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- END OF SECTION -
Incorporated into the Contract Documents will be the Dallas-Fort Worth International Airport Standard Specification Book Version 2, Published December 07, 2018, and can be found at https://www.dfwairport.com/business/solicitations.

Any Section marked as “Applicable” below is hereby incorporated into the Project Manual by reference. Any Section revised or a new Section to be added to supersede the above published document are as indicated and dated below and are hereby included in the Project Manual. Any Section included in the published book that are not included in the table below are not included in the Project Manual.

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--- END OF SECTION ---
1.1 EXISTING HAZARDOUS MATERIAL INFORMATION

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

B. An existing asbestos report for Project, prepared by DFW Titled: “Limited Asbestos Inspection”, dated October 22, 2019, is available for viewing as appended to this Document.

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LIMITED ASBESTOS INSPECTION
DALLAS/FORT WORTH INTERNATIONAL AIRPORT
DEPARTMENT OF ENVIRONMENTAL AFFAIRS

PROJECT NAME: Terminal D – Holdroom Proof of Concept D12-D14
DFW PROJECT ID NO.: DFWEAD20192016
DFW PERMIT NO.: A19-285B
REPORT DATE: October 22, 2019

INITIAL WALK-THROUGH/SITE INVESTIGATION

BUILDING USE: Terminal D is used for the processing of passengers and luggage.

SUSPECT MATERIALS: Suspect materials include sprayed-on fireproofing and soundproofing, ceiling tile, drywall, texture, joint compound, leveling compound and construction mastics.

INTRODUCTION

The following report represents a Limited Asbestos Inspection (LAI) of suspect asbestos-containing building materials (SACBM) located in Terminal D at DFW Airport, Texas.

The subject building was constructed in 2005 and is located south of Terminal B. The subject inspection area consists of the concourse level and INS level that may be disturbed during planned renovation activities. The building allows full public access. The scope of services for this inspection includes the identification, location, quantification, and sampling of SACBM within the study area of the subject property. Sampling was conducted by Mr. Gonzalo Correa (TDSHS License No. 60-3095) under the guidance of Mr. Javier Araya of DFW Airport’s Environmental Affairs Department (EAD).

The analytical method used to determine the asbestos content of bulk samples collected for SACBM was polarized light microscopy (PLM) with dispersion staining, EPA Method 600. If bulk sample analysis was between 2% to 5% asbestos, the use of EPA Point Count Method 400/1000 was utilized to further determine if regulated asbestos-containing material was present. Samples were analyzed through EAD’s current contractual agreement with Cates Laboratories.

The inspection represents a limited site investigation that complies with National Emission Standard for Hazardous Air Pollutants (NESHAP) and Texas Asbestos Health Protection Rules (TAHPR); however, as with most scientific studies, an asbestos inspection is subject to various limitations, including access and observation limitations.
OBSERVATIONS AND FINDINGS

Terminal D is used for the processing of passengers and luggage. The areas of interest were as follows:

- Terminal D – INS Level
  - Columns L.3-M.08, Rows 3.48-4.6, Secure-side
- Terminal D – Concourse Level
  - Columns L.3-M.08, Rows 3.48-4.6, Secure-side

REFERENCES

During the inspection, the following asbestos reports were referenced and shall be used in conjunction with this report.

<table>
<thead>
<tr>
<th>Report</th>
<th>Date</th>
<th>Laboratory Report No.</th>
<th>Asbestos Firm</th>
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<td>Terminal D – Public Safety Das*</td>
<td>09/17/19</td>
<td>21072</td>
<td>DFW International Airport Environmental Affairs Dept.</td>
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<td>Terminal D – CBP Power and Data Install**</td>
<td>08/14/19</td>
<td>18221</td>
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</table>

During the onsite inspection, these previously sampled suspect materials were observed in the project work areas.

- **Ceiling System**
  - Sprayed-on Fireproofing*
    - Lt. Gray I01
  - 2’x4’ Ceiling Tile (White) C01*
  - Sprayed-on Fireproofing**
    - Gray I01, I02
  - 2’x5’ Ceiling Tile C01 w/**
    - Fiberglass C02, C03, C04

- **Wall System**
  - Drywall**
    - W01, W03, W05, W07, W08 w/
    - Texture (Smooth) T01, T03,
    - T05, T07
    - Joint Compound T02, T04,
    - T06, T08, T09
    - Unfinished Drywall W02, W04, W06**

Laboratory analysis of the above-listed samples indicated the absence of asbestos in the prior sampled suspect materials.

During the previous onsite inspections the following non-suspect materials were observed:

- Ceiling System: Concrete
- Wall System: Metal Wall Studs, Glass
- Floor System: Concrete, Carpet
- Plumbing System: Metal Pipe, Fiberglass Insulation
- HVAC System: Not in scope of work
During the current onsite inspection the following non-suspect materials were observed:

- Ceiling System: Concrete
- Wall System: Metal Wall Studs, Glass
- Floor System: Concrete, Carpet
- Plumbing System: Metal Pipe, Fiberglass Insulation
- HVAC System: Not in scope of work

The LAI was performed on October 15 & 16, 2019. All sampling procedures were in accordance with federal and state protocols. During the inspection, twenty-one (21) bulk samples of SACBM were collected and submitted for analysis. The Bulk Sample Analytical Results are summarized in a table in Appendix A, Sample Location Maps in Appendix B and Reference Report C.

During the on-site inspection, EAD observed the below-listed suspect materials requiring sampling. Each building material was given a unique identification number represented with an alpha-numeric number (i.e. C01). Suspect materials requiring sampling included:

- Ceiling System
  - 2’x5’ Ceiling Tile (Rough) C01
  - Sprayed-on Fireproofing
    - Gray I01, I03
  - Sprayed-on Soundproofing
    - White I02

- Wall System
  - Drywall W01 w/
    - Texture (Smooth) T02
    - Joint Compound T03

- Flooring System
  - Carpet Mastic (Yellow) M01 w/
    - Leveling Compound T01

- Plumbing System
  - Pipe Mastic (White) M02

Laboratory analysis of the samples collected during the inspection indicated non-detect for the presence of asbestos.
The following photographs represent the type and conditions of the suspect materials observed at the time of the inspection.

Concourse Level – Above Ceiling System

White Soundproofing Above Concourse Level – Ceiling System
Concourse Level – Ceiling System

Concourse Level – Ceiling System
Concourse Level – Ceiling and Flooring Systems
RECOMMENDATIONS

Based on laboratory analysis and field reconnaissance, suspect materials sampled within the inspection area were non-detect for asbestos. Therefore, renovation activities may continue. If presumed asbestos-containing materials or materials other than steel, concrete, or rubber are to be disturbed that are not covered in this report, additional sampling will need to be performed to identify the absence or presence of asbestos-containing materials. Construction, maintenance, and custodial staff shall have asbestos awareness training compliant with OSHA 29 CFR 1926.1101 or 1910.1001. This report has been prepared by the Dallas/Fort Worth International Airport, Environmental Affairs Department for the exclusive use of the DFW Airport Board. Any use of or reliance on this report by a third party shall be at such party’s sole risk.

Mr. Gonzalo Correa
Environmental Operations Analyst
TDSHS License #: 60-3095

Mr. Javier Araya
Environmental Project Manager
TDSHS License #: 20-5701

DFW International Airport
Asbestos Management Planner Agency
License #: 20-0030
Appendix A
Bulk Sample Analytical Results
<table>
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<th>Sample #</th>
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<th>Detailed Area</th>
<th>Suspect Material</th>
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<th>HA3</th>
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<td>13</td>
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<td>21391</td>
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<td>16</td>
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<td>17</td>
<td>2</td>
<td>Terminal D - Gates D12-D14</td>
<td>Sprayed-on Soundproofing (White)</td>
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<td>Sample #</td>
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<td>Descript Lyr 1</td>
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<td>HA2</td>
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<tbody>
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<td>I02</td>
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<td>Terminal D - Gates D12-D14</td>
<td>10/15/2019</td>
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<td></td>
<td>I03</td>
<td>Gray Fireproofing</td>
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<td>21391</td>
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<tr>
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<td>Terminal D - Gates D12-D14</td>
<td>10/15/2019</td>
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<td>I03</td>
<td>Gray Fireproofing</td>
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<td>21</td>
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<td>Terminal D - Gates D12-D14</td>
<td>10/15/2019</td>
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<tr>
<td></td>
<td></td>
<td>I03</td>
<td>Gray Fireproofing</td>
</tr>
<tr>
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<td>21391</td>
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On 10/15/2019, twenty-one (21) bulk samples were submitted by Mr. John Lerro of Dallas/Fort Worth International Airport for asbestos analysis by PLM/DS. Copies of the lab data sheets are attached; additional information may be found therein. The results are summarized below:

<table>
<thead>
<tr>
<th>Lab Sample No</th>
<th>Client Field I.D</th>
<th>Sample Description/Location</th>
<th>Asbestos Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL760309</td>
<td>01</td>
<td>M01, T01 - Carpet Mastic (yellow) w/Leveling Compound - Terminal D, Gates D13-D14</td>
<td>None Detected - Yellow Mastic None Detected - Leveling Compound</td>
</tr>
<tr>
<td>CL760310</td>
<td>02</td>
<td>M01, T01 - Carpet Mastic (yellow) w/Leveling Compound - Terminal D, Gates D13-D14</td>
<td>None Detected - Yellow Mastic None Detected - Leveling Compound</td>
</tr>
<tr>
<td>CL760311</td>
<td>03</td>
<td>M01, T01 - Carpet Mastic (yellow) w/Leveling Compound - Terminal D, Gates D13-D14</td>
<td>None Detected - Yellow Mastic None Detected - Leveling Compound</td>
</tr>
<tr>
<td>CL760312</td>
<td>04</td>
<td>W01, T02, T03 - Drywall, Texture (smooth), Joint Compound - Terminal D, Gates D13-D14</td>
<td>None Detected - Paint Texture None Detected - Joint Compound None Detected - Wallboard Material</td>
</tr>
<tr>
<td>CL760313</td>
<td>05</td>
<td>W01, T02, T03 - Drywall, Texture (smooth), Joint Compound - Terminal D, Gates D13-D14</td>
<td>None Detected - Paint Texture None Detected - Joint Compound None Detected - Wallboard Material</td>
</tr>
<tr>
<td>CL760314</td>
<td>06</td>
<td>W01, T02, T03 - Drywall, Texture (smooth), Joint Compound - Terminal D, Gates D13-D14</td>
<td>None Detected - Paint Texture None Detected - Joint Compound None Detected - Wallboard Material</td>
</tr>
<tr>
<td>CL760315</td>
<td>07</td>
<td>C01 - 2’ X 5’ Ceiling Tile (rough) - Terminal D, Gates D13-D14</td>
<td>None Detected - Ceiling Tile</td>
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<tr>
<td>CL760316</td>
<td>08</td>
<td>C01 - 2’ X 5’ Ceiling Tile (rough) - Terminal D, Gates D13-D14</td>
<td>None Detected - Ceiling Tile</td>
</tr>
<tr>
<td>CL760317</td>
<td>09</td>
<td>C01 - 2’ X 5’ Ceiling Tile (rough) - Terminal D, Gates D13-D14</td>
<td>None Detected - Ceiling Tile</td>
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<tr>
<td>CL760318</td>
<td>10</td>
<td>I01 - Sprayed-on Fireproofing (grey) - Terminal D, Gates D13-D14</td>
<td>None Detected - Grey Fireproofing</td>
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<tr>
<td>CL760319</td>
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<td>I01 - Sprayed-on Fireproofing (grey) - Terminal D, Gates D13-D14</td>
<td>None Detected - Grey Fireproofing</td>
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<td>CL760320</td>
<td>12</td>
<td>I01 - Sprayed-on Fireproofing (grey) - Terminal D, Gates D13-D14</td>
<td>None Detected - Grey Fireproofing</td>
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<tr>
<td>CL760321</td>
<td>13</td>
<td>M02 - Pipe Mastic (white) - Terminal D, Gates D13-D14</td>
<td>None Detected - White Mastic</td>
</tr>
<tr>
<td>CL760322</td>
<td>14</td>
<td>M02 - Pipe Mastic (white) - Terminal D, Gates D13-D14</td>
<td>None Detected - White Mastic</td>
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<tr>
<td>CL760323</td>
<td>15</td>
<td>M02 - Pipe Mastic (white) - Terminal D, Gates D13-D14</td>
<td>None Detected - White Mastic</td>
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<tr>
<td>CL760324</td>
<td>16</td>
<td>I02 - Sprayed-on Soundproofing (white) - Terminal D, Gates D13-D14</td>
<td>None Detected - White Insulation</td>
</tr>
</tbody>
</table>

