Zurn Plumbing Products Group; Light Commercial Operation.
   j. Zurn Plumbing Products Group; Wilkins Div.

5. Finish: Rough bronze.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers <BFP-1 & BFP-2>:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

   a. Ames Co.
   b. Conbraco Industries, Inc.
   c. FEBCO; SPX Valves & Controls.
   d. Flomatic Corporation.
   e. Watts Industries, Inc.; Water Products Div.
   f. Zurn Plumbing Products Group; Wilkins Div.

3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved.

6. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.

7. Configuration: Designed for horizontal, straight through flow.

8. Accessories:
   a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

B. Backflow-Preventer Test Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Conbraco Industries, Inc.
   b. FEBCO; SPX Valves & Controls.
   c. Flomatic Corporation.
   e. Zurn Plumbing Products Group; Wilkins Div.

2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.3 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
   a. Strainers NPS 2 (DN 50) and Smaller: 0.020 inch (0.51 mm).

2.4 HOSE BIBBS

A. Hose Bibbs <HB-1>:

4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.

2.5 WALL HYDRANTS

A. Nonfreeze Wall Hydrants <WH-1>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. MIFAB, Inc.
   c. Prier Products, Inc.
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products Inc.
   g. Woodford Manufacturing Company.
   h. Zurn Plumbing Products Group; Light Commercial Operation.
   i. Zurn Plumbing Products Group; Specification Drainage Operation.

4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
11. Nozzle and Wall-Plate Finish: Rough bronze.
12. Operating Keys(s): Two with each wall hydrant.

2.6 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
8. Inlet: Threaded or solder joint.
2.7 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AMTROL, Inc.
   b. Josam Company.
   c. MIFAB, Inc.
   d. PPP Inc.
   e. Sioux Chief Manufacturing Company, Inc.
   g. Tyler Pipe; Wade Div.
   h. Watts Drainage Products Inc.
   i. Zurn Plumbing Products Group; Specification Drainage Operation.

3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet

1. Install thermometers and water regulators if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve, solenoid valve, and pump.
G. Install water hammer arrestors in water piping according to PDI-WH 201.

H. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

I. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

J. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Reduced-pressure-principle backflow preventers.
2. Primary, thermostatic, water mixing valves.

K. 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. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

END OF SECTION 221119
SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe, tube, and fittings.
   2. Specialty pipe fittings.

B. Related Section:
   1. Division 22 Section "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.2 SUBMITTALS

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

B. Field quality-control reports.

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

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.
B. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ANACO-Husky.
   c. Fernco Inc.
   d. Matco-Norca, Inc.
   e. MIFAB, Inc.
   f. Mission Rubber Company; a division of MCP Industries, Inc.
   g. Stant.
   h. Tyler Pipe.

3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ANACO-Husky.
   b. Clamp-All Corp.
   d. MIFAB, Inc.
   e. Mission Rubber Company; a division of MCP Industries, Inc.
   f. Stant.
   g. Tyler Pipe.

3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.
   1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Solvent Cement: ASTM D 2564.
   1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:
   1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
   2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
   3. Unshielded, Nonpressure Transition Couplings:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         2) Fernco Inc.
         3) Mission Rubber Company; a division of MCP Industries, Inc.
         4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
      c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
      d. Sleeve Materials:
         2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
         3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
   4. Shielded, Nonpressure Transition Couplings:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         2) Mission Rubber Company; a division of MCP Industries, Inc.
c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

A. 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.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. 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.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. 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 two 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.

I. 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.

J. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping: 1 percent downward in direction of flow.
3. Vent Piping: 1 percent downward toward vertical fixture vent or toward vent stack.

L. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

M. Install aboveground PVC piping according to ASTM D 2665

N. Install underground PVC piping according to ASTM D 2321.

O. Plumbing Specialties:
   1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
   2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION


B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

E. Plastic, Nonpressure-Piping, Solvent-Cement 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 Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:
1. Install transition couplings at joints of piping with small differences in OD's.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:
   a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
7. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one 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.
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. 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).

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
4. NPS 3 and NPS 5 (DN 80 and DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.

I. Install supports for vertical copper tubing every 10 feet (3 m).
J. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
   2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
   3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.

K. Install supports for vertical PVC piping every 48 inches (1200 mm).

L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:
   1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
   2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
   3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
   4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
   5. Comply with requirements for cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
   6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. 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 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.8 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 or, in absence of published procedures, 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 drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

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

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

2. Copper DWV tube, copper drainage fittings, and soldered joints.

3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Hubless, cast-iron soil pipe and fittings; [CISPI] [heavy-duty] hubless-piping couplings; and coupled joints.
2. Copper DWV tube, copper drainage fittings, and soldered joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

D. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Hubless, cast-iron soil pipe and fittings; heavy-duty cast-iron hubless-piping couplings; and coupled joints.

E. Underground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:

1. Hubless, cast-iron soil pipe and fittings; heavy-duty cast-iron hubless-piping couplings; coupled joints.
2. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.

END OF SECTION 221316
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SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Trench drains.
4. Roof flashing assemblies.
5. Miscellaneous sanitary drainage piping specialties.
6. Flashing materials.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for oil interceptors.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Cast-Iron Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

   b. MIFAB, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts:
1. **Basis-of-Design Product:** Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   b. Oatey.
   c. Sioux Chief Manufacturing Company, Inc.
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products Inc.
   g. Zurn Plumbing Products Group; Light Commercial Operation.
   h. Zurn Plumbing Products Group; Specification Drainage Operation.

2. **Standard:** ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
3. **Size:** Same as connected branch.
4. **Type:** Heavy-duty, adjustable housing.
5. **Body or Ferrule:** Cast iron.
6. **Clamping Device:** Required.
7. **Outlet Connection:** Spigot.
8. **Closure:** Brass plug with tapered threads.
9. **Adjustable Housing Material:** Cast iron with threads.
10. **Frame and Cover Material and Finish:** Rough bronze.
11. **Frame and Cover Shape:** Round.
12. **Top Loading Classification:** Extra Heavy Duty.
13. **Riser:** ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

C. **Cast-Iron Wall Cleanouts:**

1. **Basis-of-Design Product:** Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   b. MIFAB, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. **Standard:** ASME A112.36.2M. Include wall access.
3. **Size:** Same as connected drainage piping.
4. **Body:** Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. **Closure:** Countersunk, brass plug.
6. **Closure Plug Size:** Same as or not more than one size smaller than cleanout size.
7. **Wall Access:** Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

### 2.2 FLOOR DRAINS

A. **Cast-Iron Floor and Hub Drains:**

1. **Basis-of-Design Product:** Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   a. Commercial Enameling Co.
   b. Josam Company; Josam Div.
   c. MIFAB, Inc.
   d. Prier Products, Inc.
e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
f. Tyler Pipe; Wade Div.
g. Watts Drainage Products Inc.
h. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
11. Sediment Bucket: Not required.
12. Top or Strainer Material: Bronze.
14. Top Shape: Round.
15. Top Loading Classification: Extra Heavy-Duty.
16. Funnel: Required for hub drain.
17. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
18. Trap Material: Cast iron.
20. Trap Features: Not required.

2.1 TRENCH DRAINS

A. Trench Drains, <TD>: Comply with ASME A112.21.1M.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
      a. Josam Co.
      b. ABT, Inc.
      d. Tyler Pipe, Wade Div.
   2. Body Material: See plumbing fixture schedule
   3. Outlet: End.
   4. Grate Material: See plumbing fixture schedule
   5. Grate Finish: See plumbing fixture schedule
   6. Top Loading Classification: See plumbing fixture schedule
   7. Trap Material: Cast iron.
      Trap Pattern: Deep seal P-trap.

2.2 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch- (2.4-mm-) thick, lead flashing collar and skirt extending at least 6 inches (150 mm) from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.


2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains, HD-1

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping[ with increaser fitting of size indicated].

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
   a. NPS 2 (DN 50): 4-inch- (100-mm-) minimum water seal.
   b. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.

C. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

D. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch (25 mm) above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

E. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

F. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.4 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
   1. General Use: 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
   2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
   3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" 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 minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
   4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
   1. Position floor drains for easy access and maintenance.
   2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
      a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
      b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

H. Assemble open drain fittings and install with top of hub 2 inches (51 mm) above floor.

I. Install deep-seal traps on floor drains and other waste outlets, if indicated.

J. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
   1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
   2. Size: Same as floor drain inlet.

K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

M. Install vent caps on each vent pipe passing through roof.

N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
   1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminated equipment nameplate or sign on or near each grease interceptor.

B. 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. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319
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SECTION 221513 - GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes piping and related specialties for general-service compressed-air systems operating at 150 psig (1035 kPa) or less.

B. See Division 22 Section "General-Service Packaged Air Compressors and Receivers" for general-service air compressors and accessories.

1.2 SUBMITTALS

A. Product Data: For the following:
   1. Pressure regulators. Include rated capacities and operating characteristics.
   2. Automatic drain valves.
   3. Filters. Include rated capacities and operating characteristics.
   4. Lubricators. Include rated capacities and operating characteristics.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE


PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B, black with ends threaded according to ASME B1.20.1.

   4. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel, threaded.

B. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 JOINING MATERIALS
A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.
   1. ASME B16.21, nonmetallic, flat, full-face, asbestos free, 1/8-inch (3.2-mm) maximum thickness.
B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

2.3 VALVES
A. Metal Ball, Butterfly, Check, Gate, and Globe Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping."

2.4 DIELECTRIC FITTINGS
A. General Requirements for Dielectric Fittings: Combination fitting of copper alloy and ferrous materials with insulating material; suitable for system fluid, pressure, and temperature. Include threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
B. Dielectric Unions: Factory-fabricated union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

2.5 FLEXIBLE PIPE CONNECTORS
A. Stainless-Steel-Hose Flexible Pipe Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
   1. Working-Pressure Rating: 200 psig (1380 kPa) minimum.
   2. End Connections, NPS 2 (DN 50) and Smaller: Threaded steel pipe nipple.
   3. End Connections, NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

2.6 SPECIALTIES
A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.
   1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.
B. Air-Main Pressure Regulators: Bronze body, pilot-operated direct acting, spring-loaded manual pressure-setting adjustment, and rated for 250-psig (1725-kPa) inlet pressure, unless otherwise indicated.
C. Air-Line Pressure Regulators: Diaphragm operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig (1380-kPa) minimum inlet pressure, unless otherwise indicated.
D. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig (1380-kPa) minimum working pressure, capable of automatic discharge of collected condensate. Include mounting bracket if wall mounting is indicated.

E. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. Include mounting bracket if wall mounting is indicated.

2.7 QUICK COUPLINGS

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. Aeroquip Corporation; Eaton Corp.
2. Bowes Manufacturing Inc.
3. Foster Manufacturing, Inc.
5. Parker Hannifin Corp.; Fluid Connectors Group; Quick Coupling Div.
6. Rectus Corp.
7. Schrader-Bridgeport; Amflo Div.
9. Snap-Tite, Inc.; Quick Disconnect & Valve Division.
10. TOMCO Products Inc.
11. Tuthill Corporation; Hansen Coupling Div.

B. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.

C. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless-steel or nickel-plated-steel operating parts.

1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.

D. Valveless Quick Couplings: Straight-through brass body with stainless-steel or nickel-plated-steel operating parts.

1. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
2. Plug End: With barbed outlet for attaching hose.

E. Coordinate quick couplings with owner.

2.8 HOSE ASSEMBLIES

A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300-psig (2070-kPa) minimum working pressure, unless otherwise indicated.

2. Hose Clamps: Stainless-steel clamps or bands.
3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless-steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
4. Hose Splicers: One-piece, straight-through brass or stainless-steel fitting with barbed ends for connecting two sections of hose.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Compressed-Air Piping between Air Compressors and Receivers: Use the following piping materials for each size range:
   1. NPS 2 (DN 50) and Smaller: Steel pipe; threaded, malleable-iron fittings; and threaded joints.

B. Low-Pressure Compressed-Air Distribution Piping: Use the following piping materials for each size range:
   1. NPS 2 (DN 50) and Smaller: Steel pipe; threaded, malleable-iron fittings; and threaded joints.

C. Drain Piping: Use the following piping materials:
   1. NPS 2 (DN 50) and Smaller: Type M (Type C) copper tube; wrought-copper fittings; and brazed or soldered joints.

3.2 VALVE APPLICATIONS

A. Comply with requirements in "Valve Applications" Article in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Equipment Isolation Valves: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.

C. 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 otherwise indicated.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.

E. Install piping adjacent to equipment and machines to allow service and maintenance.

F. Install air and drain piping with 1 percent slope downward in direction of flow.

G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.
H. Equipment and Specialty Flanged Connections:
   1. Use steel companion flange with gasket for connection to steel pipe.
   2. Use cast-copper-alloy companion flange with gasket and brazed or soldered joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.

I. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

J. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping."

K. Install piping to permit valve servicing.

L. Install piping free of sags and bends.

M. Install fittings for changes in direction and branch connections.

N. Install unions, adjacent to each valve and at final connection to each piece of equipment and machine.

O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Apply appropriate tape or thread compound to external pipe threads.

D. Brazed Joints for Copper Tubing: Join according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Join according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.

G. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

3.5 VALVE INSTALLATION
A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.

C. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.

D. Install check valves to maintain correct direction of compressed-air flow to and from compressed-air piping specialties and equipment.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric unions in piping at connections of dissimilar metal piping and tubing.

3.7 FLEXIBLE PIPE CONNECTOR INSTALLATION

A. Install flexible pipe connectors in discharge piping and in inlet air piping from remote air-inlet filter of each air compressor.

B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.

C. Install stainless-steel-hose flexible pipe connectors in steel compressed-air piping.

3.8 SPECIALTY INSTALLATION

A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.

B. Install air-main pressure regulators in compressed-air piping at or near air compressors.

C. Install air-line pressure regulators in branch piping to equipment.

D. Install automatic drain valves on aftercoolers, receivers, and dryers. Discharge condensate onto nearest floor drain.

E. Install coalescing filters in compressed-air piping at or near air compressors and upstream from mechanical filters. Mount on wall at locations indicated.

F. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters. Mount on wall at locations indicated.

G. Install quick couplings at piping terminals for hose connections.

H. Install hose assemblies at hose connections.

3.9 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

C. Vertical Piping: MSS Type 8 or 42, clamps.

D. Individual, Straight, Horizontal Piping Runs:
   1. 100 Feet (30 m) or Less: MSS Type 1, adjustable, steel clevis hangers.
   2. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.

E. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

F. Base of Vertical Piping: MSS Type 52, spring hangers.

G. Support horizontal piping within 12 inches (300 mm) of each fitting and coupling.

H. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

I. Install hangers for Schedule 40, steel piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1/4 to NPS 1/2 (DN 8 to DN 15): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
   2. NPS 3/4 to NPS 1-1/4 (DN 20 to DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
   3. NPS 1-1/2 (DN 40): 12 feet (3.7 m) with 3/8-inch (10-mm) rod.
   4. NPS 2 (DN 50): 13 feet (4 m) with 3/8-inch (10-mm) rod.

J. Install supports for vertical, Schedule 40, steel piping every 15 feet (4.6 m).

K. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1/4 (DN 8): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
   2. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
   3. NPS 3/4 (DN 20): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
   4. NPS 1 (DN 25): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
   5. NPS 1-1/4 (DN 32): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
   6. NPS 1-1/2 (DN 40): 10 feet (3 m) with 3/8-inch (10-mm) rod.
   7. NPS 2 (DN 50): 11 feet (3.4 m) with 3/8-inch (10-mm) rod.

L. Install supports for vertical copper tubing every 10 feet (3 m).

3.10 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.11 FIELD QUALITY CONTROL

A. Perform field tests and inspections.

B. Tests and Inspections:
1. Piping Leak Tests: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig (345 kPa) above system operating pressure, but not less than 150 psig (1035 kPa). Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.

2. Repair leaks and retest until no leaks exist.

3. Inspect filters, lubricators and pressure regulators for proper operation.

END OF SECTION 221513
SECTION 221519 - GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Air compressors
   2. Receiver tanks.
   3. Inlet-air filters.
   4. Air-cooled, compressed-air aftercoolers.
   5. Refrigerant compressed-air dryers.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design compressed-air equipment mounting, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Wiring Diagrams: For power, signal, and control wiring.

B. Delegated-Design Submittal: For compressed-air equipment mounting indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Detail fabrication and assembly of supports.
   2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

C. Seismic Qualification Certificates: For compressed-air equipment, accessories, and components, from manufacturers.

D. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASME Compliance: Fabricate and label receivers to comply with ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS
2.1 GENERAL REQUIREMENTS FOR PACKAGED AIR COMPRESSOR RECEIVERS

A. General Description: Existing, relocated compressor

B. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2 and UL 508.
   1. Enclosure: NEMA ICS 6, Type 12 control panel unless otherwise indicated.
   3. Control Voltage: 120-V ac or less, using integral control power transformer.
   5. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.
   6. Automatic control switches to alternate lead-lag compressors for duplex air compressors.
   7. Instrumentation: Include discharge-air pressure gage, air-filter maintenance indicator, hour meter, compressor discharge-air and coolant temperature gages, and control transformer.
   8. Alarm Signal Device: For connection to alarm system to indicate when backup air compressor is operating.

C. Receivers: Steel tank constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
   1. Pressure Rating: At least as high as highest discharge pressure of connected compressors, and bearing appropriate code symbols.
   2. Interior Finish: Corrosion-resistant coating.
   3. Accessories: Include safety valve, pressure gage, drain, and pressure-reducing valve.

D. Mounting Frame: Fabricate mounting and attachment to pressure vessel with reinforcement strong enough to resist packaged equipment movement during a seismic event when base is anchored to building structure.

2.2 INLET-AIR FILTERS

A. Description: Combination inlet-air filter-silencer, suitable for remote installation, for each air compressor.
   1. Construction: Weatherproof housing for replaceable, dry-type filter element, with silencer tubes or other method of sound reduction.
   2. Capacity: Match capacity of air compressor, with filter having collection efficiency of 99 percent retention of particles larger than 10 micrometers.

B. Description: Combination inlet-air filter-silencer, suitable for remote installation, for multiple air compressors.
   1. Construction: Weatherproof housing for replaceable, dry-type filter element, with silencer tubes or other method of sound reduction.
   2. Capacity: Match total capacity of connected air compressors, with filter having collection efficiency of 99 percent retention of particles larger than 10 micrometers.

2.3 MOTORS
A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Equipment Mounting: Install air compressors and storage tank on concrete bases using elastomeric mounts. Comply with requirements in Division 03 Section.

1. Minimum Deflection: 1 inch (25 mm).

B. Install compressed-air equipment anchored to substrate.

C. Install the following devices on compressed-air equipment:

1. Thermometer, Pressure Gage, and Safety Valve: Install on each compressed-air receiver.
2. Pressure Regulators: Install downstream from air compressors and dryer.
3. Automatic Drain Valves: Install on aftercoolers, receivers, and dryers. Discharge condensate over nearest floor drain.

D. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check for lubricating oil in lubricated-type equipment.
3. Check belt drives for proper tension.
4. Verify that air-compressor inlet filters and piping are clear.
5. Check for equipment vibration-control supports and flexible pipe connectors and verify that equipment is properly attached to substrate.
6. Check safety valves for correct settings. Ensure that settings are higher than air-compressor discharge pressure but not higher than rating of system components.
7. Check for proper seismic restraints.
8. Drain receiver tanks.
9. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
10. Test and adjust controls and safeties.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Section "General-Service Compressed-Air Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.
3.3 IDENTIFICATION

A. Identify general-service air compressors and components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air compressors.

END OF SECTION 221519
SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Faucets for sinks.
   2. Flushometers.
   3. Toilet seats.
   4. Protective shielding guards.
   5. Fixture supports.
   7. Service sinks.

B. Related Sections include the following:
   1. Division 22 Section "Emergency Plumbing Fixtures."
   2. Division 22 Section "Drinking Fountains and Water Coolers."

1.2 DEFINITIONS


B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. FRP: Fiberglass-reinforced plastic.

D. PMMA: Polymethyl methacrylate (acrylic) plastic.

E. PVC: Polyvinyl chloride plastic.


1.3 SUBMITTALS

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

B. Shop Drawings: Diagram power, signal, and control wiring.

C. 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.


D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
3. Porcelain-Enamel, Formed-Steel Fixtures: ASME A112.19.4M.
6. Vitreous-China Fixtures: ASME A112.19.2M.

G. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
5. Hose-Connection Vacuum Breakers: ASSE 1011.

H. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

2. Brass and Copper Supplies: ASME A112.18.1.

I. Comply with the following applicable standards and other requirements specified for miscellaneous components:

2. Grab Bars: ASTM F 446.
4. Off-Floor Fixture Supports: ASME A112.6.1M.

PART 2 - PRODUCTS

2.1 SINK FAUCETS

A. Sink Faucets, SK-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   a. American Standard Companies, Inc.
   b. Bradley Corporation.
   c. Chicago Faucets.
   d. Delta Faucet Company.
   e. Eljer.
   f. Elkay Manufacturing Co.
   g. Grohe America, Inc.
   h. Just Manufacturing Company.
   i. Kohler Co.
   j. Moen, Inc.
   k. T & S Brass and Bronze Works, Inc.
   l. Zurn Plumbing Products Group; Commercial Brass Operation.

2. Description: Kitchen faucet without spray. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
   a. Body Material: Commercial, solid brass
   b. Finish: Polished chrome plate.
   c. Maximum Flow Rate: 0.5 gpm, unless otherwise indicated.
   d. Mixing Valve: Two-lever handle.
   e. Centers: 8 inches (203 mm).
   f. Mounting: Deck, exposed.
   g. Handle(s): Wrist blade, 4 inches (102 mm).
   h. Inlet(s): NPS 1/2 (DN 15) male shank.
   i. Spout Type: Swivel gooseneck.
   j. Spout Outlet: Spray.
   k. Vacuum Breaker: Not required.
   m. Drain: Lift and turn.