These samples were analyzed by layers. The overall percent asbestos for the sample is reported when relevant. The EPA considers a material to be asbestos containing only if it contains greater than one percent asbestos by Calibrated Visual Area Estimation (CVAE). EPA regulations also indicate that Regulated Asbestos Containing Materials (RACM) – materials that are friable or may become friable – be further analyzed by point counting when the results indicate less than ten percent asbestos by CVAE. CatesLab utilizes CVAE on a routine basis and does not include point counting unless specifically requested by the client. The results may not be reproduced except in full.
Cates Laboratories
NVLAP Lab No. 200569-0
TDSHS License No. 30-0287

PLM REPORT SUMMARY

1339 Motor Circle
Dallas, Texas 75207 (214) 920-5006

Client: Dallas/Fort Worth International Airport
Lab Job No.: PLM-21391

Project: Terminal D - Hold Room Concept Proof D12-D14
Set No.: 31425

Project No: DFWEAD2019206
Report Date: 10/18/2019

Identification: Asbestos, Bulk Sample Analysis
Sample Date: 10/15/2019

Test Method: Polarized Light Microscopy/Dispersion Staining (PLM/DS)
EPA Method 600/R-93/116

Page 2 of 3

On 10/15/2019, twenty-one (21) bulk samples were submitted by Mr. John Lerro of Dallas/Fort Worth International Airport for asbestos analysis by PLM/DS. Copies of the lab data sheets are attached; additional information may be found therein. The results are summarized below:

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<th>Client Field I.D.</th>
<th>Sample Description/Location</th>
<th>Asbestos Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL760325</td>
<td>17</td>
<td>I02 - Sprayed-on Soundproofing (white) - Terminal D, Gates D13-D14</td>
<td>None Detected - White Insulation</td>
</tr>
<tr>
<td>CL760326</td>
<td>18</td>
<td>I02 - Sprayed-on Soundproofing (white) - Terminal D, Gates D13-D14</td>
<td>None Detected - White Insulation</td>
</tr>
<tr>
<td>CL760327</td>
<td>19</td>
<td>I03 - Sprayed-on Fireproofing (grey) - Terminal D, Gates D13-D14</td>
<td>None Detected - Grey Fireproofing</td>
</tr>
<tr>
<td>CL760328</td>
<td>20</td>
<td>I03 - Sprayed-on Fireproofing (grey) - Terminal D, Gates D13-D14</td>
<td>None Detected - Grey Fireproofing</td>
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<tr>
<td>CL760329</td>
<td>21</td>
<td>I03 - Sprayed-on Fireproofing (grey) - Terminal D, Gates D13-D14</td>
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</tr>
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On 10/15/2019, twenty-one (21) bulk samples were submitted by Mr. John Lerro of Dallas/Fort Worth International Airport for asbestos analysis by PLM/DS. Copies of the lab data sheets are attached; additional information may be found therein.

STATEMENT OF LABORATORY ACCREDITATION

The samples were analyzed in general accordance with the procedures outlined in the Method for the Determination of Asbestos in Bulk Building Materials, EPA/600/R-93/116 or the U.S. Environmental Protection Agency EPA 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples, by polarized light microscopy. The results of each bulk sample relate only to the material tested and the results shall not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Specific questions concerning bulk sample results shall be directed to the Laboratory Director.

Analyst: Kathy Schosek

Laboratory Director: John R. Cates, P.G.

Approved Signatory: NVLAP LAB CODE 200569-0
**Chain Of Custody**

**Project Information**

- **Attention:** Javier Araya
- **Project:** Term D - Holdroom Concept Proof D12-D14
- **Sampled By:** G. Carmon
- **Special Instructions:** Point Count < 2%

**Analysis(es) Requested**

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Collect Date</th>
<th>Collect Time</th>
<th>Matrix</th>
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</thead>
<tbody>
<tr>
<td>o1 - o7, o10</td>
<td>10/15/19</td>
<td>9:00</td>
<td>Solid</td>
</tr>
<tr>
<td>o2</td>
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<td></td>
</tr>
<tr>
<td>o3</td>
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<tr>
<td>o4 - o10, o22, o32</td>
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<td>o5</td>
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<td>o6</td>
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</table>

**Turnaround Time:**
- Normal: 7 Days [ ]
- Rush: 24 Hr [ ] 3 Day [ ]

**Comments:** Page 1 of 3

**Sample Receipt (Laboratory Use Only)**

1a. Samples @ 4 degrees Celsius?
1b. Temperature of Cooler?
2. Samples received intact?
3. Zero Headspace for VOC's?
4. Correct containers used?
5. Adequate volume provided?
6. Samples preserved correctly?
7. Samples received within holding time?
8. Agreement between COC and sample labels?

**Disposal:** Dispose [X] Return [ ] Pickup [ ] Hold [ ]

**Number of Containers:**

Preservative: [H] = Hydrochloric Acid HCl, [N] = Nitric Acid HNO3, [S] = Sulfuric Acid H2SO4, [O] = Other
**Chain Of Custody**

**PMU - 2139 | SET - 31425**

<table>
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<tr>
<th>Turnaround Time:</th>
<th>Normal: 7 Days ☐</th>
<th>Rush: 2 Hr ☐ 24 Hr ☐ 3 Day ☒</th>
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**Comments:** Page 2 of 3

<table>
<thead>
<tr>
<th>Sample Receipt (Laboratory Use Only)</th>
<th>Yes</th>
<th>No</th>
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1a. Samples @ 4 degrees Celsius? ☐
1b. Temperature of Cooler? ☐
2. Samples received intact? ☒
3. Zero Headspace for VOC's? ☐
4. Correct containers used? ☐
5. Adequate volume provided? ☐
6. Samples preserved correctly? ☐
7. Samples received within holding time? ☐
8. Agreement between COC and sample labels? ☐

**Project Information**

**Attention:** Javier Araya

**Sampled By:** C. Conre

**Special Instructions:** Point Count < 2%

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<th>Return ☐</th>
<th>Pickup ☐</th>
<th>Hold ☐</th>
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<th>Sample ID</th>
<th>Collect Date</th>
<th>Collect Time</th>
<th>Matrix</th>
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</table>

Refnished By (Signature) Date Time

Refnished By (Signature) Date Time

Refnished By (Signature) Date Time

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**Chain Of Custody**

**PM - Z1391 SET - 31425**

<table>
<thead>
<tr>
<th>Turnaround Time</th>
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<tr>
<td>Normal: 7 Days</td>
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<tr>
<td>Rush: 2 Hr</td>
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<td>24 Hr</td>
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<tr>
<td>3 Day</td>
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**Comments:** Page 3 of 3

**Project Information**

- **Attention:** Javier Araya
- **Project:** Term D - Holdroom Concept Road 012 - 014
- **Sampled By:** G. Correa
- **Special Instructions:** Point Count < 2%

**Disposal:** Dispose [X] Return [ ] Pickup [ ] Hold [ ]

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Collect Date</th>
<th>Collect Time</th>
<th>Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 103</td>
<td>10/15/19</td>
<td>9:00</td>
<td>Solid</td>
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<tr>
<td>20</td>
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<tr>
<td>21</td>
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**Analysis(%) Requested (List specific method, if required) & [Preservative]**

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<tr>
<th>Method Details</th>
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<tr>
<td>TPH/Total Petroleum Hydrocarbons (TPH) [H]</td>
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<td>BTEX/Aromatic Hydrocarbons (BTEX) [H]</td>
</tr>
<tr>
<td>VOCs/Volatile Organic Compounds (VOCs) [H]</td>
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<tr>
<td>SVOCs/Semi-Volatile Organic Compounds (SVOCs) [H]</td>
</tr>
<tr>
<td>Corrosivity [H]</td>
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<tr>
<td>Reactivity [H]</td>
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<tr>
<td>Ignitability [H]</td>
</tr>
<tr>
<td>Oil &amp; Grease [H]</td>
</tr>
<tr>
<td>BOD [H]</td>
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<td>TOC [H]</td>
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<tr>
<td>TSS [H]</td>
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<td>PAHs [H]</td>
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<td>The 8 RECA Metals by TCLP [H]</td>
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<td>Total Lead [H]</td>
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<td>Asbestos - PLM [H]</td>
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<td>Asbestos - PCM [H]</td>
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<tr>
<td>Al, Cu, Zn (Individual Permit Metals) [H]</td>
</tr>
</tbody>
</table>

**Number of Containers:**

- [X]

- [ ]

- [ ]

**Replenished By (Signature):**

- [Signature]

- [Signature]

- [Signature]

**Date:** 10/15/19

**Time:** 9:00

**Received By (Signature):**

- [Signature]

**Date:** 10/15/19

**Time:** 9:00

**Preservative:** [H] = Hydrochloric Acid HCl, [N] = Nitric Acid HNO3, [S] = Sulfuric Acid H2SO4, [O] = Other
<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Homogeneity</th>
<th>Material Description</th>
<th>General Location (e.g., Room &amp; Location)</th>
<th>Column</th>
<th>Row</th>
<th>Level</th>
<th>(Sample Type)</th>
<th>SE</th>
<th>Condition</th>
<th>HA</th>
<th>HA 1</th>
<th>HA 2</th>
<th>HA 3</th>
<th>HA 4</th>
<th>HA 5</th>
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<tbody>
<tr>
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<td>C</td>
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<td>Leveling Compound</td>
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Inspector Name(s): Ashley Gonzalez, Gonzalo Correa

License Number(s): 69-2099, 60-3095
Appendix B
Inspection Area & Asbestos Sample Location Maps
Terminal D – Holdroom Proof of Concept D12-D14
33260 / 2333 S. International Pkwy.
DFW Project ID: DFWEAD2018219 / Permit No. A18-298C

Inspection Area and Sample Location Map

Inspected by: Gonzalo Correa (TDSHS No. 60-3095)
Date of Inspection: October 15, 2019
Terminal D – Holdroom Proof of Concept D12-D14
33260 / 2333 S. International Pkwy.
DFW Project ID: DFWEAD2018219 / Permit No. A18-298C

Inspection Area and Sample Location Map

Inspected by: Gonzalo Correa (TDSHS No. 60-3095)
Date of Inspection: October 16, 2019
Appendix C
Referenced Report
LIMITED ASBESTOS INSPECTION
DALLAS/FORT WORTH INTERNATIONAL AIRPORT
DEPARTMENT OF ENVIRONMENTAL AFFAIRS

PROJECT NAME: Terminal D – Public Safety DAS
DFW PROJECT ID NO.: DFWEAD2019174
DFW PERMIT NO.: A19-281
REPORT DATE: September 17, 2019

INITIAL WALK-THROUGH/SITE INVESTIGATION

BUILDING USE: Terminal D is used for the processing of passengers and luggage.