B. Sink Faucets, SK-2:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   a. American Standard Companies, Inc.
   b. Bradley Corporation.
   c. Chicago Faucets.
   d. Delta Faucet Company.
   e. Eljer.
   f. Elkay Manufacturing Co.
   g. Grohe America, Inc.
2. **Description:** Service sink faucet. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

a. **Body Material:** Commercial, solid brass
b. **Finish:** Polished chrome plate.
c. **Maximum Flow Rate:** 1.0 gpm, unless otherwise indicated.
d. **Mixing Valve:** Two-lever handle.
e. **Centers:** 8 inches (203 mm).
f. **Mounting:** Wall, exposed.
g. **Handle(s):** Wrist blade, 4 inches (102 mm).
h. **Inlet(s):** NPS 1/2 (DN 15) female shank.
i. **Spout Type:** Rigid gooseneck.
j. **Spout Outlet:** Spray.
k. **Vacuum Breaker:** Not required.
l. **Operation:** Compression, manual.
m. **Drain:** Grid.

### 2.2 FLUSHOMETERS

#### A. Flushometers, WC-1:

1. **Basis-of-Design Product:** Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

   a. **Coyne & Delany Co.**
   b. **Delta Faucet Company.**
   c. **Sloan Valve Company.**
   d. **Zurn Plumbing Products Group; Commercial Brass Operation.**

2. **Description:** Flushometer for water-closet-type fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.

   a. **Internal Design:** Diaphragm operation.
   b. **Style:** Exposed.
   c. **Inlet Size:** NPS 1 (DN 25).
   d. **Trip Mechanism:** Oscillating, lever-handle actuator.
   e. **Consumption:** Dual Flush 1.6 gal./flush and 1.1 gal./flush.
   f. **Tailpiece Size:** NPS 1-1/4 (DN 32) and standard length to top of bowl.

### 2.3 TOILET SEATS

#### A. Toilet Seats, WC-1:

1. **Basis-of-Design Product:** Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
2. Description: Toilet seat for water-closet-type fixture.
   a. Material: Molded, solid plastic.
   b. Configuration: Open front without cover.
   c. Size: Elongated.
   d. Hinge Type: CK, check.
   e. Class: Heavy-duty commercial.

2.4 WATER CLOSETS

A. Water Closets, WC-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   a. American Standard Companies, Inc.
   b. Briggs Plumbing Products, Inc.
   c. Eljer.
   d. Gerber Plumbing Fixtures LLC.
   e. Kohler Co.
   f. Mansfield Plumbing Products, Inc.
   g. Peerless Pottery, Inc.
   h. St. Thomas Creations.
   i. TOTO USA, Inc.

2. Description: Floor-mounting, floor-outlet, vitreous-china fixture designed for flushometer valve operation.
      a. Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
      b. Height: Standard.
      c. Design Consumption: Dual flush 1.6 gal./flush or 1.1 gal./flush.

2.5 SERVICE SINKS

A. Service Sinks, SK-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   b. Eljer.
   c. Just Manufacturing Company

PLUMBING FIXTURES
2. Description: Single-bowl, freestanding, stainless-steel one-compartment sink.
   a. Overall Dimensions: 24 inch by 24 inch
   b. Metal Thickness: 14 gauge type 304, 18-8 stainless steel
   c. Drain: Grid with NPS 1-1/2 (DN 40) outlet.
   d. Sink Faucet: <SK-1>
   e. Supplies: NPS 1/2 (DN 15) chrome-plated copper with stops.
   f. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular brass waste to wall; continuous waste; and wall escutcheon(s).
   g. Drain Piping: Schedule 40 PVC, NPS 1-1/2 (DN 40) P-trap; tubular waste to wall; continuous waste; and wall escutcheon(s).

B. Service Sinks, <SK-2>:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   b. Eljer.
   c. Just Manufacturing Company

2. Description: Freestanding, stainless steel, two-compartment sinks.
   a. Size: 21 by 24 inches.
   b. Faucet: Sink <SK-1> for wall mounting.
   c. Supplies: NPS 1/2 (DN 15) [chrome-plated copper with stops] [copper tubing with ball, gate, or globe valves].
   d. Drain: Grid with NPS 1-1/2 (DN 40) outlets.
   e. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular brass waste to wall; and wall escutcheon.
   f. Drain Piping: Schedule 40 PVC, NPS 1-1/2 (DN 40) P-trap; tubular waste to wall; and wall escutcheon.
   g. Stand: Not required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
   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.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.
F. Install fixtures level and plumb according to roughing-in drawings.

G. 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.

H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

J. Install flushometer valves for accessible water closets with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

K. Install toilet seats on water closets.

L. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

M. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

N. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

O. Install shower flow-control fittings with specified maximum flow rates in shower arms.

P. Install traps on fixture outlets.
   1. Exception: Omit trap on fixtures with integral traps.
   2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

Q. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Escutcheons for Plumbing Piping."

R. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

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. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
E. Install fresh batteries in sensor-operated mechanisms.

3.4 PROTECTION

A. Provide protective covering for installed fixtures and fittings.
B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000
SECTION 224500 - EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY
   A. Section Includes:
      1. Emergency eyewash.

1.2 SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Field quality-control test reports.
   C. Operation and maintenance data.

1.3 QUALITY ASSURANCE
   B. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.

PART 2 - PRODUCTS

2.1 EYEWASH EQUIPMENT
   A. Standard, Freestanding, Plumbed Eyewash Units, EW-1:
      1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
         a. Acorn Safety; a division of Acorn Engineering Company.
         b. Bradley Corporation.
         c. Guardian Equipment Co.
         d. Haws Corporation.
         e. Speakman Company.
      2. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
      3. Supply Piping: NPS 1/2 (DN 15) chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
      5. Spray-Head Assembly: Two receptor-mounted spray heads.
7. Drain Piping: NPS 1-1/4 (DN 32) minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2.

2.2 SOURCE QUALITY CONTROL

A. Certify performance of emergency plumbing fixtures by independent testing organization acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EMERGENCY PLUMBING FIXTURE INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
B. Install fixtures level and plumb.
C. Fasten fixtures to substrate.
D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency equipment.
2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
E. Install shutoff valve and strainer in steam piping and shutoff valve in condensate return piping. Comply with requirements for steam and condensate piping specified in Division 23 Section "Steam and Condensate Heating Piping."
F. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Division 22 Section "Domestic Water Piping."
G. Install trap and waste piping on drain outlet of emergency equipment receptors that are indicated to be directly connected to drainage system. Comply with requirements for waste piping specified in Division 22 Section "Sanitary Waste and Vent Piping."
H. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."
I. Fill self-contained fixtures with flushing fluid.

3.2 CONNECTIONS
A. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment. Comply with requirements for cold-water piping specified in Division 22 Section "Domestic Water Piping."

B. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary waste and vent piping. Comply with requirements for waste piping specified in Division 22 Section "Sanitary Waste and Vent Piping."

C. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary waste or storm drainage piping.

D. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

3.3 IDENTIFICATION

A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.

B. Tests and Inspections:
   1. Perform each visual and mechanical inspection.
   2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Emergency plumbing fixtures will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

END OF SECTION 224500
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SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 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.

1.2 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 requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
   B. Comply with NEMA MG 1 unless otherwise indicated.

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.


F. Bearings: Re-greaseable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:
   1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
   2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. 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.

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: Pre-lubricated, 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
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SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Thermal-hanger shield inserts.
   4. Fastener systems.
   5. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE 7-10.
   1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
   2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
   3. Design seismic-restraint hangers and supports for piping and equipment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
   1. Trapeze pipe hangers.
   2. Equipment supports.
C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Galvanized Metallic Coatings: Pregalvanized or hot-dipped.
   3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
   4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

B. Stainless-Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick 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.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.


G. 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.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.
I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:
   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 allowed by ASME B31.9 for building services piping.
   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.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
   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.
      c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
      d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
      e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
   5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
   6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M 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 so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.5 PAINTING

A. Touchup: 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.
   1. 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.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system 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).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600) if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system 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.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. 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 (680 kg).
   c. Heavy (MSS Type 33): 3000 lb (1360 kg).
8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system 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 in writing by manufacturer to prevent crushing insulation.
   3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
   2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
   3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529
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SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Isolation pads.
   2. Isolation mounts.
   3. Restrained elastomeric isolation mounts.
   4. Freestanding and restrained spring isolators.
   5. Housed spring mounts.
   6. Elastomeric hangers.
   7. Spring hangers.
   8. Spring hangers with vertical-limit stops.
   9. Pipe riser resilient supports.
  10. Resilient pipe guides.
  11. Restraining braces and cables.

1.2 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:
   1. Basic Wind Speed: Coordinate with Structural drawings.

B. Seismic-Restraint Loading:
   1. Site Class as Defined in the IBC: D.
   2. Assigned Seismic Use Group or Building Category as Defined in the IBC: I-III
   3. Mapped MCE Spectral Response Acceleration at Short Period: $S_s 0.845g$
   4. Mapped MCE Spectral Response Acceleration at 1-s Period: $S_1 0.299g$
   5. Design Spectral Response Acceleration at Short Periods: $S_{DS} 0.655g$
   6. Design Spectral Response Acceleration at 1-s Period: $S_{D1} 0.359g$
   7. Values listed are for Site Latitude 35.041503° lat. / -89.968964° long. Coordinate exact accelerations with Structural drawings.

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For professional engineer.

E. Field quality-control test reports.
1.4 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

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. Amber/Booth Company, Inc.
2. Gripple.
3. MAPA.
5. Mason Industries.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch (6-mm) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch (6-mm) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

G. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel up or down before contacting a resilient collar.

H. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

I. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the 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. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

J. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the 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. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

K. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.

L. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 SEISMIC-RESTRAINT DEVICES

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. Amber/Booth Company, Inc.
2. Gripple.
3. MAPA.
5. Mason Industries.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A 603 galvanized or ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

F. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
G. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

H. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section “Roof Accessories” for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:
   1. Install seismic-restraint devices using methods approved by OSHPD or an agency acceptable to authorities having jurisdiction providing required submittals for component.

C. Piping Restraints:
   1. Comply with requirements in MSS SP-127.
   2. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
   3. Brace a change of direction longer than 12 feet (3.7 m).

D. Install cables so they do not bend across edges of adjacent equipment or building structure.

E. Install seismic-restraint devices using methods approved by OSHPD an agency acceptable to authorities having jurisdiction providing required submittals for component.

F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Set anchors to manufacturer's recommended torque, using a torque wrench.

5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 23 Section "Hydronic Piping" for piping flexible connections.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.


4. Test at least three of each type and size of installed anchors and fasteners selected by Engineer.

5. Test to 90 percent of rated proof load of device.


7. Measure isolator deflection.

8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.
D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 230548
SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Pipe labels.
   4. Duct labels.

1.2 ACTION SUBMITTAL

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:
   1. Material and Thickness: Brass, 0.032-inch (0.8-mm), Stainless steel, 0.025-inch (0.64-mm),
      Aluminum, 0.032-inch (0.8-mm), or anodized aluminum, 0.032-inch (0.8-mm)] minimum
      thickness, and having predrilled or stamped holes for attachment hardware.
   2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by
      3/4 inch (64 by 19 mm).
   3. Minimum Letter Size: 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.
   5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch
      (3.2 mm) thick, and having predrilled holes for attachment hardware.
   4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by
      3/4 inch (64 by 19 mm).
   6. Minimum Letter Size: 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.
   7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.


C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 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.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: At least 1-1/2 inches (38 mm) high.

2.4 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.


C. Background Color: Green.
D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 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.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
   2. Lettering Size: At least 1-1/2 inches (38 mm) high.

PART 3 - EXECUTION

3.1 PREPARATION
   A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION
   A. Install or permanently fasten labels on each major item of mechanical equipment.
   B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION
   A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed 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 inaccessible 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.
B. Pipe Label Color Schedule:

1. Refrigerant Piping:
   a. Background Color: Blue.

2. Gas Piping:
   a. Background Color: Yellow.
   b. Letter Color: Black.

3.4 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 25 feet (7.5 m) in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 230553
SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Balancing Air Systems:
      a. Constant-volume air systems.
   2. Balancing Hydronic Piping Systems:

1.2 DEFINITIONS

B. TAB: Testing, adjusting, and balancing.
C. TABB: Testing, Adjusting, and Balancing Bureau.
D. TAB Specialist: An entity engaged to perform TAB Work.

1.3 ACTION SUBMITTALS

1.4 INFORMATIONAL SUBMITTALS


B. Certified TAB reports.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or TABB.
   1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or TABB.
   2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or TABB as a TAB technician.

B. 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.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Owner or Commissioning Authority.
D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

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 including 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 ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. 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.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. 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.

J. Examine operating safety interlocks and controls on HVAC equipment.
K. 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. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
6. 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 SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts 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 according to Section 230713 "Duct Insulation."

C. Mark equipment and balancing devices, including damper-control positions 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. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. 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.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.
G. Check dampers for proper position to achieve desired airflow path.
H. Check for airflow blockages.
I. Check condensate drains for proper connections and functioning.
J. Check for proper sealing of air-handling-unit components.
K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure total airflow.
      a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
   2. Measure fan static pressures as follows to determine actual static pressure:
      a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
      b. Measure static pressure directly at the fan outlet or through the flexible connection.
      c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
      d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
   3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
      a. Report the cleanliness status of filters and the time static pressures are measured.
   4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
   5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
   6. Obtain approval from Owner or Commissioning Authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
   7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
   1. Measure airflow of submain and branch ducts.
a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.

3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.

2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 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.

3.7 PROCEDURES FOR BOILERS

A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.

B. Steam Boilers: Measure and record entering-water temperature and flow and leaving-steam pressure, temperature, and flow.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.

2. Airflow.

3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

B. Measure, adjust, and record the following data for each refrigerant coil:
   1. Dry-bulb temperature of entering and leaving air.
   2. Wet-bulb temperature of entering and leaving air.
   3. Airflow.
   4. Air pressure drop.
   5. Refrigerant suction pressure and temperature.

3.9 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 Outlets and Inlets: Plus or minus 10 percent.

3.10 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.

3.11 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. Fan curves.
   2. Manufacturers' test data.
   3. Field test reports prepared by system and equipment installers.
   4. 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. Notes to explain why certain final data in the body of reports vary from indicated values.
14. 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. Fan drive settings including settings and percentage of maximum pitch diameter.
   e. Settings for supply-air, static-pressure controller.
   f. 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. Duct, outlet, and inlet sizes.

3.12 ADDITIONAL TESTS

A. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593
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SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:
   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.

B. Related Sections:
   1. Division 23 Section "Metal Ducts" for duct liners.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, 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.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

B. Products shall not contain asbestos, lead, mercury, or mercury compounds
C. 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.
D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. 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. Manson Insulation Inc.; Alley Wrap.
   e. Owens Corning; SOFTR All-Service Duct Wrap.

G. 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 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.; Commercial Board.
   b. Fibrex Insulations Inc.; FBX.
   c. Johns Manville; 800 Series Spin-Glas.
   d. Knauf Insulation; Insulation Board.
   e. Manson Insulation Inc.; AK Board.
   f. Owens Corning; Fiberglas 700 Series.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 1-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. CertainTeed Corp.; FlameChek.
   b. Johns Manville; Firetemp Wrap.
   c. Nelson Fire Stop Products; Nelson FSB Flameshield Blanket.
   d. Thermal Ceramics; FireMaster Duct Wrap.
   e. 3M; Fire Barrier Wrap Products.
   f. Unifrax Corporation; FyreWrap.

2.3 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.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   b. Eagle Bridges - Marathon Industries; 225.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.


1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   b. Eagle Bridges - Marathon Industries; 225.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Use adhesive that complies with the latest testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including addenda.

2.4 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 50 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. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   b. Vimasco Corporation; 749.

2. 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.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   b. Eagle Bridges - Marathon Industries; 550.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
   d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.6 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: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms (0.86 metric perm) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

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. ABI, Ideal Tape Division; 428 AWF ASJ.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
   c. Compac Corporation; 104 and 105.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

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. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

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. ABI, Ideal Tape Division; 488 AWF.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   c. Compac Corporation; 120.
   d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.8 SECUREMENTS

A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 3/4 inch (19 mm) wide with wing seal or closed seal.

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. ITW Insulation Systems; Gerrard Strapping and Seals.
   b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

B. 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. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
      2) GEMCO; Perforated Base.
      3) Midwest Fasteners, Inc.; Spindle.
   b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
c. 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.

d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened 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. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) GEMCO; Nylon Hangers.
2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

b. Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter.

c. Spindle: Nylon, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).

d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

3. Self-Sticking-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. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.
2) GEMCO; Peel & Press.
3) Midwest Fasteners, Inc.; Self Stick.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.

c. 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.

d. Adhesive-backed base with a peel-off protective cover.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel or aluminum 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. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.
b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick nylon 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. 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) GEMCO.
2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

D. Wire: 0.062-inch (1.6-mm) soft-annealed, galvanized steel.

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:


2.9 CORNER ANGLES

A. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. 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. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. 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.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. 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 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.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. 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 Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).

4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. 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).

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

E. 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. Comply with requirements in Division 07 Section "Penetration Firestopping."

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 overcompress insulation during installation.
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 overcompress 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. 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 overcompress 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 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. As applicable, install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 of the Architectural specifications.

3.6 FINISHES

A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.


B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

   1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.
3.8 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.

B. Items Not Insulated:
   1. Fibrous-glass ducts.
   2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE 90.1-2007.
   3. Factory-insulated flexible ducts.
   5. Flexible connectors.
   7. Factory-insulated access panels and doors.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

C. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber board, 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

D. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber board, 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

END OF SECTION 230713
SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipes, tubes, and fittings.
   2. Piping specialties.
   3. Piping and tubing joining materials.
   4. Valves.
   5. Pressure regulators.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:
   1. Piping and Valves: 100 psig (690 kPa) minimum unless otherwise indicated.
   2. Service Regulators: 65 psig (450 kPa) minimum unless otherwise indicated.

B. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa), and is reduced to secondary pressure of 0.5 psig (3.45 kPa) or less.

C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.3 SUBMITTALS

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

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Detail fabrication and assembly of seismic restraints.
   2. Design Calculations: Calculate requirements for selecting seismic restraints.

D. Welding certificates.

E. Field quality-control reports.

F. Operation and maintenance data.
1.4 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
   4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
      a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

B. PE Pipe: ASTM D 2513, SDR 11.
   1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
   2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
      b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering.
      c. Aboveground Portion: PE transition fitting.
      d. Outlet shall be threaded or suitable for welded connection.
      e. Tracer wire connection.
      f. Ultraviolet shield.
      g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
      a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
      b. Outlet shall be threaded or suitable for welded connection.
      c. Bridging sleeve over mechanical coupling.
      d. Factory-connected anode.
      e. Tracer wire connection.
      f. Ultraviolet shield.
2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig (3.45 kPa).
8. Maximum Length: 72 inches (1830 mm).

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.


C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig (862 kPa).
3. Dry seal Threads on Flare Ends: Comply with ASME B1.20.3.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.

C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
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. BrassCraft Manufacturing Company; a Masco company.

3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
8. CWP Rating: 600 psig (4140 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WO G" indicated on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

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. BrassCraft Manufacturing Company; a Masco company.

3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
8. CWP Rating: 600 psig (4140 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WO G" indicated on valve body.

E. Bronze Plug Valves: MSS SP-78.

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. Lee Brass Company.

5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig (862 kPa).
7. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. PE Ball Valves: Comply with ASME B16.40.

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. Kerotest Manufacturing Corp.
   b. Lyall, R. W. & Company, Inc.
   c. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: PE.
3. Ball: PE.
5. Seats and Seals: Nitrile.
6. Ends: Plain or fusible to match piping.
7. CWP Rating: 80 psig (552 kPa).
8. Operating Temperature: Minus 20 to plus 140 deg F (Minus 29 to plus 60 deg C).
9. Operator: Nut or flat head for key operation.
10. Include plastic valve extension.
11. Include tamperproof locking feature for valves where indicated on Drawings.

G. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 MOTORIZED GAS VALVES

A. Electrically Operated Valves: Comply with UL 429.

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. ASCO Power Technologies, LP; Division of Emerson.
   b. Dungs, Karl, Inc.
   c. Eclipse Combustion, Inc.
   d. Goyen Valve Corp.; Tyco Environmental Systems.
   e. Magnatrol Valve Corporation.
   f. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
   g. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
2. Pilot operated.
3. Body: Brass or aluminum.
5. Springs and Valve Trim: Stainless steel.
6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
7. NEMA ICS 6, Type 4, coil enclosure.

2.6 EARTHQUAKE VALVES

A. Earthquake Valves: Field verify whether or not an existing seismic shut-off valve is present. In not, provide one for each meter.

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. Pacific Seismic Products

2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 2 psig (34.5 kPa).
5. Nitrile-rubber valve washer.
7. Threaded end connections complying with ASME B1.20.1.
8. Wall mounting bracket with bubble level indicator.

2.7 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller.


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. Actaris.
   b. American Meter Company.
   c. Eclipse Combustion, Inc.
   d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
   e. Invensys.
   f. Maxitrol Company.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 2 psig (13.8 kPa).

2.8 DIELECTRIC UNIONS

A. Dielectric Unions:

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. Central Plastics Company.
   d. Jomar International Ltd.
   e. McDonald, A. Y. Mfg. Co.
   f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   g. Wilkins; a Zurn company.

2. Description:

   b. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
   c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.9 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

PART 3 - EXECUTION

3.1 OUTDOOR PIPING INSTALLATION


B. Install underground, natural-gas piping buried at least 36 inches (900 mm) below finished grade. Comply with requirements in Division 31 Section “Earth Moving” for excavating, trenching, and backfilling.