SUSPECT MATERIALS: Suspect materials include sprayed-on fireproofing, ceiling tile, drywall, texture, joint compound and construction mastic.

INTRODUCTION

The following report represents a Limited Asbestos Inspection (LAI) of suspect asbestos containing building materials (SACBM) located in Terminal D at DFW Airport, Texas.

The subject building was constructed in 2005 and is located south of Terminal B. The subject inspection area consists of the INS Level that may be disturbed during planned renovation activities. The building allows full public access. The scope of services for this inspection includes the identification, location, quantification and sampling of SACBM within the study area of the subject property. Sampling was conducted by Ms. Ashley Gonzalez (TDSHS License No. 60-2929) under the guidance of Mr. Javier Araya of DFW Airport’s Environmental Affairs Department (EAD).

The analytical method used to determine the asbestos content of bulk samples collected for SACBM was polarized light microscopy (PLM) with dispersion staining, EPA Method 600. If bulk sample analysis was between 2% to 5% asbestos, the use of EPA Point Count Method 400/1000 was utilized to further determine if regulated asbestos contain material was present. Samples were analyzed through EAD’s current contractual agreement with Cates Laboratories.

The inspection represents a limited site investigation that complies with National Emission Standard for Hazardous Air Pollutants (NESHAP) and Texas Asbestos Health Protection Rules (TAHPR); however, as with most scientific studies, an asbestos inspection is subject to various limitations, including access and observation limitations.
OBSERVATIONS AND FINDINGS

Terminal D is used for the processing of passengers and luggage. The areas of interest were as follows:

• Terminal D – INS Level
  o Columns K.3-M.2, Rows 5.1-5.5, Secure-side
  o Columns J.4-L.4, Rows 4.3-4.7, Secure-side
  o Columns D.11-E.4, Rows 5.1-5.6, Secure-side
  o Columns I.1-J.5, Rows 3.51-4.2, Secure-side
  o Columns H.4-J.4, Rows 3.22-3.32, Secure-side
  o Columns G.1-H.5, Rows 3.51-4.2, Secure-side
  o Columns E.4-G.3, Rows 3.22-3.42, Secure-side
  o Columns D.5-F.5, Rows 3.51-4.2, Secure-side
  o Columns C.52-E.5, Rows 4.3-5.0, Secure-side

• Terminal D – Arrivals Level
  o International Check-in Hall, Secure-side

REFERENCES

During the inspection, the following asbestos report was referenced and shall be used in conjunction with this report.

<table>
<thead>
<tr>
<th>Report</th>
<th>Date</th>
<th>Laboratory Report No.</th>
<th>Asbestos Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal D – CBP Power and Data Install</td>
<td>08/14/19</td>
<td>18221</td>
<td>DFW International Airport Environmental Affairs Dept.</td>
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</tbody>
</table>

During the onsite inspection, these previously sampled suspect materials were observed in the project work areas.

• Wall System
  o Drywall
    o W01, W03, W05, W07, W08 w/
    o Texture (Smooth) T01, T03, T05, T07
    o Joint Compound T02, T04, T06, T08, T09
    o Unfinished Drywall W02, W04, W06

• Ceiling System
  o Sprayed-on Fireproofing
    o Gray I01, I02
  o 2’x5’ Ceiling Tile C01 w/
    o Fiberglass C02, C03, C04

Laboratory analysis indicated the absence of asbestos in the prior sampled suspect materials.

During the onsite inspection the following non-suspect materials were observed:

• Ceiling System: Concrete
• Wall System: P-LAM Walls, Metal Wall Studs
• Floor System: Not in scope of work
• Plumbing System: Not in scope of work
• HVAC System: Not in scope of work
The LAI was performed on September 9 and 10, 2019. All sampling procedures were in accordance with federal and state protocols. During the inspection, eleven (11) bulk samples of SACBM were collected and submitted for analysis. The Bulk Sample Analytical Results are summarized in a table in Appendix A, Sample Location Maps in Appendix B and the Referenced Report in Appendix C.

During the on-site inspection, EAD observed the below listed suspect materials requiring sampling. Each building material was given a unique identification number represented with an alpha-numeric number (i.e. C01). Suspect materials requiring sampling included:

- **Ceiling System**
  - Sprayed-on Fireproofing (Lt. Gray) I01
  - 2’x4’ Ceiling Tile (White) C01

Laboratory analysis of the samples collected during the inspection indicated non-detect for the presence of asbestos.

The following photographs represent the types and conditions of suspect materials observed at the time of the inspection.

INS Level – Ceiling System
INS Level – Hallway Ceiling System

INS Level – Hallway P-LAM Wall System
INS Level – Hallway Floor System

INS Level – Window System
RECOMMENDATIONS

Based on laboratory analysis and field reconnaissance, suspect materials sampled within the inspection area were non-detect for asbestos. Therefore, renovation activities may continue. If presumed asbestos containing materials or materials other than steel, concrete, or rubber are to be disturbed that are not covered in this report, additional sampling will need to be performed to identify the absence or presence of asbestos containing materials. Construction, maintenance and custodial staff shall have asbestos awareness training compliant with OSHA 29 CFR 1926.1101 or 1910.1001. This report has been prepared by the Dallas/Fort Worth International Airport, Environmental Affairs Department for the exclusive use of the DFW Airport Board. Any use of or reliance on this report by a third party shall be at such party's sole risk.

Ms. Ashley Gonzalez
Environmental Operations Analyst
TDSHS License #: 60-2929

Mr. Javier Araya
Environmental Project Manager
TDSHS License #: 20-5701

DFW International Airport
Asbestos Management Planner Agency
License #: 20-0030
Appendix A
Bulk Sample Analytical Results
<table>
<thead>
<tr>
<th>Sample #</th>
<th>Floor</th>
<th>Detailed Area</th>
<th>Sample Date</th>
<th>Suspect Material</th>
<th>Smpl Rslt Lyr 1</th>
<th>Smpl Rslt Lyr 2</th>
<th>Smpl Rslt Lyr 3</th>
<th>Smpl Rslt Lyr 4</th>
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<tbody>
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<td>01</td>
<td>4</td>
<td>4th Level INS, Column L.3, Row 5.3</td>
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<td>HA1</td>
<td>Descript Lyr 1</td>
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<td>Sample #</td>
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<td>Suspect Material</td>
<td>Sample Date</td>
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<td>2’x4’ Ceiling Tile (White)</td>
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</table>
On 9/11/2019, eleven (11) bulk samples were submitted by Ms. Ashley Gonzalez of Dallas/Fort Worth International Airport for asbestos analysis by PLM/DS. Copies of the lab data sheets are attached; additional information may be found therein. The results are summarized below:

<table>
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<tr>
<th>Lab Sample No.</th>
<th>Client Field I.D.</th>
<th>Sample Description/Location</th>
<th>Asbestos Content</th>
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<td>C01 - 2' X 4' Ceiling Tile - INS Level</td>
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<td>C01 - 2' X 4' Ceiling Tile - INS Level</td>
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<td>C01 - 2' X 4' Ceiling Tile - INS Level</td>
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<td>I01 - Fireproofing (light grey) - INS Level</td>
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These samples were analyzed by layers. The overall percent asbestos for the sample is reported when relevant. The EPA considers a material to be asbestos containing only if it contains greater than one percent asbestos by Calibrated Visual Area Estimation (CVAE). EPA regulations also indicate that Regulated Asbestos Containing Materials (RACM) – materials that are friable or may become friable – be further analyzed by point counting when the results indicate less than ten percent asbestos by CVAE. CatesLab utilizes CVAE on a routine basis and does not include point counting unless specifically requested by the client. The results may not be reproduced except in full.
On 9/11/2019, eleven (11) bulk samples were submitted by Ms. Ashley Gonzalez of Dallas/Fort Worth International Airport for asbestos analysis by PLM/DS. Copies of the lab data sheets are attached; additional information may be found therein.

STATEMENT OF LABORATORY ACCREDITATION

The samples were analyzed in general accordance with the procedures outlined in the Method for the Determination of Asbestos in Bulk Building Materials, EPA/600/R-93/116 or the U.S. Environmental Protection Agency EPA 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples, by polarized light microscopy. The results of each bulk sample relate only to the material tested and the results shall not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Specific questions concerning bulk sample results shall be directed to the Laboratory Director.

Curtis Grigg

Analyst:

Laboratory Director: John R. Cates, P.G.