   1. If natural-gas piping is installed less than 36 inches (900 mm) below finish grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Steel Piping with Protective Coating:

   1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
   2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

E. Install fittings for changes in direction and branch connections.

F. Install pressure gage port downstream from each service regulator.

3.2 INDOOR PIPING INSTALLATION


B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. 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.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

   1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
Q. Connect branch piping from top or side of horizontal piping.

R. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment.

S. Do not use natural-gas piping as grounding electrode.

T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

U. Install sleeves for piping penetrations of walls, ceilings, and floors. Seal tight according to manufacturer’s installation instructions.

3.3 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing. Ref. also Par. 2.6 herein.

E. Install anode for metallic valves in underground PE piping.

3.4 PIPING 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:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. 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. Welded Joints:

2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.5 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

C. 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).

D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).
2. NPS 1/2 (DN 15): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
3. NPS 3/4 (DN 20) and Larger: Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).

3.6 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.7 LABELING AND IDENTIFYING

A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.
3.8 FIELD QUALITY CONTROL

A. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.

B. Natural-gas piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be one of the following:
   1. PE pipe and fittings joined by heat fusion; service-line risers with tracer wire terminated in an accessible location.
   2. Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

B. Aboveground natural-gas piping shall be one of the following:
   1. Steel pipe with malleable-iron fittings and threaded joints for 0.5 psi and under.
   2. Steel pipe with wrought-steel fittings and welded joints for 2 psi and up.

C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.10 INDOOR PIPING SCHEDULE

A. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be the following:
   1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:
   1. Steel pipe with malleable-iron fittings and threaded joints.
   2. Steel pipe with wrought-steel fittings and welded joints.

C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

D. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.11 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.

B. Underground: PE or Bronze plug valves.
3.12 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be one of the following:
   1. One-piece, bronze ball valve with bronze trim.
   2. Two-piece, full-port, bronze ball valves with bronze trim.

B. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be one of the following:
   1. One-piece, bronze ball valve with bronze trim.
   2. Two-piece, full-port, bronze ball valves with bronze trim.

C. Valves in branch piping for single appliance shall be one of the following:
   1. One-piece, bronze ball valve with bronze trim.
   2. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION 231123
SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rectangular ducts and fittings.
   2. Round ducts and fittings.
   4. Sealants and gaskets.
   5. Hangers and supports.

B. Related Sections:
   1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
   2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

   1. Seismic Hazard Level D:

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings:

   1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
   2. Factory- and shop-fabricated ducts and fittings.
   3. Duct layout indicating sizes, configuration, and static-pressure classes.
   4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.4 INFORMATONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Penetrations of smoke barriers and fire-rated construction.
5. Items penetrating finished ceiling including the following:
   a. Lighting fixtures.
   b. Air outlets and inlets.
   c. Sprinklers.

B. Welding certificates.

1.5 QUALITY ASSURANCE


B. Welding Qualifications: Qualify procedures and personnel according to the following:


C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

D. ASHRAE Compliance: Applicable requirements in ASHRAE 90.1-2007, Section 6.4.4 - "HVAC System Construction and Insulation."
PART 2 - PRODUCTS

2.1 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 2-1, "Rectangular Duct/Transverse 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 2-2, "Rectangular Duct/Longitudinal Seams," 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 4, "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 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.

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. Lindab Inc.
   b. McGill AirFlow LLC.
   c. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse 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.

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," 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.

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "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. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

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 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, 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, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:
   1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
   2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
   3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. 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 on Shop Drawings and Coordination Drawings.

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, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. 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.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

D. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 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."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. 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 maximum intervals of 16 feet.

F. 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.

3.5 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.

3.6 DUCT CLEANING

A. Clean new 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. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
   a. Pressure Class: Positive 1-inch wg.
   b. Minimum SMACNA Seal Class: C.
   c. SMACNA Leakage Class for Rectangular: 24.
   d. SMACNA Leakage Class for Round and Flat Oval: 24.

2. Ducts Connected to Variable-Volume Air-Handling Units:
   a. Pressure Class: Positive 4-inch wg.
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 12.
   d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Constant-Volume Air-Handling Units:
   a. Pressure Class: Positive 2-inch wg.
   b. Minimum SMACNA Seal Class: B.
   c. SMACNA Leakage Class for Rectangular: 24.
   d. SMACNA Leakage Class for Round and Flat Oval: 24.

4. Ducts Connected to Equipment Not Listed Above:
   a. Pressure Class: Positive 2-inch wg.
   b. Minimum SMACNA Seal Class: B.
   c. SMACNA Leakage Class for Rectangular: 24.
   d. SMACNA Leakage Class for Round and Flat Oval: 24.
C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
   a. Pressure Class: Positive or negative 1-inch wg.
   b. Minimum SMACNA Seal Class: C.
   c. SMACNA Leakage Class for Rectangular: 24.
   d. SMACNA Leakage Class for Round and Flat Oval: 24.

2. Ducts Connected to Air-Handling Units:
   a. Pressure Class: Positive or negative 2-inch wg.
   b. Minimum SMACNA Seal Class: B.
   c. SMACNA Leakage Class for Rectangular: 24.
   d. SMACNA Leakage Class for Round and Flat Oval: 24.

3. Ducts Connected to Equipment Not Listed Above:
   a. Pressure Class: Positive or negative 2-inch wg.
   b. Minimum SMACNA Seal Class: B.
   c. SMACNA Leakage Class for Rectangular: 24.
   d. SMACNA Leakage Class for Round and Flat Oval: 24.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1-2007, Class 1 and 2) Air:
   a. Pressure Class: Negative 1-inch wg.
   b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
   c. SMACNA Leakage Class for Rectangular: 24.
   d. SMACNA Leakage Class for Round and Flat Oval: 24.

2. Ducts Connected to Air-Handling Units:
   a. Pressure Class: Positive or negative 2-inch wg.
   b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
   c. SMACNA Leakage Class for Rectangular: 24.
   d. SMACNA Leakage Class for Round and Flat Oval: 24.

3. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1-2007, Class 3 and 4) Air:
   a. Type 304, stainless-steel sheet.
   1) Exposed to View: No. 3 finish.
   2) Concealed: No. 2D finish.
   b. PVC-coated, galvanized sheet steel with thicker coating on duct interior.
   c. Pressure Class: Positive or negative 3-inch wg.
   d. Minimum SMACNA Seal Class: A.
   e. SMACNA Leakage Class: 3.

4. Ducts Connected to Equipment Not Listed Above:
a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 24.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
   a. Pressure Class: Positive or negative 1-inch wg.
   b. Minimum SMACNA Seal Class: C.
   c. SMACNA Leakage Class for Rectangular: 24.
   d. SMACNA Leakage Class for Round and Flat Oval: 24.

2. Ducts Connected to Air-Handling Units:
   a. Pressure Class: Positive or negative 2-inch wg.
   b. Minimum SMACNA Seal Class: B.
   c. SMACNA Leakage Class for Rectangular: 24.
   d. SMACNA Leakage Class for Round and Flat Oval: 24.

3. Ducts Connected to Equipment Not Listed Above:
   a. Pressure Class: Positive or negative 2-inch wg.
   b. Minimum SMACNA Seal Class: B.
   c. SMACNA Leakage Class for Rectangular: 24.
   d. SMACNA Leakage Class for Round and Flat Oval: 24.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.
2. PVC-Coated Ducts:
   a. Exposed to Airstream: Match duct material.
   b. Not Exposed to Airstream: Galvanized.

3. Stainless-Steel Ducts:
   a. Exposed to Airstream: Match duct material.
   b. Not Exposed to Airstream: Match duct material.

4. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
   a. Velocity 1000 fps or Lower:
      1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      2) Mitered Type RE 4 without vanes.
   b. Velocity 1000 to 1500 fps:
1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:
1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
   c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
      3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
      4) Radius-to-Diameter Ratio: 1.5.
   b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
   c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
   a. Rectangular Main to Rectangular Branch: 45-degree entry.
   b. Rectangular Main to Round Branch: Spin in.

2. Round and Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
   a. Velocity 1000 fpm or Lower: 90-degree tap.
   b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity Greater than 1500 fpm: 45-degree lateral.

END OF SECTION 233113
SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Backdraft and pressure relief dampers.
   3. Fire dampers.
   4. Flange connectors.
   5. Turning vanes.
   6. Duct-mounted access doors.
   7. Flexible connectors.
   8. Flexible ducts.
   9. Duct accessory hardware.

1.2 SUBMITTALS

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

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
   1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
      a. Special fittings.
      c. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
      d. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE


B. Comply with AMCA 500-D testing for damper rating

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. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.


E. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. 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. 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. Air Balance Inc.; a division of Mestek, Inc.
   2. American Warming and Ventilating; a division of Mestek, Inc.
   3. Cesco Products; a division of Mestek, Inc.
   5. Pottorff; a division of PCI Industries, Inc.
   6. Ruskin Company.
   7. SEMCO Incorporated.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2000 fpm (10 m/s).

D. Maximum System Pressure: 2-inch wg (0.5 kPa).

E. Frame: 0.052-inch- (1.3-mm-) thick, galvanized sheet steel, with welded corners and mounting flange.

F. 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.

G. Blade Action: Parallel.

H. Blade Seals: Neoprene, mechanically locked.

I. Blade Axles:
   1. Material: Nonferrous metal or Galvanized steel.
2. Diameter: 0.20 inch (5 mm).

J. Tie Bars and Brackets: Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings: Steel ball or synthetic pivot bushings.

M. 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: Galvanized steel.
6. Screen Type: Bird.
7. 90-degree stops.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

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. Air Balance Inc.; a division of Mestek, Inc.
   b. American Warming and Ventilating; a division of Mestek, Inc.
   c. McGill AirFlow LLC.
   d. METALAIRE, Inc.
   e. Pottorff; a division of PCI Industries, Inc.
   f. Ruskin Company.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. 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.

5. 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.

7. 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.

8. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

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. Air Balance Inc.; a division of Mestek, Inc.
   b. American Warming and Ventilating; a division of Mestek, Inc.
   c. McGill AirFlow LLC.
   d. METALAIRE, Inc.
   e. Pottorff; a division of PCI Industries, Inc.
   f. Ruskin Company.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames: Hat-shaped, 0.10-inch- (2.5-mm-) thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Roll-Formed Aluminum Blades: 0.10-inch- (2.5-mm-) thick aluminum sheet.
   e. Extruded-Aluminum Blades: 0.050-inch- (1.2-mm-) thick extruded aluminum.

7. 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.

8. Tie Bars and Brackets: Aluminum.

C. Jackshaft:

1. Size: 1-inch (25-mm) diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.
2.4  FIRE DAMPERS

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. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
5. McGill AirFlow LLC.
6. METALAIRE, Inc.
7. Pottorff; a division of PCI Industries, Inc.
8. Ruskin Company.

B. Type: Static; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 4000-fpm (20-m/s) velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Curtain type with blades inside airstream; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

   1. Minimum Thickness: 0.052 or 0.138 inch (1.3 or 3.5 mm) thick, as indicated, and of length to suit application.

   2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F (74 deg C) rated, fusible links.

K. Heat-Responsive Device: Electric resettable link and switch package, factory installed, 165 deg F (74 deg C) and 212 deg F (100 deg C) rated.

2.5  FLANGE CONNECTORS

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. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.6 TURNING VANES

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. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.

B. 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.


C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. 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."

E. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

2.7 DUCT-MOUNTED ACCESS DOORS

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. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
5. McGill AirFlow LLC.
6. Pottorff; a division of PCI Industries, Inc.


1. Door:
   a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.

c. Vision panel.

d. Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.

e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

3. Number of Hinges and Locks:

   a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.

   b. Access Doors up to 18 Inches (460 mm) Square: Two hinges and two sash locks.

   c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches with outside and inside handles.

   d. Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm): Four hinges and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

   1. Door and Frame Material: Galvanized sheet steel.

   2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.

   3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.

   4. Factory set at 10-inch wg (2500 Pa).

   5. Doors close when pressures are within set-point range.

   6. Hinge: Continuous piano.

   7. Latches: Cam.

   8. Seal: Neoprene or foam rubber.

   9. Insulation Fill: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.

2.8 DUCT ACCESS PANEL ASSEMBLIES

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. Ductmate Industries, Inc.

   2. Flame Gard, Inc.

   3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0528-inch (1.3-mm) carbon steel.

D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F (1093 deg C).

F. Minimum Pressure Rating: 10-inch wg (2500 Pa), positive or negative.

2.9 FLEXIBLE CONNECTORS

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. Ductmate Industries, Inc.
2. Duro Dyne Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

   1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
   2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
   3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

   1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
   2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
   3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).

G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
   1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
   2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   3. Minimum Additional Travel: 50 percent of the 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. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
   7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

2.10 FLEXIBLE DUCTS

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. Flexmaster U.S.A., Inc.
   2. McGill AirFlow LLC.

B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.
   1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
   2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).

C. Noninsulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire.
   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).

D. Noninsulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire.
   1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
   2. Maximum Air Velocity: 4000 fpm (20 m/s).
   3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).

E. Noninsulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire.
   1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
   2. Maximum Air Velocity: 4000 fpm (20 m/s).
   3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).

F. Noninsulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil.
   1. Pressure Rating: 8-inch wg (2280 Pa) positive or negative.
   3. Temperature Range: Minus 100 to plus 435 deg F (Minus 73 to plus 224 deg C).

G. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
   1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
   2. Maximum Air Velocity: 4000 fpm (20 m/s).
   3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).

H. 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).

I. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
   1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
   2. Maximum Air Velocity: 4000 fpm (20 m/s).
   3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).
J. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).

K. Insulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.

1. Pressure Rating: 8-inch wg (2280 Pa) positive or negative.
3. Temperature Range: Minus 20 to plus 250 deg F (Minus 29 to plus 121 deg C).

L. Flexible Duct Connectors:

1. Clamps: Nylon strap in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.

2.11 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. 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.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. 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.
2. Install aluminum volume dampers in aluminum ducts.
E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
2. Control devices requiring inspection.
3. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).

K. Install flexible connectors to connect ducts to equipment.

L. Connect terminal units to supply ducts directly or with maximum 6-inch (300-mm) lengths of flexible duct. Do not use flexible ducts to change directions.

M. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.

N. Connect flexible ducts to metal ducts with draw bands.

O. Install duct test holes where required for testing and balancing purposes.

P. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

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. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
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SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Centrifugal roof ventilators.

1.2 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Wiring Diagrams: For power, signal, and control wiring.
   3. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Twin City.
   3. Hartzell Fan Incorporated.
   4. Loren Cook Company.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
   1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
D. Belt Drives:
   1. Resiliently mounted to housing.
   2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
   5. Fan and motor isolated from exhaust airstream.

E. 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.
   5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

F. 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: 12 inches (300 mm).

2.2 MOTORS
A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
   2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

B. Enclosure Type: Totally enclosed, fan cooled.

2.3 SOURCE QUALITY CONTROL
A. Certify sound-power level ratings according to 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. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Division 07 Architectural Section "Roof Accessories" for installation of roof curbs.

B. Install units with clearances for service and maintenance.

C. 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 "Control-Voltage Electrical Power Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

   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.
C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in 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 235400 - FURNACES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Gas-fired, condensing furnaces and accessories complete with controls.
   2. Air filters.
   3. Refrigeration components.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each of the following:
   1. Furnace.
   2. Thermostat.
   3. Air filter.
   4. Refrigeration components.

B. Operation and maintenance data.

C. Warranty.

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.


D. Comply with NFPA 70.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:
   1. Warranty Period, Commencing on Date of Substantial Completion:
      a. Furnace Heat Exchanger: 10 years.
      b. Integrated Ignition and Blower Control Circuit Board: Five years.
      d. Refrigeration Compressors: 5 years.
      e. Condenser Coils: Five years.
PART 2 - PRODUCTS

2.1 GAS-FIRED FURNACES, CONDENSING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carrier Corporation.
   2. Lennox.
   4. Daikin.


C. Cabinet: Steel.
   1. Cabinet interior around heat exchanger shall be factory-installed insulation.
   2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
   3. Factory paint external cabinets in manufacturer's standard color.

D. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.
   1. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
   2. Special Motor Features: Single speed, Premium (TM) efficiency, as defined in Division 23 Section "Common Motor Requirements for HVAC Equipment," and with internal thermal protection and permanent lubrication.
   3. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.
   4. Special Motor Features: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.

E. Type of Gas: Natural.

F. Heat Exchanger:
   1. Primary: Aluminized steel.

G. Burner:
   1. Gas Valve: 100 percent safety main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
   2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.

H. Gas-Burner Safety Controls:
   1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
   2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
   3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.
I. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.

J. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories; diagnostic light with viewport.

K. Accessories:
   1. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through roof.
   2. CPVC Plastic Vent Materials.
      a. CPVC Plastic Pipe: Schedule 40, complying with ASTM F 441/F 441M.
      b. CPVC Plastic Fittings: Schedule 40, complying with ASTM F 438, socket type.
      c. CPVC Solvent Cement: ASTM F 493.
         1) Use CPVC solvent cement that has a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
         2) Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. PVC Plastic Vent Materials:
      b. PVC Plastic Fittings: Schedule 40, complying with ASTM D 2466, socket type.
      c. PVC Solvent Cement: ASTM D 2564.
         1) Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
         2) Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2 THERMOSTATS

A. Solid-State Thermostat: Wall-mounting, programmable, microprocessor-based unit with manual switching from heating to cooling, preferential rate control, seven-day programmability with minimum of four temperature presets per day, and battery backup protection against power failure for program settings.

B. Control Wiring: Unshielded twisted-pair cabling.
   1. No. 24 AWG, 100 ohm, four pair.

C. Controls shall comply with requirements in ASHRAE/IESNA 90.1-2007, "Controls."

2.3 AIR FILTERS

A. Disposable Filters: 1-inch- (25-mm-) thick fiberglass media with ASHRAE 52.2 MERV rating of 6 or higher in sheet metal frame.

2.4 REFRIGERATION COMPONENTS
A. General Refrigeration Component Requirements:

1. Refrigeration compressor, coils, and specialties shall be designed to operate with CFC-free refrigerants.


1. Refrigerant Coil Enclosure: Steel, matching furnace and evaporator coil, with access panel and flanges for integral mounting at or on furnace cabinet and galvanized sheet metal drain pan coated with black asphaltic base paint.

C. Refrigerant Line Kits: Annealed-copper suction and liquid lines factory cleaned, dried, pressurized with nitrogen, sealed, and with suction line insulated. Provide in standard lengths for installation without joints, except at equipment connections.

1. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I, 1 inch (25 mm) thick.

D. Refrigerant Piping: Comply with requirements in Division 23 Section "Refrigerant Piping."

E. Air-Cooled, Compressor-Condenser Unit:

1. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed scroll type.
   a. Crankcase heater.
   b. Vibration isolation mounts for compressor.
   c. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
   d. Two-speed compressor motors shall have manual-reset high-pressure switch and automatic-reset low-pressure switch.
   e. Refrigerant Charge: R-410A.
   f. Refrigerant: R-410A.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
5. Fan: Aluminum-propeller type, directly connected to motor.
7. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.
B. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

1. Install seismic restraints to limit movement of furnace by resisting code-required seismic acceleration.

C. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.

1. Anchor furnace to substrate to resist code-required seismic acceleration.

D. Controls: Install thermostats and humidistats at mounting height of 60 inches (1500 mm) above floor.

E. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.

F. Install ground-mounted, compressor-condenser components on 4-inch- (100-mm-) thick, reinforced concrete base; 4 inches (100 mm) larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

G. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

3.2 CONNECTIONS

A. Gas piping installation requirements are specified in Division 23 Section "Facility Natural-Gas Piping." Drawings indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and arrangement that will protect against entry of birds, insects, and dirt.

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

   a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
   c. 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.
   d. Requirements for Low-Emitting Materials:

      1) Use CPVC solvent cement that has a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      2) Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      3) Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Slope pipe vent back to furnace or to outside terminal.

D. Connect ducts to furnace with flexible connector. Comply with requirements in Division 23 Section "Air Duct Accessories."

E. Connect refrigerant tubing kits to refrigerant coil in furnace and to air-cooled, compressor-condenser unit.

   1. Flared Joints: Use ASME B16.26 fitting and flared ends, following procedures in CDA's "Copper Tube Handbook."

F. Complete installation and startup checks and start units according to manufacturer's written instructions.

G. Verify proper operation of capacity control device.

H. Adjust airflow and initial temperature and humidity set points.

I. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

J. After completing installation, clean furnaces internally according to manufacturer's written instructions.

K. Install new filters in each furnace within 14 days after Substantial Completion.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

   1. Perform electrical test and visual and mechanical inspection.
   2. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
   4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
   5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

END OF SECTION 235400
SECTION 235523 - GAS-FIRED RADIANT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes gas-fired, tubular infrared and high-intensity infrared radiant heaters.

1.2 SUBMITTALS

A. Product Data: For each type of gas-fired radiant heater indicated. Include rated capacities, operating characteristics, and accessories.

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.

C. Field quality-control test reports.

D. Operation and maintenance data.

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.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of gas-fired radiant heater that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INFRARED RADIANT HEATERS

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. Roberts-Gordon, Inc.
   2. Schwank Inc.
   3. Solaronics, Inc.
   4. Sterling HVAC Products
B. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.20/CSA 2.34.

C. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

D. Combustion Tubing: 4-inch- (100-mm-) diameter steel with high-emissivity, high-temperature, corrosion-resistant external finish.

E. Tubing Connections: Stainless-steel couplings or flared joints with stainless-steel draw bolts.

F. Reflector: Polished aluminum, 97 percent minimum reflectivity, with end caps. Shape to control radiation from tubing for uniform intensity at floor level with 100 percent cutoff above centerline of tubing. Provide for rotating reflector or heater around a horizontal axis for minimum 30-degree (0.52-radian) tilt from vertical.

1. Reflector Extension Shields: Same material as reflectors, arranged for fixed connection to lower reflector lip and rigid support to provide 100 percent cutoff of direct radiation from tubing at angles greater than 30 degrees (0.52 radians) from vertical.

2. Include hanger kit.

G. Burner Safety Controls:

1. Gas Control Valve: Single-stage, regulated redundant 24-V ac gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.

2. Blocked Vent Safety: Differential pressure switch in burner safety circuit to stop burner operation with high discharge or suction pressure.

3. Control Panel Interlock: Stops burner if panel is open.


H. Burner and Emitter Type: Gravity-vented power burner, with the following features:

1. Emitter Tube: 4-inch- (100-mm-) diameter, hot-rolled-steel tubing with sight glass for burner and pilot flame observation.

2. Venting: Connector at exit end of emitter tubing for vent-pipe connection


5. Combustion-Air Connection: Duct connection for combustion air to be drawn directly from outdoors by burner fan.

2.2 HIGH-INTENSITY INFRARED RADIANT HEATERS

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. Roberts-Gordon, Inc.

2. Schwank Inc.

3. Solaronics, Inc.

4. Sterling HVAC Products

B. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.19A/CSA 2.35A, "Gas-Fired, High-Intensity Infrared Heaters."
C. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

D. Burner: Aluminized-steel plenum chamber with stainless-steel retainers and direct spark ignition.

E. Emitter: Ceramic combustion surface.

F. Reflector: Polished aluminum.

G. Accessories:
   1. Parabolic reflector.
   2. Wire grid for increased efficiency.
   3. Protective screen.
   5. Stainless-steel flexible connector with manual valve.
   7. Preassembled chain suspension kit.

2.3 CONTROLS

A. Modulating Heating Control:
   1. Control shall provide for modulation of the system firing rate based on outdoor air temperature. At external design temperature conditions, the system shall provide 100% input. Where conditions are milder than external design temperatures, the system shall modulate input continuously (not staged) between 60% and 100% input.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and connect gas-fired radiant heaters and associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written installation instructions.

B. Suspended Units: Suspend from substrate using chain hanger kits and building attachments.

C. Maintain manufacturers' recommended clearances to combustibles.

D. Install piping adjacent to gas-fired radiant heaters to allow service and maintenance.

E. Gas Piping: Comply with Division 23 Section "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.

F. Vent Connections: Comply with manufacturer's installation instructions.

G. Electrical Connections: Comply with applicable requirements in Division 26 Sections.

   1. Install electrical devices furnished with heaters but not specified to be factory mounted.

H. Adjust initial temperature set points.

I. Adjust burner and other unit components for optimum heating performance and efficiency.
3.2 FIELD QUALITY CONTROL

A. Tests and Inspections: Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 235523
SECTION 237333 - INDOOR, DIRECT GAS-FIRED HEATING AND VENTILATING UNITS

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes direct-fired H&V units.

1.2 SUBMITTALS
A. Product Data: Include rated capacities, furnished specialties, and accessories.
B. Shop Drawings:
   1. Mounting Details: For securing and flashing roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
   2. Wiring Diagrams: Power, signal, and control wiring.
C. Operation and maintenance data.

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.
C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

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:
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Cambridge Engineering, Inc.
5. Reznor-Thomas & Betts Corporation; Mechanical Products Division.
6. Sterling Gas; Mestek, Inc.

2.2 PACKAGED UNITS

A. Factory-assembled, prewired, self-contained unit consisting of cabinet, supply fan, controls, filters, and direct-fired gas furnace to be installed outside the building.

2.3 CABINET

A. Cabinet: Double-wall galvanized-steel panels, formed to ensure rigidity and supported by galvanized-steel channels or structural channel supports with lifting lugs. Cabinet shall be fully weatherized for outside installation.

B. Access Panels: Piano hinged with cam-lock fasteners for furnace and fan motor assemblies on both sides of unit.

C. Internal Insulation: Fibrous-glass duct lining, comply with ASTM C 1071, Type II, applied on complete unit.

1. Thickness: 1 inch (25 mm).
2. Insulation Adhesive: Comply with ASTM C 916, Type I.
3. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to casing without damaging liner when applied as recommended by manufacturer and without causing air leakage.

D. Finish: Heat-resistant, baked enamel.

E. Discharge: Horizontal-pattern, galvanized-steel assembly with diffusers incorporating individually adjustable vanes.

F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

2.4 SUPPLY-AIR FAN

A. Fan Type: Centrifugal, rated according to AMCA 210; statically and dynamically balanced, galvanized steel; mounted on solid-steel shaft with heavy-duty, self-aligning, permanently lubricated ball bearings.

B. Motor: Open dripproof, single-speed motor.

C. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly.

D. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with spring isolators.

2.5 OUTDOOR-AIR INTAKE

A. Outdoor-Air Hood: Galvanized steel with rain baffles, bird screen complying with ASHRAE 62.1-2007, and finish to match cabinet; and sized to supply maximum 100 percent outdoor air.
2.6 AIR FILTERS
A. Comply with NFPA 90A.
B. Cleanable Filters: 1-inch- (25-mm) thick, cleanable metal mesh.

2.7 DAMPERS
A. Outdoor-Air Damper: Galvanized-steel, opposed-blade dampers with vinyl blade seals and stainless-steel jamb seals, having a maximum leakage of 10 cfm/sq. ft. (51 L/s per sq. m) of damper area, at differential pressure of 2-inch wg (448 Pa).
B. Fan-Discharge Dampers: Galvanized-steel, opposed-blade damper.
C. Balancing/Bypass Dampers: Galvanized-steel, opposed-blade damper.
D. Damper Operator: Direct coupled, electronic with spring return or fully modulating as required by the control sequence.

2.8 DIRECT-FIRED GAS FURNACE
A. Description: Factory assembled, piped, and wired; and complying with ANSI Z83.4, "Direct Gas-Fired Make-Up Air Heaters"; ANSI Z83.18, "Direct Gas-Fired Industrial Air Heaters"; and NFPA 54, "National Fuel Gas Code."
B. Inside Unit External Housing: Steel cabinet with integral support inserts.
C. Outside Unit External Housing: Weatherproof steel cabinet with integral support inserts.
   1. External Casing and Cabinet Finish: Baked enamel over corrosion-resistant-treated surface in color to match fan section.
D. Burners: Cast-iron burner with stainless-steel mixing plates.
E. Safety Controls:
   1. Gas Manifold: Safety switches and controls to comply with ANSI standards and FMG.
   3. Airflow Proving Switch: Dual pressure switch senses correct airflow before energizing pilot and requires airflow to be maintained within minimum and maximum pressure settings across burner.
   5. Gas Train: Redundant, automatic main gas valves, electric pilot valve, electronic-modulating temperature control valve, main and pilot gas regulators, main and pilot manual shutoff valves, main and pilot pressure taps, and high-low gas pressure switches to comply with FMG requirements.
   6. Safety Lockout Switch: Locks out ignition sequence if burner fails to light after three tries. Controls are reset manually by turning the unit off and on.
7. **Control Transformer:** Integrally mounted 24-V ac.

### 2.9 CONTROLS

**A.** Factory-wired, fuse-protected control transformer, connection for power supply and field-wired unit to remote control panel.

**B.** Control Panel: Recessed, with trim ring remote panel, with engraved plastic cover, and the following lights and switches:

1. On-off-auto switch.
2. Summer-winter switch.
4. Heating operation indicating light.
5. Damper position potentiometer.
6. Thermostat.
7. Dirty-filter indicating light operated by unit-mounted differential pressure switch.
8. Safety-lockout indicating light.

**C.** Control Devices:

3. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
4. Fire-Protection Thermostats: Fixed or adjustable settings to operate at not less than 75 deg F (24 deg C) above normal maximum operating temperature.
5. Timers: Seven-day, programming-switch timer with synchronous-timing motor and seven-day dial; continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover; multiple-switch trippers; minimum of two and maximum of eight signals per day with two normally open and two normally closed output contacts.
6. Ionization-Type Smoke Detectors: 24-V dc, nominal; self-restoring; plug-in arrangement; integral visual-indicating light; sensitivity that can be tested and adjusted in place after installation; integral addressable module; remote controllability; responsive to both visible and invisible products of combustion; self-compensating for changes in environmental conditions.

**D.** Fan Control: Interlock fan to start with exhaust fan(s). See Division 23 Section "HVAC Power Ventilators."

**E.** Outdoor-Air Damper Control, 100 Percent Outdoor-Air Units: Outdoor-air damper shall open when supply fan starts, and close when fan stops.

**F.** Outdoor-Air and Fan-Discharge Damper Control, 100 Percent Outdoor-Air Units:

1. Outdoor-air damper shall open when supply fan starts, and close when fan stops.
2. Fan-discharge dampers shall operate to vary the amount of outdoor air to match exhaust-fan operation.

**G.** Outdoor-Air and Balancing/Bypass Damper Control, Variable Outdoor-Air Units:

1. Outdoor-air damper shall open when supply fan starts, and close when fan stops.
2. Balancing/bypass dampers shall modulate to maintain minimum air velocity through burner.
H. Outdoor-Air, Balancing/Bypass, and Return-Air Damper Control:

1. Outdoor-air damper shall open when supply fan starts, and close when fan stops.
2. Balancing/bypass dampers shall modulate to maintain minimum air velocity through the burner.

I. Temperature Control: Operates gas valve to maintain supply-air or room temperature.

1. Operates gas valve to maintain discharge-air temperature with factory-mounted sensor in fan outlet.
2. Operates gas valve to maintain space temperature with wall-mounting, field-wired sensor with temperature adjustment.
3. Timer shall select remote setback thermostat to maintain space temperature at 50 deg F (10 deg C).

2.10 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gas-fired units according to NFPA 54, "National Fuel Gas Code."

B. Install suspended units from spring hangers with minimum 1-inch (25-mm) static deflection; refer to Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Install floor-mounted units on spring isolators with minimum 1-inch (25-mm) static deflection; refer to Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

D. Install controls and equipment shipped by manufacturer for field installation with direct-fired H&V units.

E. Piping Connections: Drawings indicate general arrangement of piping, fittings, and specialties. Install piping adjacent to machine to allow service and maintenance.

1. Gas Piping: Comply with requirements in Division 23 Section "Facility Natural-Gas Piping."
   Connect gas piping with shutoff valve and union and with sufficient clearance for burner removal and service. Provide AGA-approved flexible connectors.

F. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts."
   Drawings indicate the general arrangement of ducts. Connect supply ducts to direct-fired H&V units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories."

G. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

H. Connect wiring according to Division 26 Section "Control-Voltage Electrical Power Cables."

END OF SECTION 237333
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SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Ref. Section 235400, Furnaces.

END OF SECTION 238126
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SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sleeves for raceways and cables.
   2. Sleeve seals.
   4. Common electrical installation requirements.

1.2 SUBMITTALS

A. Product Data: For sleeve seals.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.
   1. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
      b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   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. Advance Products & Systems, Inc.
      b. Metraflex Co.
      c. Pipeline Seal and Insulator, Inc.
2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.
B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
E. Cut sleeves to length for mounting flush with both surfaces of walls.
F. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.
G. Seal space outside of sleeves with grout for penetrations of concrete and masonry.
1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

H. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

I. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

J. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

L. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260500
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SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. UTP cabling.
   2. RS-232 cabling.
   3. Low-voltage control cabling.
   5. Identification products.

1.2 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

B. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

1.3 SUBMITTALS

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

B. Field quality-control reports.

C. Maintenance data.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of an NRTL.

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: 50 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

B. Test each pair of UTP cable for open and short circuits.
PART 2 - PRODUCTS

2.1 PATHWAYS

A. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

B. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 48 inches (19 by 1220 by 1220 mm).

2.3 UTP CABLE

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. Belden CDT Inc.; Electronics Division.
2. CommScope, Inc.
3. Draka USA.
4. Genesis Cable Products; Honeywell International, Inc.
5. KRONE Incorporated.
6. Mohawk; a division of Belden CDT.
7. Nordex/CDT; a subsidiary of Cable Design Technologies.
8. Superior Essex Inc.
9. SYSTIMAX Solutions; a CommScope, Inc. brand.
10. 3M.
11. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. Description: 100-ohm, four-pair UTP.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
   a. Communications, General Purpose: Type CM or Type CMG.
   b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
   c. Communications, Riser Rated: Type CMR, complying with UL 1666.
   d. Communications, Limited Purpose: Type CMX.
   e. Multipurpose: Type MP or Type MPG.
   f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
   g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.
2.4 UTP CABLE HARDWARE

A. 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. Dynacom Corporation.
3. Hubbell Premise Wiring.
4. KRONE Incorporated.
5. Leviton Voice & Data Division.
6. Molex Premise Networks; a division of Molex, Inc.
7. Nordex/CDT; a subsidiary of Cable Design Technologies.
8. Panduit Corp.
10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

C. Connecting Blocks: 110 style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare; integral with connector bodies, including plugs and jacks where indicated.

2.5 RS-232 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.

2.6 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

C. Paired Cable: NFPA 70, Type CMG.
   1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
   2. PVC insulation.
   3. Unshielded.
   4. PVC jacket.
   5. Flame Resistance: Comply with UL 1581.

D. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
   1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
   2. Fluorinated ethylene propylene insulation.
   3. Unshielded.

2.7 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, complying with UL 44.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, power-limited cable, concealed in building finishes, complying with UL 44.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

2.8 IDENTIFICATION PRODUCTS

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. Brady Corporation.
   2. HellermannTyton.
   3. Kroy LLC.
   4. Panduit Corp.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

PART 3 - EXECUTION
3.1 INSTALLATION OF PATHWAYS

A. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

B. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

C. Install manufactured conduit sweeps and long-radius elbows if possible.

D. Pathway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed or in the corner of room if multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard if entering room from overhead.
4. Extend conduits 3 inches (75 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

E. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. 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.
5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
6. 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.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

2. Install 110-style IDC termination hardware unless otherwise indicated.
3. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:
1. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (305 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (305 mm).
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.3 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables.

3.4 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits, No 12 AWG.

3.5 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING


B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling according to TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect UTP cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.

2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Test UTP 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 after cross connection.

   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

C. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.
END OF SECTION 260523
PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes: Grounding systems and equipment.

1.2 SUBMITTALS
A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 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:
   4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
   5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   6. 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.
   7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 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. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
   1. Pipe Connectors: Clamp type, sized for pipe.
C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m) in diameter.

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. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. 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 Ground Rods at Test Wells: Bolted connectors.

3.2 EQUIPMENT GROUNDING

A. 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.
   8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
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. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
   1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
   2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
   3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

E. Metal 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.

3.3 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 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.
   2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. 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.

D. 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 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.
E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

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 ground test wells. Make tests at ground rods before any conductors are connected.

B. 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 and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

C. 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 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.

1.2 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 SUBMITTALS

A. Product Data: For steel slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Equipment supports.

C. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Allied Tube & Conduit.

b. Cooper B-Line, Inc.; a division of Cooper Industries.

c. ERICO International Corporation.

d. GS Metals Corp.

e. Thomas & Betts Corporation.

f. Unistrut; Tyco International, Ltd.

g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.

4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

   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) Hilti Inc.

      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

      3) MKT Fastening, LLC.

      4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

   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) Cooper B-Line, Inc.; a division of Cooper Industries.

      2) Empire Tool and Manufacturing Co., Inc.

      3) Hilti Inc.

      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.

5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.

6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.

7. To Light Steel: Sheet metal screws.

8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Touchup: 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.

1. Apply paint by brush or spray to provide 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 260529
SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
   A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 SUBMITTALS
   A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

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.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING
   A. Rigid Steel Conduit: ANSI C80.1.
   B. IMC: ANSI C80.6.
   C. EMT: ANSI C80.3.
   D. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
      2. Fittings for EMT: Steel, compression type.

2.2 NONMETALLIC CONDUIT AND TUBING
   B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
   C. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
   D. LFNC and FNC
2.3 METAL WIREWAYS

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. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type or As indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS

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. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.5 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Thomas & Betts Corporation.
   c. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Butler Manufacturing Company; Walker Division.
   b. Enduro Systems, Inc.; Composite Products Division.
   c. Hubbell Incorporated; Wiring Device-Kellems Division.
2.6 BOXES, ENCLOSURES, AND CABINETS

A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

D. Metal Floor Boxes: Cast metal, semi-adjustable, rectangular.

E. Nonmetallic Floor Boxes: Nonadjustable, round.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

H. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

I. Cabinets:
   1. NEMA 250, Type 1, 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.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
   1. Exposed Conduit: IMC.
   2. Concealed Conduit, Aboveground: RNC, Type EPC-40-PVC.
   4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.
   5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Physical Damage: IMC. Includes raceways in the following locations:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
   d. Truck Bays.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: IMC.
6. Raceways for Optical Fiber or Communications Cable: EMT.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, nonmetallic in damp or wet locations.

C. Minimum Raceway Size: 1/2-inch (16-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.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
J. 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.

K. Raceways for Optical Fiber and Communications Cable: Install as follows:
   1. 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
   2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
   3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

L. Install raceway sealing fittings at suitable, approved, and accessible locations 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. Install raceway sealing fittings at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where otherwise required by NFPA 70.

M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit 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).
   1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
      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 the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
      d. Attics: 135 deg F (75 deg C) temperature change.
   2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.
   3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

N. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures, 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.

O. 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.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:
1. 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 as specified in Division 31 Section "Earth Moving."

2. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.

3. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
   b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

4. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of conduit.

3.4 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260533
SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Identification for raceways.
   2. Identification of power and control cables.
   3. Identification for conductors.
   5. Warning labels and signs.
   6. Instruction signs.
   7. Equipment identification labels.
   8. Miscellaneous identification products.

1.2 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.
B. Comply with NFPA 70.
D. Comply with ANSI Z535.4 for safety signs and labels.
E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
B. Colors for Raceways Carrying Circuits at 600 V or Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage.
C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage.

C. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

D. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 UNDERGROUND-LINE WARNING TAPE

A. Tape:
   1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
   2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE, ...
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.6 WARNING LABELS AND SIGNS


B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.7 INSTRUCTION SIGNS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.

G. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 21-foot (7-m) maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

2. Power.
3. UPS.
4. Fire alarm

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.

b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum 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. Locate bands to avoid obscuring factory cable markings.

D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.
J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
   a. Indoor Equipment: Adhesive film label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 260553
SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following lighting control devices:

1. Time switches.
2. Outdoor photoelectric switches.
3. Indoor occupancy sensors.
4. Outdoor motion sensors.
5. Lighting contactors.

B. See Division 26 Section "Network Lighting Controls" for low-voltage, manual and programmable lighting control systems.

C. See Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.2 SUBMITTALS

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

B. Operation and maintenance data.

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.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

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. Intermatic, Inc.
3. Lightolier Controls; a Genlyte Company.
4. Lithonia Lighting; Acuity Lighting Group, Inc.
5. Paragon Electric Co.; Invensys Climate Controls.
6. Square D; Schneider Electric.
7. TORK.
8. Watt Stopper (The).
B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.

1. Contact Configuration: SPST.
2. Contact Rating: 30-A inductive or resistive, 240-V ac.
3. Program: 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
4. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
5. Astronomic Time: All channels.
6. Battery Backup: For schedules and time clock.

C. Electromechanical-Dial Time Switches: Type complying with UL 917.

1. Contact Configuration: SPST.
2. Contact Rating: 30-A inductive or resistive, 240-V ac.
3. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
4. Astronomic time dial.
5. Eight-Day Program: Uniquely programmable for each weekday and holidays.
6. Skip-a-day mode.
7. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of 16 hours.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

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. Intermatic, Inc.
2. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Square D; Schneider Electric.
5. TORK.
6. Watt Stopper (The).

B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
2. Time Delay: 15-second minimum, to prevent false operation.
4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 INDOOR OCCUPANCY SENSORS

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. Hubbell Lighting.
3. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Sensor Switch, Inc.
5. TORK.
6. Watt Stopper (The).

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:
   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lx); keep lighting off when selected lighting level is present.

C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of sound and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.

2.4 OUTDOOR MOTION SENSORS (PIR)

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. Hubbell Lighting.
2. Lithonia Lighting; Acuity Lighting Group, Inc.
4. RAB Lighting, Inc.
5. TORK.

B. Performance Requirements: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F (minus 40 to plus 54 deg C), rated as raintight according to UL 773A.

1. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Mounting:
   a. Sensor: Suitable for mounting in any position on a standard outdoor junction box.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

3. Bypass Switch: Override the on function in case of sensor failure.

4. Automatic Light-Level Sensor: Adjustable from 1 to 20 fc (11 to 215 lx); keep lighting off during daylight hours.

C. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).

D. Detection Coverage: Up to 35 feet (11 m), with a field of view of 180 degrees.

E. Lighting Fixture Mounted Sensor: Suitable for switching 300 W of tungsten load at 120- or 277-V ac.

F. Individually Mounted Sensor: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
   1. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
   2. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

2.5 LIGHTING CONTACTORS

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. ASCO Power Technologies, LP; a division of Emerson Electric Co.
   4. GE Industrial Systems; Total Lighting Control.
   5. Hubbell Lighting.
   6. Lithonia Lighting; Acuity Lighting Group, Inc.
   8. Square D; Schneider Electric.
   9. TORK.
   10. Watt Stopper (The).

B. Description: Electrically operated and electrically held, combination type with fusible switch, complying with NEMA ICS 2 and UL 508.
   1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
   2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
   3. Enclosure: Comply with NEMA 250.
   4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.
C. BAS Interface: Provide hardware interface to enable the BAS to monitor and control lighting contactors.
   2. Control: On-off operation.

2.6 EMERGENCY SHUNT RELAY

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. Lighting Control and Design, Inc.