Approved Signatory:

实验室主任：John R. Cates, P.G.
### Chain Of Custody

**Project Information**

Attention: Javier Araya


Sampled By: Ashley Gonzalez (C602928)

Special Instructions: Point Count < 2%

**Analysis(es) Requested (List specific method, if required) & [Preservative]**

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<th>Collect Date</th>
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Requisitioned By (Signature): Ashley Gonzalez

Date: 9/11/19

Time: 12:30

Received By (Signature): [Signature]

Date: 9/11/19

Time: 12:30

Requisitioned By (Signature): [Signature]

Date: [Date]

Time: [Time]

Received By (Signature): [Signature]

Date: [Date]

Time: [Time]

Requisitioned By (Signature): [Signature]

Date: [Date]

Time: [Time]

Received By (Signature): [Signature]

Date: [Date]

Time: [Time]

Preservative: [H] = Hydrochloric Acid HCl, [N] = Nitric Acid HNO3, [S] = Sulfuric Acid H2SO4, [O] = Other
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Received By (Signature) | Date | Time |
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Preservative: [H] = Hydrochloric Acid HCl, [N] = Nitric Acid HNO₃, [S] = Sulfuric Acid H₂SO₄, [O] = Other
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<th>HA2</th>
<th>HA3</th>
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Facility Name / FID #: Terminal D (33260)  Project Name: Public Safety DAS

DFW Project ID: DEWED2019174  Secondary ID: A19-281

DFW Environmental Affairs
Asbestos Bulk Sample Log

Department: PM - Z1092  Page(s): 1 of 1

Date: 9/10/2019

Inspector Name(s): Ashley Gonzales  License Number(s): B02929
Appendix B
Inspection Area & Asbestos Sample Location Maps
Key

Terminal D – Public Safety DAS
33260 / 2333 S. International Pkwy.
DFW Project ID: DFWEAD2019174 / Permit No. A19-281

Inspection Area Location Map

Inspected by: Javier Araya (TDSHS No. 20-5701) &
Ashley Gonzalez (TDSHS No. 60-2929)
Date of Inspection: September 10, 2019
Terminal D – Public Safety DAS
33260 / 2333 S. International Pkwy.
DFW Project ID: DFWEAD2019174 / Permit No. A19-281

Inspection Area Location Map

Inspected by: Javier Araya (TDSHS No. 20-5701) & Ashley Gonzalez (TDSHS No. 60-2929)
Date of Inspection: September 10, 2019
Terminal D – Public Safety DAS
33260 / 2333 S. International Pkwy.
DFW Project ID: DFWEAD2019174 / Permit No. A19-281

Inspection Area Location Map

Inspected by: Javier Araya (TDSHS No. 20-5701) & Ashley Gonzalez (TDSHS No. 60-2929)
Date of Inspection: September 10, 2019
Key
Inspection Area
Sample Location

Terminal D – Public Safety DAS
33260 / 2333 S. International Pkwy.
DFW Project ID: DFWEAD2019174 / Permit No. A19-281

Inspection and Sample Location Map

Inspected by: Javier Araya (TDSHS No. 20-5701) & Ashley Gonzalez (TDSHS No. 60-2929)
Date of Inspection: September 10, 2019
Terminal D – Public Safety DAS
33260 / 2333 S. International Pkwy.
DFW Project ID: DFWEAD2019174 / Permit No. A19-281

Inspection and Sample Location Map

Inspected by: Javier Araya (TDSHS No. 20-5701) & Ashley Gonzalez (TDSHS No. 60-2929)
Date of Inspection: September 10, 2019
Key
- Inspection Area
- Sample Location

Terminal D – Public Safety DAS
33260 / 2333 S. International Pkwy.
DFW Project ID: DFWEAD2019174 / Permit No. A19-281

Inspection and Sample Location Map

Inspected by: Javier Araya (TDSHS No. 20-5701) &
Ashley Gonzalez (TDSHS No. 60-2929)
Date of Inspection: September 10, 2019
Terminal D – Public Safety DAS
33260 / 2333 S. International Pkwy.
DFW Project ID: DFWEAD2019174 / Permit No. A19-281

Inspection and Sample Location Map

Inspected by: Javier Araya (TDSHS No. 20-5701) & Ashley Gonzalez (TDSHS No. 60-2929)
Date of Inspection: September 10, 2019
Terminal D – Public Safety DAS
33260 / 2333 S. International Pkwy.
DFW Project ID: DFWEAD2019174 / Permit No. A19-281

Inspection and Sample Location Map

Inspected by: Javier Araya (TDSHS No. 20-5701) & Ashley Gonzalez (TDSHS No. 60-2929)
Date of Inspection: September 10, 2019
Appendix C
Referenced Report
LIMITED ASBESTOS INSPECTION
DALLAS/FORT WORTH INTERNATIONAL AIRPORT
DEPARTMENT OF ENVIRONMENTAL AFFAIRS

PROJECT NAME: Terminal D – CBP Power and Data Install
DFW PROJECT ID NO.: DFWEAD2019165
DFW PERMIT NO.: A19-278
REPORT DATE: August 14, 2019

INITIAL WALK-THROUGH/SITE INVESTIGATION

BUILDING USE: Terminal D is used for the processing of passengers and luggage.

SUSPECT MATERIALS: Suspect materials include sprayed-on fireproofing, drywall, texture, joint compound and construction mastic.

INTRODUCTION

The following report represents a Limited Asbestos Inspection (LAI) of suspect asbestos containing building materials (SACBM) located in Terminal D at DFW Airport, Texas.

The subject building was constructed in 2005 and is located south of Terminal B. The subject inspection area consists of the non-secure hallway adjacent to the Customs and Border Patrol area that may be disturbed during planned renovation activities. The building allows full public access. The scope of services for this inspection includes the identification, location, quantification, and sampling of SACBM within the study area of the subject property. Sampling was conducted by Mr. Javier Araya (TDSHS License No. 20-5701) with DFW Airport’s Environmental Affairs Department (EAD).

The analytical method used to determine the asbestos content of bulk samples collected for SACBM was polarized light microscopy (PLM) with dispersion staining, EPA Method 600. If bulk sample analysis was between 2% to 5% asbestos, the use of EPA Point Count Method 400/1000 was utilized to further determine if regulated asbestos contain material was present. Samples were analyzed through EAD’s current contractual agreement with Cates Laboratories.

The inspection represents a limited site investigation that complies with National Emission Standard for Hazardous Air Pollutants (NESHAP) and Texas Asbestos Health Protection Rules (TAHPR); however, as with most scientific studies, an asbestos inspection is subject to various limitations, including access and observation limitations.
OBSERVATIONS AND FINDINGS

Terminal D is used for the processing of passengers and luggage. The area of interest was as follows:

- Terminal D – Arrivals Level
  - International Check-in Hall, Secure-side

REFERENCES

During the inspection, the following asbestos report was referenced and shall be used in conjunction with this report,

<table>
<thead>
<tr>
<th>Report</th>
<th>Date</th>
<th>Laboratory Report No.</th>
<th>Asbestos Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amendment No. 1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

During the onsite inspection, the following sampled suspect materials were observed in the project work areas:

- **Wall System**
  - Drywall
    - W01, W03, W05, W07, W08 w/
    - Texture (Smooth)
    - T01, T03, T05, T07
    - Joint Compound
    - T02, T04, T06, T08, T09
    - Unfinished Drywall W02, W04, W06

- **Ceiling System**
  - Sprayed-on Fireproofing
    - Gray I01, I02
  - 2’x5’ Ceiling Tile C01 w/
    - Fiberglass C02, C03, C04

Laboratory analysis indicated the absence of asbestos in the prior sampled suspect materials.

During the onsite inspection the following non-suspect materials were observed:

- Ceiling System: Concrete, Metal Ceiling Tile
- Wall System: Metal Wall Studs, Reinforced Fiberglass Paneling, P-LAM Walls, Metal Sign Frames
- Floor System: Concrete
- Plumbing System: Not in scope of work
- HVAC System: Not in scope of work

The LAI was performed on August 12, 2019. All sampling procedures were in accordance with federal and state protocols. During the inspection, no additional suspect asbestos containing building materials were observed and no bulk samples of SACBM were collected for analysis. The Inspection Location Map can is enclosed in Appendix A and the Referenced Report in Appendix B.
The following photographs represent the types and conditions of the suspect materials observed at the time of the inspection.

Above Arrivals Ceiling System 8/12/2019

Arrivals Ceiling System 8/12/2019
RECOMMENDATIONS

Based on laboratory analysis and field reconnaissance, suspect materials previously sampled within the inspection area were non-detect for asbestos. No suspect asbestos containing material was observed at the time of the limited asbestos inspection conducted August 12, 2019. Therefore, renovation activities may continue. If presumed asbestos containing materials or materials other than steel, concrete, or rubber are to be disturbed that are not covered in this report, additional sampling will need to be performed to identify the absence or presence of asbestos containing materials. Construction, maintenance and custodial staff shall have asbestos awareness training compliant with OSHA 29 CFR 1926.1101 or 1910.1001. This report has been prepared by the Dallas/Fort Worth International Airport, Environmental Affairs Department for the exclusive use of the DFW Airport Board. Any use of or reliance on this report by a third party shall be at such party’s sole risk.

[Signature]

Mr. Javier Araya  
Environmental Project Manager  
TDSHS License #: 20-5701

DFW International Airport  
Asbestos Management Planner Agency  
License #: 20-0030
Appendix A
Inspection Area Location Map
Appendix B
Referenced Report
INITIAL WALK-THROUGH/SITE INVESTIGATION

BUILDING USE: Terminal D is used for the processing of passengers and luggage.

SUSPECT MATERIALS: Suspect materials include sprayed-on fireproofing, drywall, texture, and ceiling tile and various construction mastics.

INTRODUCTION

The following report represents a Limited Asbestos Inspection (LAI) of suspect asbestos-containing building materials (SACBM) located in Terminal D at DFW Airport, Texas.

The subject building was constructed in 2005 and is located south of Terminal B. The subject inspection area consists of the south communication room and adjacent hallway located on the ramp level that may be disturbed during planned renovation activities. The building allows full public access. The scope of services for this inspection includes the identification, location, quantification, and sampling of SACBM within the study area of the subject property. Sampling was conducted by Mr. Javier Araya (TDSHS License No. 20-5701) of DFW Airport’s Environmental Affairs Department (EAD).

The analytical method used to determine the asbestos content of bulk samples collected for SACBM was polarized light microscopy (PLM) with dispersion staining, EPA Method 600. If bulk sample analysis was between 2% to 5% asbestos, the use of EPA Point Count Method 400/1000 was utilized to further determine if regulated asbestos contain material was present. Samples were analyzed through EAD’s current contractual agreement with Cates Laboratories.

The inspection represents a limited site investigation that complies with National Emission Standard for Hazardous Air Pollutants (NESHAP) and Texas Asbestos Health Protection Rules (TAHPR); however, as with most scientific studies, an asbestos inspection is subject to various limitations, including access and observation limitations.
OBSERVATIONS AND FINDINGS

Terminal D is used for the processing of passengers and luggage. The area of interest was as follows:

- Terminal D – Ramp Level Secure-side
  - South Comm. Room
  - South Hallway

REFERENCES

During the inspection, the following asbestos report was referenced and shall be used in conjunction with this report,

<table>
<thead>
<tr>
<th>Report</th>
<th>Date</th>
<th>Laboratory Report No.</th>
<th>Asbestos Firm</th>
</tr>
</thead>
</table>

During the onsite inspection, the following sampled suspect materials were observed in the project work areas:

- **Ceiling System**
  - Sprayed-on Fireproofing (Gray) I01
  - 2’x5’ Ceiling Tile C01 w/
    - Fiberglass C02

- **Wall System**
  - Drywall W01, W03, W05, W07 w/
    - Texture (Smooth) T01, T03, T05, T07
    - Joint Compound T02, T04, T06, T08
    - Unfinished Drywall W02, W04, W06

Laboratory analysis of the above-listed samples indicated the absence of asbestos in the prior sampled suspect materials.