B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual switching contacts; complying with UL 924.
   1. Coil Rating: 120 V.

2.7 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 16 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

B. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION
A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

END OF SECTION 260923
SECTION 260943 - NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes manually operated lighting controls with relays and control module.

B. Related Sections:

1. Division 26 Section "Lighting Control Devices" for time clocks, photoelectric sensors, occupancy sensors, and multipole contactors.

1.2 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.

C. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.

1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.

2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.

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. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

D. Comply with NFPA 70.

1.4 COORDINATION
A. Coordinate lighting control components to form an integrated interconnection of compatible components.

B. Coordinate lighting control components specified in this Section with components specified in Division 26 Section "Panelboards."

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Failure of software input/output to execute switching or dimming commands.
   b. Failure of modular relays to operate under manual or software commands.
   c. Damage of electronic components due to transient voltage surges.

2. Warranty Period: Two years from date of Substantial Completion.

3. Extended Warranty Period Failure Due to Transient Voltage Surges: Eight years.

4. Extended Warranty Period for Electrically Held Relays: 10 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. Acuity Brands Lighting, Inc.; Lithonia Lighting brand.
3. Lighting Control & Design, Inc.
4. Lightolier Controls; a division of Genlyte Group, LLC.
5. Lutron Electronics Co., Inc.
7. Square D; a brand of Schneider Electric.
8. Watt Stopper/Legrand?.

2.2 SYSTEM REQUIREMENTS

A. Expandability: System shall be capable of increasing the number of control functions in the future by 25 percent of current capacity; to include equipment ratings, housing capacities, spare relays, terminals, number of conductors in control cables, and control software.

B. Performance Requirements: Manual switch operation sends a signal to network-system control module that processes the signal according to its programming and routes an open or close command to one or more relays in the power-supply circuits to groups of lighting fixtures or other loads.

C. Performance Requirements: Manual switches, an internal timing and control unit, and external sensors or other control signal sources send a signal to a PC-based network-system control module that processes the signal according to its programming and routes an open or close command to one or more relays in
the power-supply circuits, or routes variable commands to one or more dimmers, for groups of lighting fixtures or other loads.

2.3 CONTROL MODULE

A. Control Module Description: Comply with UL 916 (CSA C22.2, No. 205); microprocessor-based, solid-state, 365-day timing and control unit. Unit shall be networked for control of indicated number of output circuits. Output circuits shall be switched on or off by internally programmed time signals or by program-controlled analog or digital signals from external sources. Output circuits shall be pilot-duty relays compatible with power switching devices, all located in other enclosures. An integral keypad shall provide local programming and control capability. A key-locked cover and a programmed security access code shall protect keypad use. An integral alphanumeric LCD shall display manual-control and programming steps. Modules and their associated control panels shall include the following features:

1. Multiple inputs for indicated occupancy sensors and hand-held programming device.

2.4 POWER DISTRIBUTION COMPONENTS

A. Modular Relay Panel: Comply with UL 508 (CAN/CSA C22.2, No. 14) and UL 916 (CSA C22.2, No. 205); factory assembled with modular single-pole relays, power supplies, and accessory components required for specified performance.

1. Cabinet: Steel with hinged, locking door.
   a. Barriers separate low-voltage and line-voltage components.
   b. Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device if any.
   c. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.

2. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type.
   a. Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
   c. Endurance: 50,000 cycles at rated capacity.

B. Electrically Operated, Molded-Case Circuit-Breaker Panelboard: Comply with NEMA PB 1 and UL 50 (CAN/CSA C22.2, No. 94), UL 67 (CSA C22.2, No. 29), UL 489 (CAN/CSA C22.2, No. 65), and UL 916 (CSA C22.2, No. 205).

1. Cabinets: In addition to requirements specified below, comply with Division 26 Section "Panelboards."
2. Electrically Operated, Molded-Case Circuit Breakers: Bolt-on type.
   a. Switching Endurance Ratings: Certified by manufacturer or by a nationally recognized testing laboratory (NRTL) for at least 20,000 open and close operations under rated load at 0.8 power factor.
   b. Minimum 30,000 open and close operations with load equal to circuit-breaker trip rating and consisting of 100 percent tungsten filament load.
c. Minimum 30,000 open and close operations with load equal to circuit-breaker trip rating and consisting of 100 percent fluorescent ballasts rated for 10 percent total harmonic distortion.
d. Listed and labeled as complying with UL SWD, HCAR, and HID ratings by an NRTL acceptable to authorities having jurisdiction.

C. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state control panels.

D. Line-Voltage Surge Suppression: Field-mounting surge suppressors that comply with Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits" for Category A locations.

E. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state control panels or field-mounting surge suppressors that comply with Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits" for Category A locations.

2.5 FIELD-MOUNTED DIGITAL CONTROLS AND PLATES

A. Connection Type: RS-485 protocol, category 5e UTP cable, using RJ45 connectors. Power shall be from the control unit.

B. Pushbutton Switches: Modular, solid-state, programmable, digital, momentary contact, designed to connect to a microprocessor-based control unit as a manual control source.
   1. Mounting: Standard single-gang recessed switchbox, using device plates specified in Division 26 Section "Wiring Devices."
   2. Multi-Gang Mounting: One to six pushbuttons per gang.

2.6 CONDUCTORS AND CABLES

A. Structured Network Digital and Multiplexed Signal Cables: UTP cable with copper conductors, complying with TIA/EIA-568-B.2, Category 5e for horizontal copper cable.

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install wiring in raceways except where installed in accessible ceilings. Minimum conduit size shall be 1/2 inch (13 mm).

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.

D. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.

E. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.

G. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Test for circuit continuity.
   2. Verify that the control module features are operational.
   3. Check operation of local override controls.
   4. Test system diagnostics by simulating improper operation of several components selected by Architect.

C. Lighting controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.3 SOFTWARE INSTALLATION

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting controls. See Division 01 Section "Demonstration and Training."

END OF SECTION 260943
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SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 SUBMITTALS

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

B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
   2. Detail enclosure types and details for types other than NEMA 250, Type 1.
   3. Detail bus configuration, current, and voltage ratings.
   4. Short-circuit current rating of panelboards and overcurrent protective devices.
   5. Include evidence of NRTL listing for series rating of installed devices.
   6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   7. Include wiring diagrams for power, signal, and control wiring.

C. Panelboard schedules for installation in panelboards.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS
A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.
   a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
   b. Outdoor Locations: NEMA 250, Type 3R.
   c. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
   d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.


5. Lockable, all keyed alike.

B. Incoming Mains Location: Top.

C. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

   2. Main and Neutral Lugs: Mechanical type.
   3. Ground Lugs and Bus Configured Terminators: Mechanical type.
   4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
   5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.


2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

D. Mains: Lugs only.

F. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker.

D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

E. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. External Control-Power Source: 120-V branch circuit.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

G. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
c. Long- and short-time time adjustments.

d. Ground-fault pickup level, time delay, and $I^2t$ response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).


8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
   d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
   f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
   g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

   1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 26 Section "Fuses."

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

D. Install overcurrent protective devices and controllers not already factory installed.

   1. Set field-adjustable, circuit-breaker trip ranges.
E. Install filler plates in unused spaces.

F. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade depending on top or bottom fed.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

H. Comply with NECA 1.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

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 distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

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:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   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. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262416
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SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Wall-box motion sensors.
3. Snap switches and wall-box dimmers.
4. Wall-switch and exterior occupancy sensors.
5. Communications outlets.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
C. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Cooper; 5351 (single), 5352 (duplex).
b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cooper; GF20.
   b. Pass & Seymour; 2084.

2.4 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
   b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
   c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
   d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cooper; 2221PL for 120 V and 277 V.
   b. Hubbell; HPL1221PL for 120 V and 277 V.
   c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
   d. Pass & Seymour; PS20AC1-PLR for 120 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cooper; 2221L.
   b. Hubbell; HBL1221L.
2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   b. Hubbell; HBL1557.
   c. Leviton; 1257.
   d. Pass & Seymour; 1251.

F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cooper; 1995L.
   b. Hubbell; HBL1557L.
   c. Leviton; 1257L.
   d. Pass & Seymour; 1251L.

2.5 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.

1. 600 W; dimmers shall require no derating when ganged with other devices. Retain subparagraph above or below. If retaining below, insert other dimmers with their characteristics. UL 1472 covers ratings from 300 W to 2000 W in increments of 50 W.

2.6 OCCUPANCY SENSORS

A. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cooper; 6111 for 120 V, 6117 for 277 V.
   b. Hubbell; WS1277.
   c. Leviton; ODS 10-ID.
   d. Pass & Seymour; WS3000.
e. Watt Stopper (The); WS-200.
f. Douglas Controls

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

B. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Hubbell; ATP1600WRP.
   b. Leviton; ODWWV-IRW.
   c. Pass & Seymour; WA1001.
   d. Watt Stopper (The); CX-100.
   e. Douglas Controls
   
2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

C. Exterior Occupancy Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Leviton; PS200-10.
   b. Watt Stopper (The); EW-100-120.
   c. Hubbell; ATP1600WRP.
   
2. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot (34-m) detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

2.7 COMMUNICATIONS OUTLETS

A. Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Cooper; 3560-6.
   b. Leviton; 40649.
   c. Hubbell; ATP1600WRP.
   
2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1 complying with Category 5e. Comply with UL 1863.

B. Combination TV and Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Cooper; 3562.
   b. Leviton; 40595.
2. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.

2.8 WALL PLATES
A. Single and combination types to match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant die-cast aluminum with lockable cover.

2.9 FLOOR SERVICE FITTINGS
A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
B. Compartments: Barrier separates power from voice and data communication cabling.
C. Service Plate: Rectangular with satin finish.
D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.
E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 Category 6 jacks for UTP cable.

2.10 FINISHES
A. Color: Wiring device catalog numbers in Section Text do not designate device color.
   1. Wiring Devices Connected to Normal Power System: White or As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
   3. TVSS Devices: Blue.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
B. Coordination with Other Trades:
   1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 IDENTIFICATION
A. Comply with Division 26 Section "Identification for Electrical Systems."
   1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
   1. Test Instruments: Use instruments that comply with UL 1436.

B. Tests for Convenience 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 not acceptable.
   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.
   6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

END OF SECTION 262726
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PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes trailer mounted, portable, packaged engine-generator sets for emergency power supply with the following features:

1. Diesel engine.
2. Unit-mounted cooling system.
3. Unit-mounted control and monitoring.
4. Outdoor enclosure.

B. See Division 26 Section "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.2 SUBMITTALS

A. Product Data: For each type of packaged engine generator and accessory 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.

C. Source quality-control test reports.

D. Field quality-control test reports.

E. Operation and maintenance data.

F. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles (321 km) of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with ASME B15.1.

D. Comply with NFPA 37.

E. Comply with NFPA 70.

F. Comply with NFPA 99.

G. Comply with NFPA 110 requirements for Level 2 emergency power supply system.
H. Comply with UL 2200.

I. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

J. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.4 PROJECT CONDITIONS

A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Minus 15 to plus 40 deg C.
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to 1000 feet (300 m).

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which 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: 5 years from date of Substantial Completion.

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. Caterpillar; Engine Div.
2. Generac Power Systems, Inc.
3. Kohler Co.; Generator Division.
4. Magnetek, Inc.

2.2 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

C. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.
2. Output Connections: Three-phase, four wire.
3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

D. Generator-Set 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 3-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.

2.3 ENGINE

A. Fuel:
   1. No. 2 Diesel.

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).

D. Lubrication System: The following items are mounted on engine or skid:
   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.

E. Engine Fuel System:
   2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
   3. Dual Natural Gas with LP-Gas Backup (Vapor-Withdrawal) System:
a. Carburetor.
b. Secondary Gas Regulators: One for each fuel type.
c. Fuel-Shutoff Solenoid Valves: One for each fuel source.
d. Flexible Fuel Connectors: One for each fuel source.

F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

G. Governor: Adjustable isochronous, with speed sensing.

H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set 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. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

I. Muffler/Silencer: Industrial 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 12 dB at 500 Hz.
2. Sound level measured at a distance of 23 feet (7 m) from exhaust discharge after installation is complete shall be 87 dBA or less.

J. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

K. Starting System: 24-V electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least twice without recharging.

a. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236.

2.4 FUEL OIL STORAGE

A. Comply with NFPA 30.

B. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:

1. Tank level indicator.
2. Capacity: Fuel for 12 hours' continuous operation at 100 percent rated power output.
3. Vandal-resistant fill cap.

2.5 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 generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.

C. 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 generator set. Mounting method shall isolate the control panel from generator-set vibration.

D. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 2 system, and the following:

1. AC voltmeter.
2. AC ammeter.
3. AC frequency meter.
4. DC voltmeter (alternator battery charging).
5. Engine-coolant temperature gage.
6. Engine lubricating-oil pressure gage.
7. Running-time meter.
9. Generator-voltage adjusting rheostat.
10. Fuel tank derangement alarm.
11. Fuel tank high-level shutdown of fuel supply alarm.
12. Generator overload.

E. 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.

2.6 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.

1. Tripping Characteristic: Designed specifically for generator protection.
2. Trip Rating: Matched to generator rating.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.

2.7 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 H or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. 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.

F. Enclosure: Dripproof.

G. Instrument Transformers: Mounted within generator enclosure.

H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
   1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: 20 percent, maximum.

2.8 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.
2.9 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

B. 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.

2.10 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.11 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.


2. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

C. Install packaged engine generator with elastomeric isolator.

D. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet. Flexible connectors and steel piping materials and installation requirements are specified in Division 23 Section "Hydronic Piping."

1. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints.
Flexible connectors and piping materials and installation requirements are specified in Division 23 Section "Hydronic Piping."

E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

F. Piping installation requirements are specified in Division 23 Sections. Drawings indicate general arrangement of piping and specialties.

G. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.

H. Connect engine exhaust pipe to engine with flexible connector.

I. Connect fuel piping to engines with a gate valve and union and flexible connector.

J. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

K. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

L. Identify system components according to Division 23 Section "Identification for HVAC Piping and Equipment" and Division 26 Section "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.

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. Exhaust Emissions Test: Comply with applicable government test criteria.

8. 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.

9. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.

10. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at a location 23 feet away, and compare measured levels with required values.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

E. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

F. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

G. Remove and replace malfunctioning units and retest as specified above.

H. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

I. 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.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Division 01 Section "Demonstration and Training."

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SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes automatic transfer switches rated 600 V and less.

B. See Division 21 Section "Electric-Drive, Centrifugal Fire Pumps" for automatic transfer switches for fire pumps.

C. See Division 21 Section "Electric-Drive, Vertical-Turbine Fire Pumps" for automatic transfer switches for fire pumps.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

C. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified[ and the unit will be fully operational after the seismic event]."

2. Dimensioned Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based.

D. Field quality-control test reports.

E. Operation and maintenance data.

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 NEMA ICS 1.

C. Comply with NFPA 70.
D. Comply with NFPA 99.
E. Comply with NFPA 110.
F. Comply with UL 1008 unless requirements of these Specifications are stricter.

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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Contactor Transfer Switches:
   a. AC Data Systems, Inc.
   b. Caterpillar; Engine Div.
   c. Emerson; ASCO Power Technologies, LP.
   d. Generac Power Systems, Inc.
   e. GE Zenith Controls.
   f. Kohler Power Systems; Generator Division.
   g. Onan/Cummins Power Generation; Industrial Business Group.
   h. Russelectric, Inc.
   i. Spectrum Detroit Diesel.
   j. <Insert manufacturer's name.>

2. Transfer Switches Using Molded-Case Switches or Circuit Breakers:
   a. AC Data Systems, Inc.
   c. GE Zenith Controls.
   d. Hubbell Industrial Controls, Inc.
   e. Lake Shore Electric Corporation.
   f. <Insert manufacturer's name.>

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. 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.

B. Tested Fault-Current Closing and Withstand 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.

   1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. 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 not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

G. Neutral Switching. Where four-pole switches are indicated, provide [neutral pole switched simultaneously with phase poles] [overlapping neutral contacts].

H. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

I. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.

J. Battery Charger: For generator starting batteries.

1. Float type rated [2][10] A.
2. Ammeter to display charging current.
3. Fused ac inputs and dc outputs.

K. Enclosures: General-purpose NEMA 250, Type [1][3R][12], complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

D. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.

E. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase.

F. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated.
G. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer.

H. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal 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 is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.

2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.

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 0 to 30 minutes, and factory set for 10 minutes to 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 automatic 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 are adjustable from 10 to 30 minutes. Factory settings are 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 not available.
2.4  **SOURCE QUALITY CONTROL**

A.  Factory test and inspect components, assembled switches, and associated equipment. 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.

PART 3 - EXECUTION

3.1  **INSTALLATION**

A.  Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B.  Floor-Mounting Switch: Anchor to floor by bolting.

   1.  Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Division 26 Section "Hangers and Supports for Electrical Systems."

C.  Identify components according to Division 26 Section "Identification for Electrical Systems."

D.  Set field-adjustable intervals and delays, relays, and engine exerciser clock.

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."

3.3  **FIELD QUALITY CONTROL**

A.  Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B.  Perform tests and inspections and prepare test reports.

   1.  Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.

   2.  After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.


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.

5. After energizing circuits, 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 of 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 1 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.


a. Verify grounding connections and locations and ratings of sensors.

C. Coordinate tests with tests of generator and run them concurrently.

D. 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.

E. Remove and replace malfunctioning units and retest as specified above.

F. 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. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. 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.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Division 01 Section "Demonstration and Training."

B. Coordinate this training with that for generator equipment.

END OF SECTION 263600
SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior lighting fixtures, lamps, and ballasts.
   2. Emergency lighting units.
   3. Exit signs.
   4. Lighting fixture supports.

B. Related Sections:
   1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
   2. Division 26 Section "Network Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
   3. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.2 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, and finishes.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. LED Fixtures: Comply with IES LM-80 and IES LM-79

E. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

F. Metal Parts: Free of burrs and sharp corners and edges.

G. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

H. 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.

I. Diffusers and Globes:
   1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
      a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
      b. UV stabilized.
   2. Glass: Annealed crystal glass unless otherwise indicated.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:
   1. Comply with UL 935 and with ANSI C82.11.
   2. Designed for type and quantity of lamps served.
   3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
   4. Total Harmonic Distortion Rating: Less than 10 percent.
   5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
   6. Operating Frequency: 42 kHz or higher.
   7. Lamp Current Crest Factor: 1.7 or less.
   8. BF: 0.88 or higher.
   9. Power Factor: 0.95 or higher.

B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.

D. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.
E. Ballasts for Low-Temperature Environments: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.

F. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
   a. High-Level Operation: 100 percent of rated lamp lumens.
   b. Low-Level Operation: 30 percent of rated lamp lumens.

2. Ballast shall provide equal current to each lamp in each operating mode.
3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher unless otherwise indicated.
9. Power Factor: 0.95 or higher.
10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.5 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Nightlight Connection: Operate one fluorescent lamp continuously.
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.

2.6 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
   a. Battery: Sealed, maintenance-free, nickel-cadmium type.
   b. Charger: Fully automatic, solid-state type with sealed transfer relay.
   c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
   d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.7 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of \([15] <\text{Insert period}>\) minutes when power is restored after an outage.

2.8 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.
B. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.

C. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at three hours operation per start, and suitable for use with dimming ballasts unless otherwise indicated.

1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
6. 57 W: T4, triple tube, rated 4300 initial lumens (minimum).
7. 70 W: T4, triple tube, rated 5200 initial lumens (minimum).

2.9 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Comply with NFPA 70 for minimum fixture supports.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Adjust aimable lighting fixtures to provide required light intensities.
3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

END OF SECTION 265100
SECTION 265600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.

1.2 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4-M.

C. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied as stated in AASHTO LTS-4-M Ice Load Map.

D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.

1. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is 100 mph (45 m/s).

   a. Wind Importance Factor: 1.0.
   c. Velocity Conversion Factors: 1.0.

1.3 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.

B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.


C. Comply with NFPA 70.

PART 2 - PRODUCTS
2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. 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. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

   1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. 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. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
   a. Color: As selected by Architect from manufacturer's full range.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
   2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
   3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
   4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
      a. Color: Dark bronze.

O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located 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 and ballast characteristics:
      a. "USES ONLY" and include specific lamp type.
      b. Lamp tube configuration (twin, quad, triple), base type, and nominal wattage for compact fluorescent luminaires.
      c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
      d. Start type (preheat, rapid start, instant start) compact fluorescent luminaires.
      e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
      f. CCT and CRI for all luminaires.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.
   1. Relay with locking-type receptacle shall comply with ANSI C136.10.
   2. Adjustable window slide for adjusting on-off set points.

2.4 FLUORESCENT BALLASTS AND LAMPS

A. Ballasts for Low-Temperature Environments:
1. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.

B. Ballast Characteristics:

1. Power Factor: 90 percent, minimum.
2. Sound Rating: Class A.
3. Total Harmonic Distortion Rating: Less than 10 percent.
6. Transient-Voltage Protection: Comply with IEEE C62.41.1 and IEEE C62.41.2, Category A or better.

2.5 BALLASTS FOR HID LAMPS

A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C).
4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

B. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.

2.6 HID LAMPS

A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), CCT color temperature 1900 K, and average rated life of 24,000 hours, minimum.

1. Dual-Arc Tube Lamp: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.

B. Low-Pressure Sodium Lamps: ANSI C78.43.

C. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and CCT color temperature 4000 K.

D. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and CCT color temperature 4000 K.

E. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and CCT color temperature 4000 K.

2.7 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.
1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.

2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
   1. Materials: Shall not cause galvanic action at contact points.
   3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws. Provide on all, except wood poles.

E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

F. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

G. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

2.8 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.
   1. Shape: Square, straight.
   2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Steel Mast Arms: Single-arm type, continuously welded to pole attachment plate. Material and finish same as pole.