During the onsite inspection the following non-suspect materials were observed:

- Ceiling System: Concrete
- Wall System: Metal Wall Studs, Reinforced Fiberglass Paneling
- Floor System: Concrete
- Plumbing System: Not in Scope of work
- HVAC System: Not in Scope of work

The LAI was performed on April 4, 2019. All sampling procedures were in accordance with federal and state protocols. During the inspection, twelve (12) bulk samples of SACBM were collected and submitted for analysis. The Bulk Sample Analytical Results are summarized in a table in Appendix A, Sample Location the Maps in Appendix B and the Referenced Report in Appendix C.
During the on-site inspection, EAD observed the below-listed suspect materials requiring sampling. Each building material was given a unique identification number represented with an alpha-numeric number (i.e. C01). The Suspect materials requiring sampling included:

- **Ceiling System**
  - Sprayed-on Fireproofing (Gray) I02
  - 2’x5’ Fiberglass Ceiling Tile C03, C04

- **Wall System**
  - Drywall W08 w/
    - Texture (Smooth) T08
    - Joint Compound T09

Laboratory analysis of the samples collected during the inspection indicated non-detect for the presence of asbestos.

**RECOMMENDATIONS**

Based on laboratory analysis and field reconnaissance, suspect materials sampled within the inspection area were non-detect for asbestos. Therefore, renovation activities may continue. If presumed asbestos-containing materials or materials other than steel, concrete, or rubber are to be disturbed that are not covered in this report, additional sampling will need to be performed to identify the absence or presence of asbestos-containing materials. Construction, maintenance, and custodial staff shall have asbestos awareness training compliant with OSHA 29 CFR 1926.1101 or 1910.1001. This report has been prepared by the Dallas/Fort Worth International Airport, Environmental Affairs Department for the exclusive use of the DFW Airport Board. Any use of or reliance on this report by a third party shall be at such party’s sole risk.

---

Mr. Javier Araya  
Environmental Project Manager  
TDSHS License #: 20-5701

DFW International Airport  
Asbestos Management Planner Agency  
License #: 20-0030
Appendix A
Bulk Sample Analytical Results
## Terminal D - Queue Wait Time (Amendment # 1)

### Facility ID #: 33206

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<th>Detailed Area</th>
<th>Suspect Material</th>
<th>Sample Date</th>
<th>Lab Report #</th>
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<th>Smpl Rslt Lyr 3</th>
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<tr>
<td>37</td>
<td>1</td>
<td>Ramp, INS Level, South Hallway</td>
<td>2'x5' Fiberglass Ceiling Tile</td>
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<td>38</td>
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<td>Ramp, INS Level, South Hallway</td>
<td>2'x5' Fiberglass Ceiling Tile</td>
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<td>4/4/2019</td>
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<td>Sample #</td>
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<td>Suspect Material</td>
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<td>Ramp, INS Level, South Hallway</td>
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</tr>
</tbody>
</table>
On 4/5/2019, twelve (12) bulk samples were submitted by Mr. John Lerro of Dallas/Fort Worth International Airport for asbestos analysis by PLM/DS. Copies of the lab data sheets are attached; additional information may be found therein. The results are summarized below:

<table>
<thead>
<tr>
<th>Lab Sample No.</th>
<th>Client Field I.D.</th>
<th>Sample Description/Location</th>
<th>Asbestos Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL707034</td>
<td>28</td>
<td>W08, T08, T09 - Drywall, Texture (smooth), Joint Compound - INS Level, South Comm. Room</td>
<td>None Detected - Paint Texture None Detected - Joint Compound None Detected - Wallboard Material</td>
</tr>
<tr>
<td>CL707035</td>
<td>29</td>
<td>W08, T08, T09 - Drywall, Texture (smooth), Joint Compound - INS Level, South Comm. Room</td>
<td>None Detected - Paint Texture None Detected - Joint Compound None Detected - Wallboard Material</td>
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<tr>
<td>CL707036</td>
<td>30</td>
<td>W08, T08, T09 - Drywall, Texture (smooth), Joint Compound - INS Level, South Comm. Room</td>
<td>None Detected - Paint Texture None Detected - Joint Compound None Detected - Wallboard Material</td>
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<tr>
<td>CL707037</td>
<td>31</td>
<td>I02 - Sprayed-On Fireproofing (grey) - INS Level, South Comm. Room</td>
<td>None Detected - Grey Fireproofing</td>
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<tr>
<td>CL707038</td>
<td>32</td>
<td>I02 - Sprayed-On Fireproofing (grey) - INS Level, South Comm. Room</td>
<td>None Detected - Grey Fireproofing</td>
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<tr>
<td>CL707039</td>
<td>33</td>
<td>I02 - Sprayed-On Fireproofing (grey) - INS Level, South Comm. Room</td>
<td>None Detected - Grey Fireproofing</td>
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<tr>
<td>CL707040</td>
<td>34</td>
<td>C03 - 2’ X 5’ Fiberglass Ceiling Tile - INS Level, South Hallway</td>
<td>None Detected - Ceiling Tile</td>
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<tr>
<td>CL707041</td>
<td>35</td>
<td>C03 - 2’ X 5’ Fiberglass Ceiling Tile - INS Level, South Hallway</td>
<td>None Detected - Ceiling Tile</td>
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<td>CL707042</td>
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<td>C03 - 2’ X 5’ Fiberglass Ceiling Tile - INS Level, South Hallway</td>
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<tr>
<td>CL707043</td>
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<td>C04 - 2’ X 5’ Fiberglass Ceiling Tile - INS Level, South Hallway</td>
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<td>C04 - 2’ X 5’ Fiberglass Ceiling Tile - INS Level, South Hallway</td>
<td>None Detected - Ceiling Tile</td>
</tr>
<tr>
<td>CL707045</td>
<td>39</td>
<td>C04 - 2’ X 5’ Fiberglass Ceiling Tile - INS Level, South Hallway</td>
<td>None Detected - Ceiling Tile</td>
</tr>
</tbody>
</table>

These samples were analyzed by layers. The overall percent asbestos for the sample is reported when relevant. The EPA considers a material to be asbestos containing only if it contains greater than one percent asbestos by Calibrated Visual Area Estimation (CVAE). EPA regulations also indicate that Regulated Asbestos Containing Materials (RACM) – materials that are friable or may become friable – be further analyzed by point counting when the results indicate less than ten percent asbestos by CVAE. CatesLab utilizes CVAE on a routine basis and does not include point counting unless specifically requested by the client. The results may not be reproduced except in full.
On 4/5/2019, twelve (12) bulk samples were submitted by Mr. John Lerro of Dallas/Fort Worth International Airport for asbestos analysis by PLM/DS. Copies of the lab data sheets are attached; additional information may be found therein.

STATEMENT OF LABORATORY ACCREDITATION

The samples were analyzed in general accordance with the procedures outlined in the Method for the Determination of Asbestos in Bulk Building Materials, EPA/600/R-93/116 or the U.S. Environmental Protection Agency EPA 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples, by polarized light microscopy. The results of each bulk sample relate only to the material tested and the results shall not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Specific questions concerning bulk sample results shall be directed to the Laboratory Director.

Analyst: Benjamin Deans

Laboratory Director: John R. Cates, P.G.

Approved Signatory: NVLAP LAB CODE 200569-0
<table>
<thead>
<tr>
<th>Sample ID</th>
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<th>Collect Time</th>
<th>Matrix</th>
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<td>4/4/19</td>
<td>14:00</td>
<td>Solid</td>
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<tr>
<td>36</td>
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</table>

Preservative: [H] = Hydrochloric Acid HCl, [N] = Nitric Acid HNO3, [S] = Sulfuric Acid H2SO4, [O] = Other
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<th>Sample Number</th>
<th>Homogeneous Material Description</th>
<th>Sample Location (Lq., Room #, Location)</th>
<th>Column</th>
<th>Row</th>
<th>Level</th>
<th>Sample Type</th>
<th>Sample Condition</th>
<th>HA 1</th>
<th>HA 2</th>
<th>HA 3</th>
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<th>HA 5</th>
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<td>4</td>
<td>C</td>
<td>Y</td>
<td>Work</td>
<td>Tob Tob</td>
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<td>I02</td>
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</tbody>
</table>

Inspector Name(s): J. Araya  
License Number(s): 20-5701
Appendix B
Inspection Area & Sample Location Map
Terminal D – Queue Wait Time (Amendment # 1)
33260 / 2333 S. International Pkwy.
DFW Project ID: DFWEAD2019091 / Permit No. A18-371B

Inspection Area and Sample Location Map

Inspected by: Javier Araya (TDSHS # 20-5701)
Date of Inspection: April 4, 2019
Appendix C
Referenced Report
LIMITED ASBESTOS INSPECTION
DALLAS/FORT WORTH INTERNATIONAL AIRPORT
DEPARTMENT OF ENVIRONMENTAL AFFAIRS

PROJECT NAME: Terminal D – Queue Wait Time
DFW PROJECT ID NO.: DFWEAD2018212
DFW PERMIT NO.: TBD
REPORT DATE: October 22, 2018

INITIAL WALK-THROUGH/SITE INVESTIGATION

BUILDING USE: Terminal D is used for the processing of passengers and luggage.

SUSPECT MATERIALS: Suspect materials include sprayed-on fireproofing, ceiling tile, drywall, joint compound and texture.

INTRODUCTION

The following report represents a Limited Asbestos Inspection (LAI) of suspect asbestos containing building materials (SACBM) located in Terminal D at DFW Airport, Texas.

The subject building was constructed in 2005 and is located south of Terminal B. The subject inspection area consists of TSA checkpoints that may be disturbed during planned installation activities. The building allows full public access. The scope of services for this inspection includes the identification, location, quantification and sampling of SACBM within the study area of the subject property. Sampling was conducted by Mr. Gonzalo Correa (TDSHS License No. 60-3095) under the guidance of Mr. Javier Araya of DFW Airport’s Environmental Affairs Department (EAD).

The analytical method used to determine the asbestos content of bulk samples collected for SACBM was polarized light microscopy (PLM) with dispersion staining, EPA Method 600. If bulk sample analysis was between 2% to 5% asbestos, the use of EPA Point Count Method 400/1000 was utilized to further determine if regulated asbestos contain material was present. Samples were analyzed through EAD’s current contractual agreement with Cates Laboratories.

The inspection represents a limited site investigation that complies with National Emission Standard for Hazardous Air Pollutants (NESHAP) and Texas Asbestos Health Protection Rules (TAHPR); however, as with most scientific studies, an asbestos inspection is subject to various limitations, including access and observation limitations.
OBSERVATIONS AND FINDINGS

Terminal D is used for the processing of passengers and luggage. The areas of interest were as follows:

- Terminal D – Departures Level
  - Columns K.1-K.5, Rows 4.2-4.6 (TSA Security Area and Comm Rm. only),
  - Columns J.2-K.2, Rows 3.7-4.4 (Hallway only)
  - Columns 4.3-5.2, Rows J.3-K.5 (Ticketing Hall only)
    - Non-secure Side, Gate D14
  - Columns H.1-H.4, Rows 3.6-4.2 (TSA Security Area and Comm Rm. only),
  - Columns H.1-I.4, Rows 4.2-4.3 (Landside Corridor Area only)
    - Non-secure Side, Gate D22
  - Columns E.2-E.5, Rows 4.2-4.6 (TSA Security Area and Comm Rm. only),
  - Columns 4.5-5.2, Rows D.4-E.3 (Hallway only)
    - Non-secure Side, Gate D30

During the onsite inspection the following non-suspect materials were observed:

- Ceiling System: Concrete
- Wall System: Metal Wall Studs
- Floor System: Not in scope of work
- Plumbing System: Not in scope of work
- HVAC System: Not in scope of work
- Electrical System: Metal Conduit

The LAI was performed on October 19, 2018. All sampling procedures were in accordance with federal and state protocols. During the inspection, twenty-seven (27) bulk samples of SACBM were collected and submitted for analysis. The Bulk Sample Analytical Results are summarized in a table in Appendix A and Sample Location Map in Appendix B.

During the on-site inspection, EAD observed the below listed suspect materials requiring sampling. Each building material was given a unique identification number represented with an alpha-numeric number (i.e. C01). Suspect materials requiring sampling included:

- **Ceiling System**
  - Sprayed-on Fireproofing (Gray) I01
  - 2'x5' Ceiling Tile C01 w/
    - Fiberglass C02

- **Wall System**
  - Drywall W01, W03, W05, W07 w/
    - Texture (Smooth) T01, T03, T05, T07
    - Joint Compound T02, T04, T06, T08
    - Unfinished Drywall W02, W04, W06

Laboratory analysis of the samples collected during the inspection indicated non-detect for the presence of asbestos.
PRESUMED ASBESTOS CONTAINING MATERIALS

During the on-site inspection, in an effort not to perform destructive sampling or due to inaccessibility, the following suspect materials shall be presumed as asbestos containing building materials (PACBM) until further sampling is performed.

Ceiling Tile C03
Located at Gate D14 – Nonsecure side
The material was found in good condition at the time of the inspection.

Ceiling Tile C04
Located at Gate D22 – Nonsecure side
The material was found in good condition at the time of the inspection.

If these above materials are observed during construction activities, the contractor shall make every effort not to disturb them. The Presumed Asbestos Location Map is included in Appendix C.
RECOMMENDATIONS

Based on the laboratory analysis and field reconnaissance, (PACM) identified during the inspection was found in the (Ceiling Tile C03, C04). Details regarding type, location and condition of the PACM can be located in the Presumed Asbestos Containing Building Materials section of this report. Per requirement of State and Federal Regulations, abatement is required prior to any renovation of the ACM. Third party air monitoring will be required during the abatement. Trained Asbestos Professionals licensed by the Texas Department of State Health Services shall perform asbestos abatement and air monitoring. If PACM or materials other than steel, concrete or rubber are encountered during construction that are not addressed in this inspection, the contractor should contact EAD for sampling prior to disturbance. Construction, maintenance and custodial staff shall have asbestos awareness training compliant with OSHA 29 CFR 1926.1101 or 1910.1001. This report has been prepared by the Dallas/Fort Worth International Airport, Environmental Affairs Department for the exclusive use of the DFW Airport Board. Any use of or reliance on this report by a third party shall be at such party’s sole risk.

Mr. Gonzalo Correa  
Environmental Operations Analyst  
TDHS License #: 60-3095

Mr. Javier Araya  
Environmental Project Manager  
TDHS License #: 20-5701

DFW International Airport  
Asbestos Management Planner Agency  
License #: 20-0030
Appendix A
Bulk Sample Analytical Results
## Asbestos Tracker

### Terminal D

**Facility ID #:**

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Floor</th>
<th>Detailed Area</th>
<th>Sample Date</th>
<th>Suspect Material</th>
<th>Descript Lyr 1</th>
<th>Smpl Rslt Lyr 1</th>
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</thead>
<tbody>
<tr>
<td>01</td>
<td>3</td>
<td>Concourse, D17A364, Comm. Rm. C25</td>
<td>10/19/2018</td>
<td>Drywall, Texture (Smooth), Joint Compound</td>
<td>T01 Paint Texture</td>
<td>None Detected</td>
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<tr>
<td></td>
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<td>18221</td>
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<td>T02 Joint Compound</td>
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<td></td>
<td></td>
<td>W01 Wallboard Material</td>
<td>None Detected</td>
</tr>
</tbody>
</table>

| 02       | 3     | Concourse, D17A364, Comm. Rm. C25 | 10/19/2018 | Drywall, Texture (Smooth), Joint Compound | T01 Paint Texture | None Detected |
|          |       |               | 18221       |                  | T02 Joint Compound | None Detected |
|          |       |               |             |                  | W01 Wallboard Material | None Detected |

| 03       | 3     | Concourse, D17A364, Comm. Rm. C25 | 10/19/2018 | Drywall, Texture Smooth), Joint Compound | T01 Paint Texture | None Detected |
|          |       |               | 18221       |                  | T02 Joint Compound | None Detected |
|          |       |               |             |                  | W01 Wallboard Material | None Detected |

| 04       | 3     | Concourse, TSS Area, Gate D14     | 10/19/2018 | Unfinished Drywall | W02 Wallboard Material | None Detected |
|          |       |               | 18221       |                  |               | |

<p>| 05       | 3     | Concourse, TSS Area, Gate D14     | 10/19/2018 | Unfinished Drywall | W02 Wallboard Material | None Detected |
|          |       |               | 18221       |                  |               | |</p>
<table>
<thead>
<tr>
<th>Sample #</th>
<th>Floor</th>
<th>Detailed Area</th>
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<th>Suspect Material</th>
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<td>T04 Joint Compound None Detected</td>
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On 10/19/2018, twenty-seven (27) bulk samples were submitted by Mr. Gonzalo Correa of Dallas/Fort Worth International Airport for asbestos analysis by PLM/DS. Copies of the lab data sheets are attached; additional information may be found therein. The results are summarized below:

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These samples were analyzed by layers. The overall percent asbestos for the sample is reported when relevant. The EPA considers a material to be asbestos containing only if it contains greater than one percent asbestos by Calibrated Visual Area Estimation (CVAE). EPA regulations also indicate that Regulated Asbestos Containing Materials (RACM) – materials that are friable or may become friable – be further analyzed by point counting when the results indicate less than ten percent asbestos by CVAE. CatesLab utilizes CVAE on a routine basis and does not include point counting unless specifically requested by the client. The results may not be reproduced except in full.
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These samples were analyzed by layers. The overall percent asbestos for the sample is reported when relevant. The EPA considers a material to be asbestos containing only if it contains greater than one percent asbestos by Calibrated Visual Area Estimation (CVAE). EPA regulations also indicate that Regulated Asbestos Containing Materials (RACM) – materials that are friable or may become friable – be further analyzed by point counting when the results indicate less than ten percent asbestos by CVAE. CatesLab utilizes CVAE on a routine basis and does not include point counting unless specifically requested by the client. The results may not be reproduced except in full.
On 10/19/2018, twenty-seven (27) bulk samples were submitted by Mr. Gonzalo Correa of Dallas/Fort Worth International Airport for asbestos analysis by PLM/DS. Copies of the lab data sheets are attached; additional information may be found therein. The results are summarized below:

<table>
<thead>
<tr>
<th>Lab Sample No.</th>
<th>Client Field I.D.</th>
<th>Sample Description/Location</th>
<th>Asbestos Content</th>
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</thead>
<tbody>
<tr>
<td>CL666521</td>
<td>27</td>
<td>W07, T07, T08 - Drywall, Texture (smooth), Joint Compound - Concourse, D29L322, Comm Room CN3, Gate D30</td>
<td>None Detected - Paint Texture None Detected - Joint Compound None Detected - Wallboard Material</td>
</tr>
</tbody>
</table>

These samples were analyzed by layers. The overall percent asbestos for the sample is reported when relevant. The EPA considers a material to be asbestos containing only if it contains greater than one percent asbestos by Calibrated Visual Area Estimation (CVAE). EPA regulations also indicate that Regulated Asbestos Containing Materials (RACM) – materials that are friable or may become friable – be further analyzed by point counting when the results indicate less than ten percent asbestos by CVAE. CatesLab utilizes CVAE on a routine basis and does not include point counting unless specifically requested by the client. The results may not be reproduced except in full.
On 10/19/2018, twenty-seven (27) bulk samples were submitted by Mr. Gonzalo Correa of Dallas/Fort Worth International Airport for asbestos analysis by PLM/DS. Copies of the lab data sheets are attached; additional information may be found therein.

### STATEMENT OF LABORATORY ACCREDITATION

The samples were analyzed in general accordance with the procedures outlined in the Method for the Determination of Asbestos in Bulk Building Materials, EPA/600/R-93/116 or the U.S. Environmental Protection Agency method, under AHERA (EPA 600/M4-82-020), for the analysis of asbestos in building materials by polarized light microscopy. The results of each bulk sample relate only to the material tested and the results shall not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Specific questions concerning bulk sample results shall be directed to the Laboratory Director.

Analyst: Benjamin Deans

Laboratory Director: John R. Cates, P.G.

Approved Signatory:

NVLAP LAB CODE 200569-0
### Chain Of Custody

<table>
<thead>
<tr>
<th>Turnaround Time</th>
<th>Sample Receipt (Laboratory Use Only)</th>
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<tr>
<td>Normal: 7 Days</td>
<td>1a Samples @ 4 degrees Celsius? Yes No</td>
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<tr>
<td>Rush 2 Hr</td>
<td>1b Temperature of Coolant? Yes No</td>
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<td>24 Hr</td>
<td>2 Samples received intact? Yes No</td>
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<tr>
<td>3 Day</td>
<td>3 Zero Headspace for VOC’s? Yes No</td>
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<tr>
<td>Comments</td>
<td>4 Correct containers used? Yes No</td>
</tr>
<tr>
<td>2 of 3</td>
<td>5 Adequate volume provided? Yes No</td>
</tr>
<tr>
<td></td>
<td>6 Samples preserved correctly? Yes No</td>
</tr>
<tr>
<td></td>
<td>7 Samples received within holding time? Yes No</td>
</tr>
<tr>
<td></td>
<td>8 Agreement between CCC and sample labels? Yes No</td>
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</table>

#### Project Information

**Attention:** Javier Araya  
**Project:** Terminal D Queue Wait Time  
**Sampled by:** G. Correa  
**Special Instructions:** $V L \leq 2\%$  
**Disposal:** Dispose  

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<th>Sample ID</th>
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<td>10 1,01</td>
<td>10/18/18</td>
<td>10:00</td>
<td>Solid</td>
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<td>12</td>
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<td></td>
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<td>13 W04</td>
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<td>14</td>
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<td>15</td>
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<td>16 W05 - 05 - 04</td>
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<td>18</td>
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</table>

Requisitioned By (Signature): G. Correa  
Date: 10/18/18  
Time: 055

Preservative: [H] = Hydrochloric Acid HCl, [N] = Nitric Acid HNO3, [S] = Sulfuric Acid H2SO4, [O] = Other
## Chain Of Custody

### Project Information

**Attention:**
- **SUSAN ARAYA**
- **SUSAN CARREDO**

**Sampling Details:**
- **Terminal D: Queue Wait Time**
- **P.C. L2%**

**Sample ID:**

<table>
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<tr>
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<td>27</td>
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</table>

**Requisitioned By:**
- **G. CARREDA**

**Received By:**
- **Signature:**

**Comments:**
- 2007-07-10

### Analysis Requested

- **Sample Receipt (Laboratory Use Only):**
  - Yes
  - No

- **Sample Analysis:**
  - TPH/Total Petroleum Hydrocarbons (100%) (M)
  - BTEX/Aromatic Hydrocarbons (60632260C) (M)
  - VOCs: Volatile Organics GC/MS (6250260C) (M)
  - SVOC: Semivolatile Organics GC/MS (6250260C) (M)
  - Corrosivity, pH, Reactivity
  - Oil & Grease (1584) (P)
  - Ignitability (1584) (P)
  - BOD, TOC
  - TSS, DS (Dissolved Solids)
  - Organic Chlorine Pesticides (62582601)
  - PAH (62582602)
  - Ammonia (S)
  - Total Heavy Metals by TCLP
  - Total Lead
  - Asbestos - PLM
  - Boiler
  - CO (P)
  - Al, Cu, Zn (Individual Metal) (M)
  - Number of Containers

**Preservative:**
- [H] = Hydrochloric Acid HCl
- [N] = Nitric Acid HNO₃
- [S] = Sulfuric Acid H₂SO₄
- [O] = Other
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<th>Sample Number</th>
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<th>HA2</th>
<th>HA3</th>
<th>HA4</th>
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<td>Drywall, Texture (Smooth)</td>
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<td>C</td>
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<td>13</td>
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Appendix B
Inspection Area & Asbestos Sample Location Map
Terminal D – Queue Wait Time
33260 / 2333 S. International Pkwy.