C. Brackets for Luminaires: Detachable, cantilever, without underbrace.
   1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with stainless-steel bolts.
   2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
   3. Match pole material and finish.

D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
E. Steps: Fixed steel, with nonslip treads, positioned for 15-inch (381-mm) vertical spacing, alternating on opposite sides of pole; first step at elevation 10 feet (3 m) above finished grade.

F. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

G. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

H. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

I. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.

J. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."

2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.

3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

   a. Color: As selected by Architect from manufacturer's full range.

2.9 ALUMINUM POLES

A. Poles: Seamless, extruded structural tube complying with ASTM B 429/B 429M, Alloy 6063-T6 with access handhole in pole wall.


1. Shape: Square, straight.

2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

E. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.

1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.

2. Finish: Same as pole.

F. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
G. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

2.10 POLE ACCESSORIES

A. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Division 26 Section "Wiring Devices" for ground-fault circuit-interrupter type.

1. Recessed, 12 inches (300 mm) above finished grade.
2. Nonmetallic polycarbonate plastic or reinforced fiberglass, weatherproof in use, cover, that when mounted results in NEMA 250, Type 3R enclosure.
3. With cord opening.
4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.

B. Minimum 1800-W transformer, protected by replaceable fuses, mounted behind access cover.

C. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.
B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:
1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).
3. Trees: 15 feet (5 m) from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
   1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
   2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
   3. Install base covers unless otherwise indicated.
   4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
   1. Dig holes large enough to permit use of tampers in the full depth of hole.
   2. Backfill in 6-inch (150-mm) layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.

F. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
   1. Make holes 6 inches (150 mm) in diameter larger than pole diameter.
   2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.
   3. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
   4. Cure concrete a minimum of 72 hours before performing work on pole.

G. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.

H. Raise and set poles using web fabric slings (not chain or cable).

3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.
3.4 GROUNDING

A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundations.

END OF SECTION 265600
PART 1 GENERAL

1.01 DESCRIPTION:
A. The work of this section consists of furnishing and installing steel helical piers.

1.02 QUALITY ASSURANCE
A. Installer Qualifications: Installation shall be done by a contractor with a minimum of 10 years experience installing helical piers and deep foundation systems. A list of 10 recent projects shall be submitted prior to starting installation.

B. A qualified inspector (when required) shall be present during helical pier installation in accordance with the local building code.

C. Welding: Meet requirements of AWS “Structural Welding Code,” D1.1, latest edition. All welders shall be AWS certified.

1.03 SUBMITTALS
A. Submit shop drawings with plans, sections, and details indicating shaft and helix sizes, and include manufacturer’s catalog cut and data sheets.

PART 2 PRODUCTS

2.01 MATERIAL
A. Square Tubular Steel Helical Piers:
   1. Pier Shafts (Lead Section and Extensions)
      a. The 2 inch square tubular shaft is 2” x 2” x .25” wall thickness with connection bolt of 0.75” diameter SAE J429 Gr 5 steel (Fy=120 KSI) or equivalent. Structural tubing per ASTM A500 Gr C. Ultimate mechanical capacity 40,000 lbs compression, 40,000 lbs tension.
      b. The 2.5 inch square tubular shaft is 2.5” x 2.5” x .25” wall thickness with connection bolt of 0.75” diameter SAE J429 Gr 5 steel (Fy=120 KSI) or equivalent. Structural tubing per ASTM A500 Gr C. Ultimate mechanical capacity 70,000 lbs compression, 70,000 lbs tension.
      c. The 3 inch square tubular shaft is 3” x 3” x .25” wall thickness with connection bolt of 0.875” diameter SAE J429 Gr 5 steel (Fy=120 KSI) or equivalent. Structural tubing per ASTM A500 Gr C. Ultimate mechanical capacity 110,000 lbs compression, 110,000 lbs tension.
   2. Helices: Carbon steel sheet, strip, or plate formed on matching metal dies to true helical shape, 0.5 inch (12.7 mm) thick, and shall conform to the following ASTM specifications:
      a. 7,000 ft-lbs(9.49 kN-m) 1.5 inch (38.1 mm) piers: ASTM A656 Grade 80.
      b. 11,000 ft-lbs.(14.9 kN-m) 1.75 (44.5 mm) inch piers: ASTM A656 Grade 80.
   3. Bolts: The sizes and types of bolts used to connect the helical pier extensions to lead sections or another extension shall conform to the following ASTM specifications:
      a. 1.5 inch (38.1 mm) helical piers: 0.75 inch (19.1 mm) diameter bolt per ASTM A449.
      b. 1.75 inch (44.5 mm) helical piers: 0.875 inch (22.2 mm) diameter bolt per ASTM A193 Grade B7.
   4. Underpinning Brackets: 8” X 8” X 1/2” structural steel angle, 12” long, with qty (2) concrete expansion bolts in slotted holes. Weld angle to threaded rods and provide
gusset plate stiffeners as required. Provide coupler and structural tube attached to threaded rods. Coupler as compatible with pier shaft fastened to shaft with weld, bolt or epoxy. A36 angle, plate and structural steel tubing. 35 KSI min for all pipe. Ultimate capacity 200,000 lbs

5. Rebar Caps: Qty (2) #5 bars ASTM A615 Gr 40 (weldable per AWS D1.4) welded to 1/2” thick A36 steel top plate welded to top of coupler with 1/4” fillet weld all around coupler. Coupler as compatible with pier shaft fastened to shaft with weld, bolt or epoxy.

6. Plate Caps: 1/2” thick A36 steel top plate welded to top of coupler with 1/4” fillet weld all around coupler. Coupler as compatible with pier shaft fastened to shaft with weld, bolt or epoxy.

7. Couplings: Cold-forged welded to the shaft.

8. Finish: All material shall be galvanized per ASTM B633.

B. Modular Steel Helical Piers:

1. Pier Shafts (Lead Section and Extensions)
   a. The 1.5 inch (38.1 mm) round cornered square (RCS) solid steel threaded shafts shall conform to the general requirements of ASTM A29 and the following descriptions: High strength low alloy (HSLA), low to medium carbon steel grade with improved strength due to fine grain size and structure having a torsional strength rating of 7,000 ft.-lbs (9.49 kN-m).
   b. The 1.75 inch (44.5 mm) round cornered square (RCS) solid steel threaded shafts shall conform to the general requirements of ASTM A29 and the following descriptions: High strength low alloy (HSLA), low to medium carbon steel grade with improved strength due to fine grain size and structure having a torsional strength rating of 11,000 ft.-lbs (14.9 kN-m).

2. Helices: Attach to threaded shaft via steel keys. Helices made of carbon steel sheet, strip, or plate formed on matching metal dies to true helical shape, 0.5 inch (12.7 mm) thick, and shall conform to the following ASTM specifications:
   a. 7,000 ft-lbs (9.49 kN-m) 1.5 inch (38.1 mm) piers: ASTM A656 Grade 80.
   b. 11,000 ft-lbs (14.9 kN-m) 1.75 (44.5 mm) inch piers: ASTM A656 Grade 80.

3. Bolts: The sizes and types of bolts used to connect the helical pier extensions to lead sections or another extension shall conform to the following ASTM specifications:
   a. 1.5 inch (38.1 mm) helical piers: 0.75 inch (19.1 mm) diameter bolt per ASTM A449.
   b. 1.75 inch (44.5 mm) helical piers: 0.875 inch (22.2 mm) diameter bolt per ASTM A193 Grade B7.

4. Underpinning Brackets: 8” X 8” X 1/2” structural steel angle, 12” long, with qty (2) concrete expansion bolts in slotted holes. Weld angle to threaded rods and provide gusset plate stiffeners as required. Provide coupler and structural tube attached to threaded rods. Coupler as compatible with pier shaft fastened to shaft with weld, bolt or epoxy. A36 angle, plate and structural steel tubing. 35 KSI min for all pipe. Ultimate capacity 200,000 lbs

5. Rebar Caps: Qty (2) #5 bars ASTM A615 Gr 40 (weldable per AWS D1.4) welded to 1/2” thick A36 steel top plate welded to top of coupler with 1/4” fillet weld all around coupler. Coupler as compatible with pier shaft fastened to shaft with weld, bolt or epoxy.

6. Plate Caps: 1/2” thick A36 steel top plate welded to top of coupler with 1/4” fillet weld all around coupler. Coupler as compatible with pier shaft fastened to shaft with weld, bolt or epoxy.

7. Couplings: Cold-forged, attached to threaded shaft via steel keys.

8. Finish: All material shall be galvanized per ASTM B633.
C. Conventional Solid Bar Steel Helical Piers:

1. Pier Shafts (Lead Section and Extensions)
   a. The 1.5 inch (38.1 mm) round cornered square (RCS) solid steel shafts shall conform to the general requirements of ASTM A29 and the following descriptions: High strength low alloy (HSLA), low to medium carbon steel grade with improved strength due to fine grain size and structure having a torsional strength rating of 7,000 ft.-lbs (9.49 kN-m).
   b. The 1.75 inch (44.5 mm) round cornered square (RCS) solid steel shafts shall conform to the general requirements of ASTM A29 and the following descriptions: High strength low alloy (HSLA), low to medium carbon steel grade with improved strength due to fine grain size and structure having a torsional strength rating of 11,000 ft.-lbs (14.9 kN-m).

2. Helices: Carbon steel sheet, strip, or plate formed on matching metal dies to true helical shape, 0.5 inch (12.7 mm) thick, and shall conform to the following ASTM specifications:
   a. 7,000 ft-lbs(9.49 kN-m) 1.5 inch (38.1 mm) piers: ASTM A656 Grade 80.
   b. 11,000 ft.-lbs.(14.9 kN-m) 1.75 (44.5 mm) inch piers: ASTM A656 Grade 80.

3. Bolts: The sizes and types of bolts used to connect the helical pier extensions to lead sections or another extension shall conform to the following ASTM specifications:
   a. 1.5 inch (38.1 mm) helical piers: 0.75 inch (19.1 mm) diameter bolt per ASTM A449.
   b. 1.75 inch (44.5 mm) helical piers: 0.875 inch (22.2 mm) diameter bolt per ASTM A193 Grade B7.

4. Underpinning Brackets: 8" X 8" X 1/2" structural steel angle, 12" long, with qty (2) concrete expansion bolts in slotted holes. Weld angle to threaded rods and provide gusset plate stiffeners as required. Provide coupler and structural tube attached to threaded rods. Coupler as compatible with pier shaft fastened to shaft with weld, bolt or epoxy. A36 angle, plate and structural steel tubing. 35 KSI min for all pipe. Ultimate capacity 200,000 lbs

5. Rebar Caps: Qty (2) #5 bars ASTM A615 Gr 40 (weldable per AWS D1.4)welded to 1/2" thick A36 steel top plate welded to top of coupler with 1/4" fillet weld all around coupler. Coupler as compatible with pier shaft fastened to shaft with weld, bolt or epoxy.

6. Plate Caps: 1/2" thick A36 steel top plate welded to top of coupler with 1/4" fillet weld all around coupler. Coupler as compatible with pier shaft fastened to shaft with weld, bolt or epoxy.

7. Couplings: Cold-forged welded to the shaft.

8. Finish: All material shall be galvanized per ASTM B633.

PART 3 EXECUTION
3.01 EQUIPMENT:

A. Installation Equipment:

1. Shall be a rotary type motor with equal forward and reverse torque capabilities. This equipment shall be capable of continual adjustment of the torque drive unit's revolutions per minute (RPM's) during installation. Percussion drilling equipment will not be allowed.

2. Shall be capable of applying installation torque equal to the torque required to meet the pier loads.

3. Equipment shall be capable of applying axial compression (crowd) pressure and torque simultaneously.

4. Torque Monitoring Devices:
5. The torque being applied by the installing units shall be monitored throughout the installation by the installer. The torque monitoring device shall either be a part of the installing unit or an independent device in-line with the installing unit. Calibration for either unit shall be available for review by the Owner.

3.02 INSTALLATION PROCEDURES:

B. Advancing Sections:

1. Engage and advance the helical pier sections in a smooth, continuous manner with the rate of pier rotation in the range of 5 to 35 RPM.

2. Apply sufficient axial compression (crowd) pressure to uniformly advance the helical sections to approximately 3-inches (76.2 mm) per revolution. The rate of rotation and magnitude of crowd pressure must be adjusted for different soil conditions and depths in order to maintain the penetration rate.

3. If the helical section ceases to advance, refusal will have been reached and the installation shall be terminated.

C. Termination Criteria:

1. The torque as measured during the installation shall not exceed the torsional strength rating of the steel helical lead and extension sections.

2. The minimum depth criteria indicated on the Drawings must be satisfied prior to terminating the steel helical pier.

3. The top helix is to be located not less than five (5) feet (1.5 m) below the grade elevation unless otherwise approved by the Owner.

4. If the torsional strength rating of the pier and/or installing unit has been reached prior to satisfying the minimum depth required, the installing contractor shall have the following options:

   a. Terminate the installation at the depth obtained with the approval of the Owner, or,
   b. Remove the existing pier and install a pier with smaller and/or fewer helices. This revised pier shall be terminated deeper than the terminating depth of the original pier as directed by the Owner.

5. In the event the minimum installation torque is not achieved at minimum depth, the Contractor shall install the foundation deeper using additional plain extension sections.

6. The minimum specified installation torque shall have been met when the measured installation torque meets or exceeds the minimum specified installation torque in two successive readings of the measuring device, unless otherwise specified by the Owner.

7. The installer shall keep a written installation record for each helical pier. This record shall include the following information as a minimum:

   a. Project name and location.
   b. Name of authorized dealer/installer.
   c. Name of installers foreman or representative witnessing the installation.
   d. Date of installation.
   e. Location of helical pier(s).
   f. Description of lead section including number and diameter of helices and extensions used.
   g. Overall depth of installation from a known reference point.
   h. Installation torque at termination of pier.
   i. Load transfer device

END OF SPECIFICATION
SECTION 32 11 00
UNBOUND BASE COURSES AND BALLASTS

PART 1 GENERAL

1.1 SCOPE

A. This work shall consist of furnishing and placing one or more courses of graded aggregate on a prepared subgrade in accordance with these Specifications and in conformity with the lines, grades, thickness, and typical cross-sections shown on the Plans or as directed by the Owner.

PART 2 – MATERIALS AND EQUIPMENT

2.1 Aggregates for Graded Aggregates

A. Aggregates for Graded Aggregate Base Course shall be crushed stone or crushed or uncrushed gravel together with such material as manufactured sand or other fine materials naturally contained or added there to as needed to conform with one of the three gradations shown in the table below as specified.

<table>
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<th>Size No.</th>
<th>2 ½&quot;</th>
<th>2&quot;</th>
<th>1 ½&quot;</th>
<th>1&quot;</th>
<th>3/8&quot;</th>
<th>No. 40</th>
<th>Clay*</th>
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<td>95-100</td>
<td></td>
<td>35-65</td>
<td>10-30</td>
<td>1-12</td>
<td></td>
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<tr>
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<td>100</td>
<td>95-100</td>
<td>40-65</td>
<td>10-30</td>
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<td>10-35</td>
<td>2-12</td>
<td></td>
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</tr>
</tbody>
</table>

- Clay content shall be determined by the Hydrometer Test – AASHTO T 88 4. Clay content may exceed 12 percent with the written permission of the Owner.

B. Mineral aggregate for graded aggregate base course shall consist of hard durable particles or fragments of stone or gravel and other finely divided mineral matter. Individual materials shall meet the requirements specified hereinafter.

1. Crushed Stone
   a) Crushed stone shall be free of silt and clay. The coarse aggregate portion of the stone shall have a percentage of wear of not more than 50, and when subjected to five (5) alternations of the sodium sulfate soundness test, the weighted percentage of loss shall not exceed fifteen (15).

2. Gravel
   a) Gravel shall be screened and all oversize material may be crushed and fed uniformly back over the screen. The coarse aggregate portion (retained on the No. 4 sieve) shall have a percentage of wear of not more than 50, and when subjected to five (5) alternations of the sodium sulfate soundness test, the weighted percentage of loss shall not exceed fifteen (15). The portion of the material passing the No. 40 sieve shall be nonplastic or shall have a liquid limit of not more than thirty (30) and a plasticity index of not more than eight (8).

C. If fine aggregate, coarse aggregate, or binder, in addition to that present in the base material, is needed in order to meet the gradation or density requirements or for satisfactory bonding of the material, it shall be uniformly blended with the base course material at the mixing plant by a mechanical feeder to maintain a uniform flow on the belt to the mixer. Blending of materials on the stockpiles or in the pits by bulldozer, clamshell, dragline, or similar equipment will not be permitted. The composite gradation of aggregate shall be the grading specified.
2.2 EQUIPMENT

A. All equipment necessary for the satisfactory performance of this construction shall be on the Project and approved before work will be permitted to begin. If mixing is required, an approved stationary twin shaft pugmill or a mechanical mixer (for road mixing) shall be included. Pneumatic-tire rollers and motor graders shall also be included.

PART 3 – CONSTRUCTION REQUIREMENTS

3.1 GENERAL

A. After the subgrade has been completed, aggregate shall be spread in one or more layers for one or more lane widths as directed by the Owner. It shall not be laid on a subgrade that is frozen or contains frost. Hauling over material already placed will not be permitted until it has been spread, mixed, shaped, and compacted.

3.2 MIXING - If mixing of two or more materials is required, one of the following types of mixing operations may be used.

A. Stationary Plant Method
   The base course material shall be mixed in an approved stationary mixing plant. Water shall be added during the mixing operation in the amount necessary to provide a moisture content satisfactory for compaction.

B. Road Mix method (Mechanical Mixer)
   After the material for the base course has been placed by an aggregate spreader or windrow-sizing device, the material shall be mixed by means of an approved mechanical mixer (for road mixing). Water shall be added during mixing in the amount necessary to provide a moisture content satisfactory for compaction.

C. Road Mix Method (Motor Grade)
   1. After the material has been thoroughly mixed, it shall be spread while at the required optimum moisture content by means of approved motor graders.
   2. If the required compacted depth of the base course exceeds six (6) inches, the base shall be constructed in two or more layers of approximate equal thickness unless vibrating or other approved types of special compacting equipment is used. In such cases, the compacted depth of a single layer of base course may be increased to eight (8) inches upon approval by the Owner.

3.3 MANHOLE ADJUSTMENTS

A. Drainage and sanitary sewer manholes owned by the City shall be adjusted and set at final grade by the contractor as necessary for compliance with the Plans. Manholes, valve boxes and other utility structures not owned by the City but within the right-of-way of the Project shall be adjusted as necessary by the owner of such facilities. The Contractor shall be responsible for notifying other owners of any required adjustments and for the accomplishment of the work by the owner of such facilities according to the project schedule.

3.4 SHAPING AND COMPACTION

A. Except where mechanical aggregate spreading equipment is used to place the base material, final shaping of each layer prior to compaction shall be accomplished by motor grader. In the event that mechanical spreading equipment fails to shape the base material properly, final shaping shall be done by motor grader or other approved means.
B. Immediately following spreading and final shaping, each successive layer shall be compacted with pneumatic-tire rollers and any other types of compacting equipment provided the required density and the required degree of uniformity and smoothness are attained. Compaction shall progress gradually from the edges of the base to the center, parallel with the centerline of the road, and shall continue until the base layer has been compacted to its full width. Where lifts of shoulder materials are placed to confine the base material, the initial pass of the compacting equipment shall overlap the shoulder to a width of not less than twelve (12) inches. In areas where rollers or other standard types of compacting equipment cannot be used to compact the base due to surface interference of structures or other obstructions, hand operated vibratory equipment shall be used to obtain the required density.

C. Compaction of each layer shall continue until an average dry density of not less than 100 percent of theoretical density based upon 83 percent of a solid volume has been achieved. Further, no individual test shall be less than 97 percent of theoretical density. The density determination will be based on the bulk specific gravity, AASHTO T 84 and T 85 and the dry weight of the aggregate. The compaction of each layer shall be approved before material for the next successive layer is placed. Placing and compacting areas shall be kept separate.

D. Unless otherwise specified, the above described density requirements will not apply to base construction on projects that do not include the construction of a surface upon the base, nor to projects which have a specified total base thickness less than four (4) inches. When the specified density requirements do not apply, the desired degree of compaction will be considered to have been reached when the surface is tightly bound and shows no rutting or displacement under operation of the roller or other construction equipment.

E. At the direction of the Owner, the desired degree of compaction may be considered to have been reached for any graded aggregate base construction when the surface is tightly bound and does not show evidence of pumping under operation of a motor grader and/or there is no rutting or displacement under operation of a roller or other selected construction equipment. The other selected construction equipment used to check the desired degree of compaction for any graded aggregate base shall be a loaded tandem dump truck, with a minimum of ten (10) tons weight. The degree of compaction may be considered to be reached when aggregate base does not show evidence of pumping, rutting or displacement, under the weight of said truck, when driven over the base at slow speed. This is to be done in the presence of the inspector prior to the placement of finished surface.

F. The surface of each layer shall be so constructed that the aggregates become firmly keyed and a uniform texture produced and shall be maintained in that condition until covered by the following stage of construction or until final acceptance of the project. Any irregularities that develop shall be corrected by loosening the material at those places and adding or removing material as required.

G. Approved distributors shall be used to apply water uniformly over the base materials during compaction in sufficient quantity for proper compaction. Softening of the underlying subgrade resulting from use of excess water is to be avoided.

3.5 MAINTENANCE

A. After construction of the base has been completed satisfactorily, it shall be maintained, under traffic if required, smooth and uniform until covered by the following stage of construction or until the project has been completed and accepted.

3.6 THICKNESS REQUIREMENTS
A. The thickness of the completed base shall be in conformity with the thickness shown on the Plans. The thickness shall be measured at such frequency as established by the Owner by means of test holes or other approved methods.