Sample Location Map

Inspected by: Gonzalo Correa (TDSHS No. 60-3095)

Date of Inspection: October 19, 2018
Appendix C
Presumed Asbestos-Containing Material (PACM)
Location Map
Terminal D – Queue Wait Time
33260 / 2333 S. International Pkwy.

Presumed Asbestos Containing Material Location Map

Inspected by: Gonzalo Correa (TDSHS No. 60-3095)

Date of Inspection: October 19, 2018
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PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of this Contract comprises of Terminal D Gate Area of the Future. The project area is approximately 10,500 SF of the continuous area between gates D12 and D14 and an additional approximately 3,000 SF in two additional seating areas across the main corridor from the D12-D14 gate lounge in Terminal D. The project consists of selective demolition, interior renovations, and integration of new furniture and technology elements into the gate areas. Construction will be on secure site on the concourse level, with under floor work with access via the AOA. The construction will be phased to accommodate ongoing operation during construction. Construction will be inside the Airport’s Air Operations Area (AOA). The Contractor shall be responsible for reviewing all existing conditions associated with the Work prior to commencement of work activities.

1.2 BADGING, AOA ACCESS AND REVENUE AREA ACCESS

A. Identification/Access badge required for Contractor to work on the project: Yes

B. Access to Revenue Area (RA) for Contractor to work on the project.
   1. Default access through the North and South Control plazas is required: Yes
   2. Vehicle access through Crossover gate(s) is NOT approved.
   3. Vehicle permit and AOA gate access is required: Yes

C. The Contractor and all Subcontractors must obtain and pay for all Airport Identification Badges, Vehicle Permits and access to Revenue Area as required by the Airport.

D. Refer to section 01 55 20 for detailed information on obtaining Identification/Access badge, AOA access and Revenue Area access

E. This project does not anticipate the need for an off-duty DPS officer while working on-site.

1.3 CONTRACT TIME & SCHEDULE MILESTONES

A. The Contractor shall sequence and stage the Work in accordance with the requirements of the Contract Documents to meet the following interim requirements and Final Completion date.
   1. One-hundred-ninety (190) consecutive Calendar Days for Substantial Completion, from the date set forth in the Notice to Proceed (NTP).
   2. Sixty (60) consecutive Calendar Days for Final Completion, from the date set forth for Substantial Completion.
   3. Total Contract Time is two-hundred-fifty (250) consecutive Calendar Days from NTP.
4. A phasing plan shall be submitted within 10 calendar days of NTP for DFW review and approval.

5. **Milestone 1**: Six weeks prior to substantial completion Contractor must make ready a minimum of one LED column wrap, the full proscenium LED display, one fully integrated configuration of lighting Type E, one fully integrated configuration of lighting Type G, and the full configuration of Lighting Type C for testing, training, and commissioning by Owner's third-party vendor. Contractor must coordinate with Owner and third-party vendor to allow access to the construction area. Owner and third-party vendor will require access to the construction area during this time. Ongoing construction work in the area must be coordinated to allow this effort to take place.

B. The Owner reserves the right to request the completion of work based on critical Milestones established in the Contract Documents. Refer to the proposed phasing plan for work area restrictions on sheet AP-001.

C. The Owner reserves the right to apply Liquidated Damages associated with the request the completion of work based on critical Milestones.

1.4 HOURS OF WORK

A. The Work may be performed in all areas up to 24 hours a day, 7 days a week, as necessary to meet the Project completion dates, except as noted below.

B. Work activities within the active area of the concourse are restricted to after hours to not impact DFW daily operation. Typical daily operation hours are 5:00 AM to 10:00 PM which can vary pending on daily flight schedules. Daily activities shall be coordinated daily with DFW representative.

C. Exceptions to above work hours:

1. There are two types of Holiday Blackout periods. One governs the area within the Air Operations Area (AOA) and the other holiday blackout periods governs the area outside of the Air Operations area. The following construction blackout dates are recognized for the Project:

   a. **Airfield Blackout Dates**:

      1) 10 pm Friday November 20, 2020 to 10 pm Monday November 30, 2020
      2) 10 pm Thursday December 17, 2020 to 10 pm Monday January 4, 2021

   b. **Landside Blackout Dates**:

      1) The following annual dates have been established as construction blackout dates in the landside and customer service areas. During the noted landside Holiday blackout dates any work that impacts ramp level operations, roadways, guests inside the terminals and non-emergency utility outage requests, will normally not be approved. Work
and utility outages that do not impact stakeholder operations or have limited impact will be evaluated on a case by case basis during the blackout periods. The dates listed are the primary dates and others may follow:

a) Spring Break – Thursday, March 5 at 00:00 am through Monday, March 23, 2020 at 11:59 pm  
b) Memorial Day – Thursday, May 21 at 00:00 am through Tuesday, May 26, 2020 at 11:59 pm  
c) July 4 – Thursday, July 2, at 00:00 am through Monday, July 6, 2020 at 11:59 pm  
d) Labor Day – Thursday, September 3 at 00:00 am through Tuesday, September 8, 2020 at 11:59 pm  
e) Thanksgiving – Thursday, November 19 at 00:00 am through Tuesday, December 1, 2020 at 11:59 pm  
f) Christmas/New Year – Friday, December 18 at 00:00 am through Tuesday, January 5, 2020 at 11:59 pm  

c. For all utility outages, a Utility Outage Request form must be submitted via email seven days in advance to PowerOutage@dfwairport.com. For power outage requests, all impacted panel schedules must be submitted with the request. Operations will review and if needed, coordinate a stakeholder meeting to discuss mitigation plans. One hour prior to all utility outages, the requestor must call the Airport Operations Center at 972-973-3112 one hour prior to the scheduled outage for a final go/no-go. The Utility Outage Request form may be found on https://www.dfwairport.com/operations/ or you may request a form from PowerOutage@dfwairport.com.

1.5 CONSTRUCTION

A. The project shall be constructed in accordance with the requirements and restrictions shown on the construction documents.

1.6 WORK REQUIREMENTS AND RESTRICTIONS

A. The specific work requirements and restrictions are identified throughout the specifications and contract drawings. Special attention is to be given to the notes on contract drawings for construction phasing and sequencing that may only be amended by executing a change order.

B. All Contractor work activities shall be under the oversight of the Owner’s Authorized Representative (OAR).

C. Construction operations at the site shall be confined to areas permitted by Law, Ordinances, Permits, and these Contract Documents.

D. Restrict construction personnel from access to areas other than those designated within these specifications and associated drawings.
E. Obtain a permit from the DFW Department of Public Safety for all hot work activities including cutting, welding, grinding or open flame operations.

F. The Contractor will be required to submit the following items prior to issuance of a construction permit:

1. Spill Response Plan (SRP) - Projects that involve the use of fuels, oils, paints, chemicals, and any other material that may pose a threat to human health or the environment may require a Spill Response Plan (SRP).
2. Solid Waste Management Plan (SWMP) - Identify the types and quantities of all solid wastes (including hazardous, non-hazardous or otherwise regulated wastes) that will be generated during this project and provide details on the management of these wastes, including labeling, storage, transportation and disposal. A sample Solid Waste Management Plan spreadsheet is contained in the Guidance document.

1.7 CONTRACTOR USE OF PREMISES

A. Authority and Project Coordination:

1. Coordination with the Board, governmental agencies, utility companies or other entities associated with performance of work required under this Contract shall be accomplished through the OAR.
2. Under unusual, urgent or emergency circumstances, Board Representatives such as the Departments of Public Safety and Airfield Operations may issue instructions directly to Contractor or subcontractor personnel.
3. Cooperate fully with other Contractors, Board, or FAA personnel who may be performing maintenance, navigational aid or other work within the project areas. Access to FAA facilities shall be coordinated through the OAR.
4. Notify the OAR immediately of any project conditions or situations that might affect the safety of Airport operations or constitute a deviation from the requirements and restrictions contained in these Contract Documents.

B. Safety:

1. The Contractor is required to prepare a Safety Manual and provide it to the OAR within seven days after the Notice to Proceed.
2. Ensure that all Contractor and subcontractor employees present on the job site are thoroughly familiar with and adhere to the safety and security requirements and restrictions stipulated in the Specifications before commencing work.
3. The Contractor and all subcontractors are required to attend a kickoff safety meeting prior to the start of work. Periodic safety meetings will be required during the construction of the project.
4. Implement and maintain an effective program to control dust and debris.
5. Provide reverse movement alarms on construction vehicles as required under OSHA regulations.
6. Ensure that all Contractor and subcontractor employees present on the job site are thoroughly familiar with and adhere to the safety and security requirements and restrictions stipulated in the Specifications before commencing work.
7. Employ adequate and OAR-approved fire and safety precautions when using open flame welding or torch cutting operations. Maintain adequate shielding to prevent pilot, employee, or public viewing of such open flame operations.

8. Provide adequate levels of artificial temporary lighting for areas of work when natural lighting is not adequate for safety and for the proper performance of work. Temporary lighting shall be approved in advance by the OAR. Lighting shall be shielded and/or aimed in a manner to prevent lighting from impairing the vision of pilots, airport personnel, air traffic controllers or the general public.

9. Provide head, ear, and eye protection to all personnel working within AOA work areas. ReflectORIZED vests are required outer clothing for all AOA work.

10. Adhere to supplemental project safety or security procedures that shall be prepared and issued by the OAR from time to time on an as-needed basis.

11. Maintain, on a 24-hour per day, seven days-a-week basis, clear unobstructed routes for routine and emergency vehicle traffic within project areas and access routes to and from project areas.