3.7 SURFACE REQUIREMENTS

A. The surface of the finished base shall have a satisfactorily smooth riding quality.

END OF SECTION 02720
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pre-wired, self-contained, slide gate operator for horizontal sliding gates, including all selected attachments and accessory equipment.

B. Related Sections
1. Electrical service and connections: See Electrical Sections.

C. Submittals And Shop Drawings:
1. Submit shop drawings under the provisions of SC 110 - Submittals.
2. Submit drawings showing connections to adjacent construction, range of travel, and all electrical and mechanical connections to the operator.
3. Drawings shall show the size and location of the concrete mounting pad.
4. Underground electrical runs and inductive vehicle obstruction loop locations shall be shown on shop drawings.
5. Installation instructions: Submit two copies of manufacturer's installation instructions for this specific project.
6. Submit manufacturer's completed warranty registration form to Project Manager.

D. Test Reports:
1. Submit affidavits from the manufacturer demonstrating that the gate mechanism has been tested to 200,000 cycles without breakdown.
2. Each operator shall bear a label indicating that the operator mechanism has been tested for full power and pressure of all hydraulic components, full stress tests of all mechanical components and electrical tests of all overload devices.

1.2 QUALITY ASSURANCE

A. Manufacturer: A company specializing in the manufacture of hydraulic gate operators of the type specified, with a minimum of ten years’ experience.

B. Installer: A minimum of three years’ experience installing similar equipment, provide proof of attending manufacturer’s factory technical training within previous three years, or obtain other significant manufacturer endorsement of technical aptitude, if required, during the submittal process.

1.3 CODES AND REGULATORY REQUIREMENTS

A. Operators shall be built to UL 325 standards and be listed by a testing laboratory. Complete all electrical work according to local codes and National Electrical Code. All fieldwork shall be performed in a neat and professional manner, completed to journeyman standards.

B. Current safety standards require the use of multiple external sensors to be capable of reversing the gate in either direction upon sensing an obstruction.

C. Vehicle gates should never be used by pedestrians. Separate pedestrian gates must always be provided when foot traffic is present.

D. Current safety standards require gate operators to be designed and labeled for specific usage.
classes. Equipment shall be listed for use in all UL 325 Usage Classes: I, II, III, and IV.

1.4 PRODUCT DELIVERY AND STORAGE

A. Store products upright in the original shipping containers, covered, ventilated and protected from all weather conditions.

1.5 WARRANTY

A. Provide a five-year limited warranty against all defects in materials or workmanship. Defective materials shall be replaced with comparable materials furnished by the manufacturer, at no cost to the owner. Freight, labor and other incidental costs are not covered under the factory warranty, but may be covered by a separate service agreement between installing company and the owner.

PART 2 – PRODUCTS

2.1 GATE OPERATORS

A. Gate Operators shall be HySecurity Model SlideDriver 10 (222 SS ST) with Smart Touch Controller, or equal as approved by the Owner and Engineer.

2.2 OPERATION

Operation shall be by means of a metal rail passing between a pair of hydraulically driven solid metal wheels with polyurethane treads. Operator motors shall be hydraulic, geroller type, and system shall not include belts, gears, roller chains or sprockets to transfer power from operator to gate panel. The operator shall generate a minimum horizontal pull of 300 pounds (136 kg) without the drive wheels slipping and without distortion of supporting arms. Operator shall be capable of handling gates weighing up to 1000 pounds (454 kg). Gate panel velocity shall not be less than 1.0 foot (.30 m) per second and shall be stopped gradually to prevent shock loads to the gate and operator assembly.

A. Standard mechanical components shall include as a minimum:
   1. Supporting arms: Cast aluminum channel. Arms shall incorporate a fully bushed, 1-1/2” (38 mm) bronze bearing surface, acting on arm pivot pins. (Item 2 below)
   2. Arm pivot pins: 3/4” (19 mm) diameter, stainless steel, with integral tabs for ease of removal.
   3. Tension spring: 2-1/2” (63.5 mm) heavy duty, 800 pound (363 kg) capacity.
   4. Tension adjustment: Finger tightened nut, not requiring the use of tools.
   5. Drive release: Must instantly release tension on both drive wheels, and disengage them from contact with drive rail in a single motion, for manual operation.
   7. Electrical enclosure: Oversized, metal, with hinged lid gasketed for protection from intrusion of foreign objects, and providing ample space for the addition of accessories.
   8. Chassis: ¼” (6.35mm) steel base plate and 12 Ga. (2.66mm) sides and back welded and ground smooth.
   9. Cover: 16 Ga. (1.52 mm) galvanized sheet metal with a textured paint finish. All joints welded.
   10. Finish: Prime painted, with a textured finish coat, proven to withstand 100-hour salt spray test.
   11. Drive wheels: two 6” (152 mm) Dia. metal hub with polyurethane tread.
   12. Drive rail: Shall be extruded 6061 T6, not less than 1/8” (3.175 mm) thick. Drive rail shall incorporate alignment pins for ease of replacement or splicing. Pins shall enable a perfect butt splice.
   13. Hydraulic hose: Shall be 1/4” (6.35 mm) synthetic, rated to 2750 PSI (19 MPa).
15. Hose fittings: At manifold shall be quick-disconnect type, others shall be swivel type.

16. Hydraulic fluid: High performance type with a viscosity index greater than 375 and temperature range -40F to 167F degrees (-40C to 75C).

17. A zero to 2000 PSI (13.79 MPa) pressure gauge, mounted on the manifold for diagnostics, shall be a standard component.

18. The hydraulic fluid reservoir shall be formed from a single piece of metal, non-welded, and shall be powder painted on the inside and the outside, to prevent fluid contamination.

B. Minimum Standard Electrical Components:
1. Pump motor: Shall be a 1 HP, 56C, TEFC, continuous duty motor, with a service factor of 1.15, or greater. Standard voltages available, single or three phase.

2. All components shall have overload protection.

3. Controls: Smart Touch Controller Board with 256K of program memory containing:
   a) inherent entrapment sensor;
   b) built in “warn before operate” system;
   c) built in timer to close;
   d) liquid crystal display for reporting of functions;
   e) 26 programmable output relay options;
   f) anti-tailgate mode;
   g) built-in power surge/lightning strike protection;
   h) menu configuration, event logging and system diagnostics easily accessible with a PC;
   i) RS232 port for connection to laptop or other computer peripheral and RS485 connection of Master/Slave systems or network interface.

1. Transformer: 75 VA, non-jumpered taps, for all common voltages.
2. Control circuit: 24VDC

C. Required external sensors: photo eyes and gate edges to be installed such that the gate is capable of reversing in either direction upon sensing an obstruction.

D. Optional control devices: card reader and intercom.

E. Optional alert devices: Flashing lights or rotating beacon. Configurable audible beacon included as standard.

F. Other Options:
   1. Heater with thermostat control for cold or damp climates.
   2. Weather-stripped drive rail slot in chassis, and snow wiper blades for drive rail.
   3. Through Beam or Reflective type photo eyes, open and close direction.
   4. Gate edge and transmitter radio reversing device.
   5. HY-5A plug in loop detectors.
   7. Factory drive rail.
   8. 115/208/230 VAC single phase and 208/230/460 VAC three phase available.
   9. UPS battery powered and solar models available

2.3 FACTORY TESTING

A. Fully assemble and test, at the factory, each gate operator to assure smooth operation, sequencing and electrical connection integrity. Apply physical loads to the operator to simulate field conditions. Tests shall simulate physical and electrical loads equal to the fully rated capacity of the operator components.

B. Check all mechanical connections for tightness and alignment. Check all welds for completeness
and continuity. Check welded corners and edges to assure they are square and straight.

C. Inspect painted finish for completeness. Touch up imperfections prior to shipment.

D. Check all hydraulic hoses and electrical wires to assure that chafing cannot occur during shipping or operation.

PART 3 – EXECUTION

3.1 Site Execution

A. Site Execution
   1. Locate concrete mounting pad in accordance with approved shop drawings.
   2. Make sure that gate is operating smoothly under manual conditions before installation of gate operators. Do not proceed until gate panel is aligned and operates without binding.

3.2 INSTALLATION

A. Install gate operator in accordance with the manufacture’s printed instructions, current at the time of installation. Coordinate locations of operators with contract drawings, other trades and shop drawings.

B. Installer shall insure that the electric service to the operator is at least 20 AMPS. Operator wattage is 1500.

3.3 FIELD QUALITY CONTROL

A. Test gate operator through ten full cycles and adjust for operation without binding, scraping or uneven motion. Test limit switches for proper “at rest” gate position.

B. All anchor bolts shall be fully concealed in the finished installation.

C. Owner, or owner’s representative, shall complete “punch list” with installing contractor prior to final acceptance of the installation and submit completed warranty documentation to manufacturer.

3.4 CONTINUED SERVICE AND DOCUMENTATION

A. Train owner’s personnel on how to safely shut off electrical power, release and manually operate the gate. Additionally, demonstrate the general maintenance of the gate operator and accessories and provide one copy of “Installation and Reference” manual for the owner’s use (a second manual is available upon request). Manuals will identify parts of the equipment for future procurement.

END OF SECTION
## INDEX

<table>
<thead>
<tr>
<th>SECTION</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airfield Construction Standards</td>
<td>2</td>
</tr>
<tr>
<td>A. Joints and Joint Sealants</td>
<td>2</td>
</tr>
<tr>
<td>B. Sodded Areas</td>
<td>2</td>
</tr>
<tr>
<td>C. Drainage</td>
<td>2</td>
</tr>
<tr>
<td>D. Concrete Aprons</td>
<td>2</td>
</tr>
<tr>
<td>E. SIDA Fence</td>
<td>2</td>
</tr>
<tr>
<td>F. Construction Contractors</td>
<td>2</td>
</tr>
<tr>
<td>G. Miscellaneous</td>
<td>4</td>
</tr>
<tr>
<td>H. Signs</td>
<td>6</td>
</tr>
<tr>
<td>I. Construction Contractors</td>
<td>11</td>
</tr>
<tr>
<td>Airfield Electrical Construction Standards</td>
<td>4</td>
</tr>
<tr>
<td>A. General</td>
<td>4</td>
</tr>
<tr>
<td>B. Testing</td>
<td>4</td>
</tr>
<tr>
<td>C. Constant Current Regulators</td>
<td>4</td>
</tr>
<tr>
<td>D. Marking and Labeling</td>
<td>5</td>
</tr>
<tr>
<td>E. Lighting Cans, Junction Cans, Junction Can Plazas and Hand Holes</td>
<td>5</td>
</tr>
<tr>
<td>F. Connectors</td>
<td>6</td>
</tr>
<tr>
<td>G. Fixtures</td>
<td>6</td>
</tr>
<tr>
<td>H. Signs</td>
<td>6</td>
</tr>
<tr>
<td>Facilities Construction Standards</td>
<td>8</td>
</tr>
<tr>
<td>A. General</td>
<td>8</td>
</tr>
<tr>
<td>B. Penetrations</td>
<td>8</td>
</tr>
<tr>
<td>C. Signage</td>
<td>9</td>
</tr>
<tr>
<td>D. Electrical</td>
<td>9</td>
</tr>
<tr>
<td>E. Mechanical</td>
<td>9</td>
</tr>
<tr>
<td>F. Fire Alarm and Suppression Systems</td>
<td>10</td>
</tr>
<tr>
<td>G. Antennae</td>
<td>10</td>
</tr>
<tr>
<td>H. Miscellaneous</td>
<td>10</td>
</tr>
<tr>
<td>I. Construction Contractors</td>
<td>11</td>
</tr>
<tr>
<td>Painting Standards</td>
<td>13</td>
</tr>
<tr>
<td>A. Airfield</td>
<td>13</td>
</tr>
<tr>
<td>B. Roads</td>
<td>13</td>
</tr>
<tr>
<td>C. Paint Vendors</td>
<td>13</td>
</tr>
<tr>
<td>D. Terminal, Concourses, and South Parking Garage</td>
<td>13</td>
</tr>
<tr>
<td>E. Administration Building</td>
<td>14</td>
</tr>
<tr>
<td>F. Airfield Maintenance Building</td>
<td>15</td>
</tr>
<tr>
<td>G. Miscellaneous</td>
<td>15</td>
</tr>
<tr>
<td>Preferred Equipment</td>
<td>16</td>
</tr>
<tr>
<td>A. Architectural Finishes</td>
<td>16</td>
</tr>
<tr>
<td>B. Plumbing &amp; Restrooms</td>
<td>17</td>
</tr>
<tr>
<td>C. Doors</td>
<td>18</td>
</tr>
<tr>
<td>D. Electrical</td>
<td>18</td>
</tr>
<tr>
<td>E. Mechanical</td>
<td>18</td>
</tr>
<tr>
<td>F. Miscellaneous</td>
<td>19</td>
</tr>
</tbody>
</table>
Airfield Construction Standards

A. Joints and Joint Sealants
   1. All joints to be beveled on new construction and reseal projects.
   2. All concrete joint sealants to be a non-sag silicone or preformed material. Silicone is preferred on reseal projects.

B. Sodded Areas
   1. All safety areas are to be 100% sod.
   2. All areas that have had earth disturbed shall be sodded and fertilized.
   3. Any sodded area within 2’ of an apron, pad or drainage structure shall be compacted to a minimum of 95% (Modified Proctor).

C. Drainage
   1. Concrete down drains should be installed on any area that is sloped for drainage.
   2. Any drain pipes that travel outside the SIDA fence should have proper security grates installed.
   3. Outlets should have a run off pad; concrete if preferred but asphalt is acceptable for aprons or run-off pads.
   4. The sub-base for concrete down drains, drain inlets or outlets should be compacted to a minimum of 95% (Modified Proctor).
   5. All drain and under drain joints or connections should be properly grouted or sealed. All drain inlets and manholes boxes entries shall be properly grouted or sealed inside and outside junction structure.

D. Concrete Aprons
   1. All sign bases, junction boxes and manholes on new construction are to have a minimum of a 6 ft. apron around the sign or structure, sloped away from the sign or structure.
   2. Aprons should have a minimum thickness of 4”.
   3. Aprons should be flush with the structure bases and sloped to be flush with soil. The slope shall not exceed the FAA maximum.
   4. The sub bases should be compacted for the structure bases and aprons to a minimum of 95% (Modified Proctor).

E. SIDA Fence
   1. SIDA fence shall be a minimum of 6’ tall and include barbed wire.
   2. SIDA fence shall include a 6’ paved lane under the fence. This will eliminate washouts, animal intrusions, reduce maintenance, and allow easy inspections by Airport Police.

F. Construction Contractors
   1. The Contractor shall maintain all sodded areas through the duration of the contract. The Contractor shall be responsible for the upkeep of contracted areas including grass cutting,
1. Rut repair and maintaining proper drainage ditches.

2. Security grates that are installed must be maintained and in good working order by the contractor for the duration of the contract.

3. All areas that were used by the contractor must be left in conditions that will not hinder the normal routine maintenance of Airfield; this includes, but is not limited to debris removal, grading, drainage, and re-seeding or sod.
Airfield Electrical Construction Standards

A. General
1. Work performed shall be accomplished by crews with a minimum of one licensed journeyman per three apprentices.
2. All temporary cable installations shall be protected either by burying cable in grass areas or by installation in conduit for above ground applications. Other methods may be used for short term or emergency situations if approved by the Airfield Maintenance Electrical Supervisor. Location of temporary cables shall be marked sufficiently to prevent damage from construction and maintenance equipment.
3. In all circumstances enough cable shall be provided at light cans, junction cans and hand holes so as to allow a minimum of 3 feet extending above ground for maintenance purposes. The exception to this is in the installation of taxiway centerline lights on SMGCS routes where two interleaved circuits are present in the same light can. In this instance only the circuit that is attached to the transformer in an individual light can, should have the extra conductor provided. This prevents the can from becoming cluttered unnecessarily.
4. Constant current series circuits shall be limited in capacity to a maximum of 20kW. Preferred capacity is 15kW or less.

B. Testing
1. The contractor shall furnish all necessary equipment and appliances for testing the underground cable circuits after installation.
2. The contractor shall demonstrate that all lighting power and control circuits are continuous and free from short circuits and unspecified grounds.
3. The insulation resistance to ground of all non-grounded series circuits shall be not less than 500 MΩ and shall be maintained at the required level by the contractor during the term of the warranty period.
4. Each new series circuit, or new part of existing circuits being extended or replaced, shall be tested as follows:
   i. Low voltage megger tests shall be performed to comply with (c.) above. Circuits shall then be subjected to a Hi-Pot test in accordance with engineer’s specifications.
5. All new fixture installations may, at the owner’s request, be subjected to photometric testing to certify performance in accordance with FAA specifications.

C. Constant Current Regulators
1. The constant current regulators shall be magnetic designs; the susceptibility to extraneous signals of solid-state designs is not acceptable. The regulators shall not have solid-state controls in the series circuit and shall be designed to prohibit radio communications interference. The regulators shall limit transient current peaks without the use of solid-state series circuit controls with soft-on feature.
2. Each regulator shall include a true RMS ammeter, and ON/OFF/REMOTE switch and brightness controls.
3. In addition, the regulators shall be provided with SPDT contacts rated 2 amperes at 120 volts to indicate the following functions for remote monitoring:

4. REMOTE/LOCAL selected at control switch. Primary Power ON.

5. Constant current regulators, including standby regulators furnished or installed by the contractor shall be provided with seismic restraints and include all necessary equipment including control and monitoring equipment (Crouse-Hinds/Transtech digitrac units) to make the regulators operational.

D. Marking and Labeling

1. Wire identification. The contractor shall furnish and install self-sticking wire labels or identifying tags on all control wires at the point where they connect to the control equipment or to the terminal blocks.

2. Series circuit cables shall be identified with Thomas and Betts ty-rap #TY546MT or approved equivalent suitable for wet environments. Metal tags secured by tie wire or other means shall not be acceptable. All marking means shall be approved by the Airfield Maintenance Electrical Supervisor.

3. All conductors of series circuit conductors shall be marked with their circuit designation at all points where the conductor is accessible.

4. The contractor shall furnish and install engraved plastic labels on the cases of regulators, breakers, and distribution and control relay cases. All circuit breakers or other disconnecting means shall be marked and identified with their circuit designation.

5. Fiber optic runs should include #10 THWN stranded yellow tracer wire for locating purposes and connected in its entirety as a continuous conductor. Alternatively, armored fiber optic cables will be considered in lieu of tracer wire.

6. Underground electrical warning tape shall be installed above all underground conduit installations not concrete encased in unpaved areas. Warning tape shall be located as shown on the plans above the counterpoise wire.

E. Lighting Cans, Junction Cans, Junction Can Plazas and Hand Holes

1. Except in extreme cases where other means are not practical, manholes or hand holes larger than 4 feet x 4 feet x 4 feet deep shall not be used.

2. Hand holes shall be equipped with spring loaded/assisted hinged covers of a design easily opened by one person.

3. The preferred method of connectivity shall be by use of junction can plazas consisting of FAA L-868 cans installed in concrete plazas. Each can shall contain a single circuit with the designation of the circuit imprinted in a brass marker embedded in the concrete adjacent to the can. If deemed necessary, and at the approval of the Airfield Maintenance Electrical Supervisor, more than one circuit may be installed in a conduit/can. Can lids should be flush with concrete plazas with dam rings on the cans.

4. All ducts installed under paved areas shall be encased in concrete.

5. All unused conduits shall have the open ends plugged with removable tapered plugs and be provided with a pull rope equivalent to IDEAL Power-Fish pull line (200 lb strength)
6. Drain lines shall be installed to provide positive drainage to eliminate standing water in airfield lighting bases, junction cans, and hand holes in locations determined by the designer.

7. L-868 cans used for the installation of in-pavement lights shall be of a two-piece design with the top section including a multi-hole ring (VEGA #2419MEM) as manufactured by Jaquith Industries.

8. Fixture hold down bolts shall be all-thread stainless steel, type 304 or as recommended by the fixture manufacturer.

9. Fixture hold down bolts for in-pavement lights shall be tightened to the proper torque per fixture manufacture’s specifications. All bolt holes shall be cleaned using a source of compressed air prior to installation of any bolts. Threads on all bolts shall be coated with anti-seize compound approved for use on stainless steel. Bolts shall not extend past the threaded adapter ring or into the can. Final tightening of the bolts shall be done using a properly calibrated torque wrench of the required range and verified by the engineer. Electrically or pneumatically operated wrenches shall not be used to achieve the final torque on bolts.

10. Lock washers installed on hold down bolts for all fixtures shall be one piece spring-type stainless steel. CRC type washers shall not be acceptable.

11. All cans shall have factory-installed hubs. Grommet cans are not acceptable unless approved for the application by the Airfield Maintenance Electrical Supervisor. Stub-in connections into existing light bases shall be Meyers hub installation.

F. Connectors

1. L-823 connectors used to splice L-824 type C #8 AWG cables shall be Elastimold style 54-D4-D4 or equivalent. L-823 connectors shall be made waterproof by a double layer of rubber tape (scotch 23 or equal) covered by a double layer of plastic tape (scotch 88 or equal). Heat shrink, is not allowable. One-piece shrink kits that encapsulate the entire splice shall not be used. Provide Scotch 23/Scotch 88 waterproofing at center connection to extend 1-1/2” each side of break and at each end of splice kit.

G. Fixtures

1. Runway and taxiway elevated light fixtures shall use a quartz bi-pin type lamp of the minimum wattage required for the application unless LED fixtures are approved by Airfield Maintenance Electrical Supervisor.

2. In-pavement fixtures should be manufactured of aluminum and utilize no more than two lamps with a maximum total wattage of 100 watts per fixture. L-850C edge lights and fixtures used for stop bars and runway guard lights may exceed this wattage, however.

H. Signs

1. Signs should be re-lampable without the use of tools.

2. Concrete foundations for signs shall contain separate housings for transformers. Transformers shall not be housed under a leg of the sign or any portion of the sign. Sign power should be fed through the sign leg.
3. Where practical, signs should be style 5, size 3, and be installed on a dedicated circuit.
4. All signs installed on the airfield should be marked on each end with 4” vinyl reflective labels with the sign’s designation as shown on the plans.
Facilities Construction Standards

A. General

1. All work shall comply with the applicable construction codes and MSCAA standards. The contractor shall be responsible for construction code permits and shall arrange for all code required inspections. Copies of permits shall be supplied to the Manager of Building Maintenance.

2. Utilities will not be interrupted without prior coordination and approval from the MSCAA Building Maintenance Manager, telephone number (901) 922-8615 or the Maintenance Service Desk at (901) 922-8040. Approval is required for each and every interruption. A minimum of a 24-hour notice is required for utility interruptions.

3. All salvaged equipment shall be returned to MSCAA at their designated location for their use or disposed of off-site as directed by MSCAA.

4. Asbestos Containing Materials (ACMs) are specifically prohibited without specific written approval from MSCAA. Any installation of ACMs without prior written approval must be removed immediately by the installer in accord with local ACM removal regulations.

B. Penetrations

1. All concrete floor and roof penetrations must be accomplished by core drilling. Use of rotary hammer or other impact tools for this purpose is prohibited. Core drilling efforts must be coordinated with tenants occupying space below the cored floor slab. The contractor will be responsible for any damage resulting from core drilling.

2. Sealing of new and pre-existing floor penetrations must be filled full depth with hydraulic cement and sealed with epoxy or polyurethane caulk as noted under the Preferred Brands heading (pages 17 & 18). The installation shall be inspected by the MSCAA Building Maintenance Manager, telephone number (901) 922-8615 Contractor shall coordinate with MSCAA Development Division for any x-ray or ultra-sound requirements for concrete floor/roof penetrations. No drilling through concrete beams unless approved by Development.

3. When drilling or core drilling through floors, walls, ceilings etc., the contractor is responsible for inspecting for electrical, plumbing, etc and is fully responsible for all repairs to anything damaged.

4. No drilling or ramset fastening is allowed in pan sections of the concrete structure. Any attachments installed above the ceiling will be suspended from the joist structure only.

5. No holes shall be drilled and no anchors shall be attached to the glazed brick. Attachments to the glazed brick walls shall be anchored in the mortar joints.

6. Penetrations through the roof shall be coordinated with MSCAA and will be the responsibility of the contractor to restore the roof to such a condition as not to invalidate the roof warranty.

7. Hydraulic cement and core drill sealant shall be installed full depth. After curing, epoxy or polyurethane caulk shall be applied at the bottom of the plug and polyurethane caulk
shall be applied at the top surface.

C. Signage

1. Signage shall comply with the standards established by MSCAA and final approval shall be the responsibility of MSCAA Properties Division.

D. Electrical

1. Fiber optic runs should include #10 THWN stranded yellow tracer wire for locating purposes and connected in its entirety as a continuous conductor. Alternatively, armored fiber optic cables will be considered in lieu of tracer wire.

2. All electrical conductors will be installed in conduit and use of flex conduit is limited to runs of 6 feet or less. Conduit couplings and connectors utilizing setscrew fasteners are prohibited. Conduit shall be concealed from public view wherever possible. All conduits and electrical raceways shall contain an equipment grounding conductor.

3. All electrical conductors #14 AWG & larger shall be stranded copper wire unless otherwise approved in writing by MSCAA.

4. All emergency devices including emergency lights, exit lights, etc., shall be connected to emergency circuits. MSCAA does not allow battery packs.

5. MSCAA does not allow Bodine ballasts in fluorescent lighting fixtures. All fluorescent lay-in fixtures shall be T8.

6. All use of cable trays is subject to MSCAA review and approval. Conduit shall not be strapped to cable trays or any of the cable trays’ support systems, including hangers and braces.

7. All equipment shall meet the appropriate UL listing for its intended purpose.

8. 23-kV rated cable shall conform to MLG&W standards. This requires cable having an aluminum or copper conductor, extruded conductor shield, ethylene propylene rubber insulation, extruded semi-conducting insulation shield, copper concentric neutral, and polyethylene jacket. The cable shall be suitable for direct burial, conduit/duct and aerial installations. All designers should re-verify MLG&W standards prior to publication of construction documents.

E. Mechanical

1. The use of flex duct shall not exceed more than four (4) feet and banded with metal straps, no tape. Use of flex duct other than at the end of a line or connected to air diffusers must be approved by MSCAA.

2. Controls for the HVAC system shall be Johnson Controls and compatible with the JCI Metasys Extended Architecture System.

3. VAV Boxes shall be pressure dependent, electronic controls with no auxiliary fan or local filter.

4. A copy of the test and balance report shall be submitted to MSCAA Building Maintenance Manager. An independent contractor shall perform the testing and complete the report.

5. The contractor shall align all motors to the associated pump, gearbox, fan, etc. MSCAA
Maintenance shall inspect alignment prior to acceptance. Maximum allowable angular and parallel misalignment is 0.003.

6. Heat trace cables shall have indicator lights installed in a visible location that illuminate when the cables are in operation.

F. Fire Alarm and Suppression Systems
1. The fire suppression system shall interface with the airport’s Simplex Fire Alarm System. For assistance contact MSCAA Building Maintenance Supervisor, telephone number (901) 922-8040.

2. All dry sprinkler pipe and fittings must be galvanized. All grooves in piping shall be the correct depth per industry standards.

3. See section “Facilities Construction Standards – Construction Contractors” for additional requirements.

G. Antennae
1. All work shall comply with the applicable construction codes and MSCAA standards.

2. No antenna is permitted on the roof; it must be parapet mounted or installed within the infrastructure on one of the antenna farms. Proposed antenna locations must be approved by the Manager of Building Maintenance or his representative.

3. Cables are not allowed on the roof or to run bare down a wall. A conduit from the parapet location down the wall with an LB connector into the wall below the spandrel beam is required. Parapet mount must be properly sealed to prevent leaks through the concrete. Any wall penetrations must also be sealed.

4. Cables above the ceiling must be independently supported from the roof structure and run by a licensed low voltage contractor, or a licensed electrical contractor, in accordance with applicable codes.

5. Installer shall be responsible for construction code permits and shall arrange for all code required inspections. Copies of permits shall be supplied to the Manager of Building Maintenance.

6. MSCAA Maintenance will not provide the escort for antenna work; either installer or Operator must be badged or tenant will have to escort antenna personnel.

H. Miscellaneous
1. Relocation and/or removal of any security device including CCTV cameras, access control equipment, etc. must be approved by MSCAA.

2. Non-shrink grout shall be used with all tile work, up to four (4) feet in height, laid on top of an approved waterproofing membrane.

3. All 12” X 12” ceiling tile shall be installed with the arrow on the back of the tile pointing south.

4. All flammable gas and liquid systems that are piped into buildings shall be properly equipped with seismic shutoff valves. Seismic shutoff valves shall be designed and installed to comply with all governing code requirements, insurance requirements, and
MSCAA Construction Standard requirements. In the case of conflict between the listed requirements, the most stringent shall apply.

5. For in-pavement loop installations, loop wire must meet IMSA Spec 51-7. Lead-in wire, if needed, must meet IMSA Spec 50-2. Loop wire shall be one continuous length with no splices from the junction box or control cabinet and back again. The wire shall be twisted by hand four twists per foot in the lead-in slot. Loops must be cut in a rectangular shape, with each 90 degree corner transected with a 45 degree cut to prevent over bending/stressing of the loop wire. Loop saw cuts should be ¼” to 3/8” wide and a minimum of 1½” deep in concrete and 2” deep in asphalt. Loop Lead-in saw cuts should be 3/8” wide and a minimum of 1½” deep in concrete and 2” deep in asphalt. Properly seal the saw cuts with Dow Corning 890 SL self-leveling sealant.

6. The removal, cutting, disfigurement or covering of the Terrazzo floor shall be reviewed and approved by MSCAA.

7. Only black steel pipe is permitted for use on systems containing diesel fuel, including tank vent stack piping, tank fill piping, and tank drain piping. No other material, including galvanized pipe, is allowed.

I. Construction Contractors

1. Electrical work performed shall be accomplished by crews with a minimum of one licensed journeyman per three apprentices.

2. The Contractor shall be responsible for maintaining a clean construction site and any space used for the removal of debris. The contractor shall be responsible for repair of any damage caused by construction to as good or better condition.

3. The Contractor shall erect a temporary wall around the construction site. All temporary walls shall be constructed of metal studs; anchored on bottom with double stick tape and anchored to the roof deck on top. The outside (public side) of the wall shall be finished floor to ceiling with 5/8” drywall with 2 coats of flat off white latex paint. The bottom of the wall shall be trimmed with 4” black cove base. A 2”x6” chair rail, blocked 2” off the wall, shall be installed 36” to center above finished floor. The chair rail shall be sanded and painted with two coats of airport brown semigloss paint. The Contractor shall retain responsibility during construction to maintain the wall for aesthetic and security issues. MSCAA Development Division shall approve its location, any attachments to terrazzo floors and all signage and/or graphics.

4. Walk-off mats shall be used at all access points to the construction area to prevent tracking of dust and debris.

5. The schedule of construction efforts and removal of debris shall be coordinated so as not to disrupt other tenants or endanger the safety of the public. Final approval shall be the responsibility of MSCAA Development Division. Working at MEM requires a badge; coordinate with MSCAA Operations Division for specific project requirements. For badging information, the Identification Office telephone number is (901) 922-8005.

6. The contractor shall inform MSCAA Development Division, telephone number (901) 922-8033 at least 48 hours prior to startup of construction.

7. A set of completed as-built drawings shall be supplied to the Manager of Building
Maintenance upon completion of the project.

8. Fire Alarm System – the Contractor shall contact Simplex to verify that the designer worked with Simplex during the design. If design is the responsibility of the Contractor, Contractor shall contact Simplex to design the installation.

9. A pre-test of the modifications to the fire alarm system shall be conducted with Simplex and the Contractor. This pre-test must be scheduled and successfully completed at least 24 hours in advance of any test with the Memphis Fire Department. MSCAA's Maintenance Department and Airport Communications will participate in the pre-test, so close coordination is required. A minimum of 72 hours advanced notification is required to both Simplex and MSCAA to schedule the pre-test. The pre-test must be performed after hours. Upon completion of the pre-test, Simplex will provide written confirmation of the successful completion of the pre-test, a copy of which is to be provided to the MFD fire marshal, and a copy is to be provided to MSCAA.

10. The test with the Memphis Fire Department for occupancy must be performed after hours and closely coordinated with MSCAA Maintenance and Airport Communications. Provide MSCAA a copy of any documentation from MFD, including deficiencies noted with the fire system, or approval of the system.
Painting Standards

A. Airfield
   1. Airfield painting shall comply with the latest revision of the P-620 specification. Thermoplastic markings are not acceptable.

B. Roads
   1. Road painting shall comply with the latest revision of the TT-P-1952 specification. Thermoplastic markings are not acceptable.

C. Paint Vendors
   1. This vendor list is provided for reference only in regards to the specific products listed in the following paragraphs. The list is not exhaustive or exclusive as equivalent vendors will be considered by MSCAA Paint Shop.
   2. PPG Architectural Finishes, Inc. (1525 Three Place, Memphis, TN, 38116)
   3. Sherwin-Williams (3850 Lamar Avenue, Suite 1, Memphis, TN)
   4. Farrell-Calhoun (3185 Millbranch Avenue, Memphis, TN)

D. Terminal, Concourses, and South Parking Garage
   1. Exterior White Fasciae, Cargo Docks, Ramp, Walls, and Columns
      i. Sherwin-Williams Universal Primer (or equivalent)
      ii. PPG Pitt-Tech Acrylic Satin – White
      iii. Sherwin-Williams A-100 Acrylic Satin – White
   2. Exterior CMU Walls
      i. Block Filler
      ii. PPG Pitt-Tech Acrylic Satin – White
      iii. Sherwin-Williams A-100 Acrylic Satin – White
   3. Interior Walls
      i. Sherwin-Williams B31W4400 Promar 400 Interior Latex Semi-Gloss – White
      ii. Farrell-Calhoun Acrylic Interior Semi-Gloss Latex Enamel 650 – Carriage House
      iii. Offices (including Airport Police, most of Building Maintenance, and Cargo Building Offices): Farrell-Calhoun Acrylic Interior Semi-Gloss Latex Enamel 650 – Carriage House
   4. Doors and Frames
ii. Green Doors: PPG Pitt-Tech Acrylic High Gloss DTM Industrial Enamel – Blarney Stone
iii. Frames: PPG Pitt-Tech Acrylic High Gloss DTM Industrial Enamel – Bronze Tone

5. Window Bases
   i. Farrell-Calhoun Acrylic Interior Semi-Gloss Latex Enamel 650 – Carriage House

6. Exterior Metal Structures
   i. Alkyd Industrial Gloss Enamel – White

7. Rotunda Columns (located in the “Y” of the B Concourse)
   i. PPG Acrylic Latex Satin 413-3 – Ostrich Feather

8. ID Office
   i. Walls: Farrell-Calhoun Interior Premium Eggshell Latex Enamel 370 – Carriage House
   ii. Doors and Frames: match Terminal & Concourses doors and frames

9. Management Work Room
   i. Walls: Farrell-Calhoun Interior Premium Eggshell Latex Enamel 370 – Carriage House
   ii. Doors and Frames: match Terminal & Concourses doors and frames

10. FIS
    i. Walls: Farrell-Calhoun Acrylic Interior Semi-Gloss Latex Enamel 650 – Carriage House
    ii. Doors: PPG Pitt-Tech Acrylic Satin DTM Industrial Enamel 90-475 – Quick Silver
    iii. Frames: PPG Pitt-Tech Acrylic Satin DTM Industrial Enamel 90-709/05 – Dark Silver

11. Painted Floors (Building Maintenance areas)
    i. Farrell-Calhoun Floor and Deck Enamel 702 – Medium Gray

E. Administration Building

1. Walls
   i. Ceilings: Farrell-Calhoun Interior Premium Eggshell Latex Enamel 370 – Zurich White
   ii. Walls: Farrell-Calhoun Interior Premium Eggshell Latex Enamel 370 – Carriage House

2. Interior Doors and Frames
   i. Sherwin-Williams Semi-Gloss Oil Base 1019 – Grey Statue
F. Airfield Maintenance Building

1. Walls
   i. Walls: Farrell-Calhoun Acrylic Interior Semi-Gloss Latex Enamel 650 – Carriage House

2. Doors and Frames
   i. Doors: PPG Pitt-Tech Acrylic Satin DTM Industrial Enamel 90-475 – Quick Silver
   ii. Frames: PPG Pitt-Tech Acrylic Satin DTM Industrial Enamel 90-709/05 – Dark Silver

G. Miscellaneous

1. De-Ice Tanks
   i. Farrell-Calhoun Premium Alkyd Industrial Gloss Enamel 800 – White

2. Exterior Light, Sign Pole, Sign Bases, and Bollards
   i. PPG Alkyd Industrial Enamel Gloss Z-Line – Bronze Tone

3. Ticket Spitters and Bollards
   i. Farrell-Calhoun Premium Alkyd Industrial Gloss Enamel 800 – Safety Zone Yellow

4. Colored Metal Surfaces
   i. Red: Farrell-Calhoun Premium Alkyd Industrial Gloss Enamel 800 – International Red
   ii. Orange: Farrell-Calhoun Premium Alkyd Industrial Gloss Enamel 800 – International Orange
   iii. Yellow: Farrell-Calhoun Premium Alkyd Industrial Gloss Enamel 800 – Safety Zone Yellow
Preferred Equipment

A. Architectural Finishes

1. Flooring: VCT – Armstrong

2. Cove Base
   i. Terminal Building: Armstrong or Roppe
   ii. Administration Building: Johnsonite Rubber 700 Series; 4” high; #24 Grey Haze
   iii. Offices: Flexco Rubber wallflowers series; 4” high; #03 Charcoal

3. Ceiling Tile
   i. Armstrong 2’ x 2’, Cortega Angled Tegular 704A (2’ x 2’ x 5/8”)
   ii. Armstrong 2’ x 2’, Fissured Square Lay-in 756A (2’ x 2’ x 5/8”)
   iii. Armstrong 2’ x 4’, Cortega Second Look 2765 (2’ x 4’ x ¾”)

4. Ceiling Grid: Armstrong Prelude
   i. Mains: 7300
   ii. 4’ Ts: XL7348
   iii. 2’ Ts: XL7328
   iv. Wall mold: 7800

5. Carpet (Hold Rooms)
   i. Style Name: Resonance
   ii. Style Number: J0118
   iii. Color: 00406 Saddle
   iv. Vendor: Continental Flooring (800-825-1221 Ext 206)
   v. The pattern for the carpet is to run perpendicular to the concourse for hold room installations.

6. Carpet (Offices)
   i. Style Name: Live Wire
   ii. Style Number: 54733
   iii. Color: 33506 Animated
   iv. Vendor: Continental Flooring (800-825-1221 Ext 206)

7. Carpet (MEM Executive Offices)
   i. Style Name: Ripple Effect
   ii. Style Number: J0116
   iii. Color: 00501 Laughs & Yawns
iv. Vendor: Continental Flooring (800-825-1221 Ext 206)

B. Plumbing & Restrooms

1. Flush valves: Sloan, Royal
2. Electronic flush valve retrofits:
   i. Urinals: Zurn ZRK-C-3.5, 3.5 GPF
   ii. Water Closets: Zurn ZRK-C-3.5, 3.5 GPF
3. Plumbing fixtures: Crane, American Standard, Kohler
4. Partitions: Accurate, Stainless Steel, No sight design, overhead braced, Continuous, Hinge type-Integral, Hinge In-swing/out-swing standard closed position, Floor mounted
5. Sinks: American Standard, 0355.012 Lucerne wall mounted Lav. sink w/4" centers
6. Service Sinks: 8” centers w/ ZURN Z841M1 Faucet
8. Water Closets
   i. Wall-mounted: American Standard 2257.103 af wall toilet 4 bolt wall mount, white
   ii. Floor-mounted: Kohler K-4368
9. Lavatories
   i. Non-ADA: American Standard, vandal resistant lavatory faucet with grid drain 2385.130 polished chrome
   ii. ADA: Delta – 511-WFHDF
10. Faucets: Sloan Optima EBF-85M infrared
11. Water closet gaskets: Wade Part # M-8 for wall hung closets
12. Backflow devices: Watts
13. Water coolers: Halsey Taylor – model #HAC8FS-Q(SS) wall-mounted
14. Toilet Accessories: Bobrick
   i. Recessed towel dispenser and waste receptacle: B-3961
   ii. Surface mounted toilet tissue dispenser: B-2888
   iii. Sanitary napkin disposal: B-270
   iv. Heavy duty robe hook: B-2116
   v. Handicap tilt mirror: B-293 (24” x 36”)
   vi. Grab bars: stainless steel with Snap Flange
15. Toilet Accessories: Non-Bobrick
   i. Foam Dispenser – Spartan Chemical Company 975700
   ii. Toilet paper dispenser: Shoreline 830 from Memphis Chemical (not for use in public
16. Eye Wash Station: Bradley S19314F
17. Angle Stops: Brasscraft

C. Doors
1. Exterior: 3070 (3.0’ x 7.0’) Steelcraft Door; 16 gauge metal, galvanized; with Steelcraft hinge prep; with 24” x 32” window prep (if specified)
2. Interior: 3070 (3.0’ x 7.0’) solid core wooden door with Steelcraft hinge prep; with 24” x 32” window prep (if specified)
3. Window Kits (if specified): Anemostat #LOPRO Visionlite 24”x32” with Tempered Glass
4. Metal Frames: Fit door openings to frame for a 3070 (3.0’ x 7.0’) Steelcraft door or solid core wooden door with Steelcraft hinge prep
5. Threshold: Aluminum to fit door frame
6. Drip Caps: 16 ad if outside door
7. Closer: LCN model 4041, arm RW/ PA, finish to match existing areas adjustment size 1-6 PC 23
8. Hinges: Stanley FBB 179-4.5 x 4.5 x USP x NRP
10. Keyways: 6-pin IC Cores with SA keyway
11. Panic Hardware: Yale #7100F  613 Trim – 626F US1013

D. Electrical
1. Wire: THHN or equal for insulation
2. VFDs: PowerFlex 400 by Allen-Bradley including latest harmonic distortion units w/ Metasys board
3. High Voltage Substations: General Electrical, Cutler Hammer
4. Panels, breakers, and contactors: Westinghouse, ITE (Siemens), Square D, Allen Bradley, Cutler Hammer
5. Devices: Leviton, Bryant, P&S, Hubbell
6. Device Covers: Stainless Steel
8. Fittings (no Set screws, couplings, or connectors): Raco, Steel City
9. Conduit/Wire: No MC or BX cable other than 6’ or less to be used as whips from junction box to item being fed

E. Mechanical
1. Heaters: Trane, McQuay
2. Electronic Controls: Johnson Controls (FEC, NAE, BACnet MS/TP), Barber Coleman,
3. Valves, Hot/Chill Water: Johnson Controls, Barber Coleman, Honeywell
4. AHUs: Trane
5. Boilers: Cleaver Brooks
6. Chillers: Trane
7. Pumps: Peerless, Bell & Gossett, Aurora, Ingersoll Rand, Pyramid Pump, Grundfos
8. VAV Boxes (All VAVs shall be pressure dependent with electronic controls): Environmental Tech, Varitrane Systems, Tuttle & Bailey
9. Electronic Thermostats: TE-6700, BACnet MS/TP, N2, Johnson Control
10. Cooling Towers: Marley, BAC

F. Miscellaneous
1. Joint Seals and Floor Penetration Seals: Evazote 380 E. S. P. with Hindered Amine Light Stabilizer