C. Construction Facilities and Storage Areas:

1. Restrict Contractor's material/equipment storage and employee parking to areas defined in the Contract documents or as approved by the OAR.

2. The Contractor assumes full responsibility for protection and safekeeping of all stored products.

3. Storage areas should be fenced and secured.

4. The Contractor will be required to hire either off duty airport DPS security or law enforcement officers or contract security guards to protect the job site, material storage areas, equipment storage areas, etc if security is required. Security guards will not be permitted to carry a firearm.

5. Do not block or obstruct any portion of any roadway while conducting activities associated with delivery or movement of materials, equipment or personnel, unless approved by the OAR in conjunction with a Traffic Control Plan.

6. General Storage: Store products immediately upon delivery and in accordance with the manufacturer's instructions, with labels and seals intact. Protect until installed. Contractor will not be allowed to store materials in terminal areas. Storage shall be arranged to provide access for maintenance and inspection.

7. Enclosed Storage: Store products subject to damage by the elements in substantial weather tight enclosures. Maintain temperature, humidity, and ventilation per manufacturer's instructions.

8. Exterior Storage: Provide substantial platforms, blocking or skids to support fabricated products above ground; slope to provide drainage. Provide impervious sheeting over products subject to dislocation and deterioration from exposure to the elements. Provide proper drainage and prevent the mixing of refuse and chemically injurious materials.

D. Vehicle Access and Haul Routes:

1. Do not unreasonably encumber site with material or equipment. All dumpsters shall be tightly covered to prevent debris from blowing out onto the AOA, thus creating Foreign Object Debris (FOD).

E. Storage and Disposal of Spoils and Refuse:
1. Always maintain project areas in a clean and safe condition. Immediately remove all trash, debris, and surplus materials from work areas regardless of source. Clean paved surfaces within project related areas as required or directed by OAR.

1.8 WORK BY OTHERS

A. During this contract, there may be other construction activities occurring on behalf of the AIRPORT BOARD in the same area(s). Coordination and cooperation with these contractors will be required during the prosecution of the project.

1.9 UNATTENDED CONSTRUCTION VEHICLES ON AIRPORT PROPERTY

A. Construction vehicles left unattended anywhere on Airport property shall be identified with the name of the company and a telephone number that is answered 24-hours a day, on both sides of the vehicle. If there is no company contact information on the sides of the vehicle, the contact information may be printed legibly on a minimum size 12” x12” white placard, securely attached to the wind shield of the vehicle and clearly visible from fifty (50) feet away. Unattended and/or unidentified vehicles are subject to removal from Airport property at the contractor’s expense.

1.10 VEHICLE RELOCATION PROCEDURES

A. The following procedures are established in order to relocate legally parked vehicles in public parking facilities operated by the Airport Board due to construction.

1. Post a “30 Day Closure Notice” sign at the entrance to the parking facility. Sign specifications are available from the DFW Sign Shop.
2. If the closure involves only a section of the parking facility, the signs should be posted in the affected area to delineate closure of the specific section. Cones, barrels, tape, barricades or any combination thereof may be used to secure vacant spaces.
3. If vehicles have been removed after 30 days, the DFW Project Manager will ensure that the Contractor:

a. Contact the Board’s contract wrecker service 48 hours in advance to ensure the company has adequate staffing.
b. Barricade the entrance to prevent additional vehicles from parking if the entire lot is involved.
c. Ensure that before and after photographs are taken of vehicles that will be relocated.
d. Create a vehicle log that includes the color, make, model, license plate number and document any existing damage.
e. Note the location where the vehicle was parked and to where it has been relocated. Relocation should be as close as practical to the original location.
f. If relocating vehicles at Remote Parking, notify Guest Services at (972) 973-4840.
g. If relocating vehicles parked at Express Parking, notify Parking Contract Bussing at (972) 574-0370 and AMPCO at (972) 574-7414.
h. If relocating vehicles parking at the Employee Parking Lots, notify Parking Contract Bussing at (972) 822-7704.

i. Fax a copy of the vehicle log to DPS Communications at (972) 973-3194, DPS Project Planning & Management Division at (972) 973-3597, DFW Customer Service at (972) 574-0342, Parking Guest Relations at (972) 973-4841, South Parking Control Plaza at (972) 973-3816, North Parking Control Plaza at (972) 973-3806 and the Airport Operations Center (AOC) at (972) 973-3188.

PART 2 - – PRODUCTS
Not Used.

PART 3 - – EXECUTION
Not Used.

PART 4 - – MEASUREMENT AND PAYMENT
Not Used.

- END OF SECTION -
SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

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

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

1.3 PROCEDURES

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

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

B. Execute accepted alternates under the same conditions as other Work of the Contract.

C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Add Alternate No. P-1: Bid Alternative 1.
1. Alternate 1: Plumbing scope for future vendor buildout as indicated on Drawings PL-005 - Plumbing Symbol Legend-Abbreviations, PL-006 - Plumbing General Notes, and PL-100 – “Plumbing Level 2 Ramp Plan” and as specified in all Division 22 Sections.

2. Alternate 2: Refer to section 26 55 19. For Lighting fixture types E & G include pricing within the base bid based on the manufacturer listed as the acceptable manufacturer (Barbican). Include unit pricing for the manufacturer noted as an alternate #2 (Innovative Lighting).

END OF SECTION
PART 1 – GENERAL

1.1 SUMMARY

This Section covers the process for the Contractor to request a clarification on the Project Documents through a Request for Information (RFI) during the Project.

1.2 GENERAL

A. An RFI is intended for the Contractor to request a clarification and/or interpretation of the Contract Documents due to an apparent inconsistency, error, or omission, or due to unanticipated existing conditions.

B. An RFI is not intended for by the Contractor to request substitutions, proposed changes to the Contract Documents, the resolution of any non-conforming work, or for general questions not related to the Contract Documents.

C. The RFI process is intended to be a cooperative effort between the Contractor, the Owner, and the Architect/Engineer to clarify any apparent errors, omissions, or ambiguities in the Contract Documents while maintaining the progress of the Work.

1.3 RFI NUMBERING

A. The Contractor shall number each RFI sequentially utilizing a three-digit code starting with “001” and continuing “002”, “003”, etc.

B. A resubmittal or revised RFI on the same subject shall be numbered utilizing the same three-digit code and including a letter suffix beginning with “A” and continuing sequentially. (e.g. The second revision to the second RFI would be numbered “002B”.) In such case, the previous edition of the RFI shall be acknowledged to be superseded and thereby closed in the description of revised RFI.

C. A three-digit alphanumeric prefix designation may be utilized on a large project, or a project involving numerous buildings or structures. (e.g. The second RFI on “Building A” could be “BDA-002”).

D. The Contractor shall consult with the Construction Manager (CM), whether such prefix designation is required for the Project and shall maintain the prefix chosen unique designation for each building or structure consistent throughout the Project.

1.4 DOCUMENTATION

A. All notifications, documentation, and transmittals between the Contractor and the Owner’s personnel for the RFI process shall utilize the Skire Unifier software application, unless an alternate form of transmission is directed by the Owner for the Project.

B. If an alternate form of transmission is directed for the Project, all notifications, documentation, and transmittals shall utilize that form of transmission.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 SUBMISSION

A. The Contractor shall submit an RFI to the CM identifying the subject and providing all necessary reference information.
B. The Contractor shall submit only a complete RFI including all attachments necessary to adequately explain the subject of the RFI.

C. The Contractor shall limit the RFI to only one (1) Contract Item or only one (1) Specification Section reference.

3.2 RESPONSE

A. The CM will review the RFI to respond or forward to the Architect/Engineer or other Owner personnel for input or reject the RFI if it is determined to be incomplete.

B. The Architect/Engineer or other Owner personnel will review the RFI and provide a response to the CM or request additional information to adequately review and respond to the RFI.

C. The CM will forward the response or request additional information from the Contractor.

D. If the CM requests additional information, the Contractor shall provide such information within two (2) Working Days unless otherwise allowed by the CM.

E. If the Contractor does not provide the requested information within two (2) Working Days, the CM will close the RFI. In such a case, the Contractor may submit a new RFI concerning the subject matter when the requested information can be provided.

F. If the Contractor submits a new RFI concerning a previously rejected or closed RFI without the previously requested information, the RFI will be rejected by the CM.

G. When the CM returns the response to the Contractor, the RFI will be closed.

PART 4 – MEASUREMENT AND PAYMENT

Not Used.

- END OF SECTION -
PART 1 – GENERAL

1.1 SUMMARY
This Section includes the required forms and schedules necessary to meet the wage rate requirements for the Project.

1.2 FORMS
A. Request for Authorization of Additional Classification and Rate - Standard Form 1444

1.3 WAGE RATES
A. United State Department of Labor (DOL) provides the required minimum wages and fringe benefits to be paid to all laborers and mechanics employed to work on this Contract, either directly under this Contract or under a related subcontract. The Contractor and all Subcontractors are required to report the actual wages paid to laborers and mechanics performing work under this Contract. The reported wages will be verified by review of the weekly payroll reports and by periodic on-site interviews conducted by the Construction Manager.
B. The Wage Determination establishes the minimum wages and fringe benefits to be paid to laborers and mechanics throughout the duration of this Contract. In no event shall these minimum wages be modified.
C. If the Work specified in this Contract requires work performed by laborers or mechanics whose job classification is not listed in the Wage Determination, the Contractor is responsible for preparing the Request for Authorization of Additional Classification and Rate Standard (Form 1444) located in Section 01 29 85.01. The latest version of Form 1444 may also be obtained at the following address: https://www.gsa.gov/forms-library/request-authorization-additional-classification-and-rate
D. Additional copies of the latest Form 1444 may also be obtained from the Owner’s Authorized Representative (OAR). The Contractor must complete Items 3 through 15 and submit the request to the OAR prior to issuance of the Notice to Proceed (NTP) or as soon as the need for the additional classification or rate is identified, if the work has been authorized to begin.

PART 2 – PRODUCTS
Not Used.

PART 3 – EXECUTION
Not Used.

PART 4 – MEASUREMENT AND PAYMENT
Not Used.

- END OF SECTION -
General Decision Number: TX20200270 01/03/2020

Superseded General Decision Number: TX20190270

State: Texas

Construction Type: Building

County: Tarrant County in Texas.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.80 for calendar year 2020 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.80 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2020. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

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ASBE0021-011 06/01/2016

Rates Fringes

ASBESTOS WORKER/HEAT & FROST INSULATOR (Duct, Pipe and Mechanical System Insulation)....$ 24.32 7.52

----------------------------------------------------------------

BOIL0074-003 01/01/2017

Rates Fringes

BOILERMAKER.........................$ 28.00 22.35
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<tr>
<td>MILLWRIGHT.................$ 26.60       8.65</td>
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<tr>
<td>ELEVATOR MECHANIC...............$ 41.24     33.705</td>
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**FOOTNOTES:**
A. 6% under 5 years based on regular hourly rate for all hours worked. 8% over 5 years based on regular hourly rate for all hours worked.


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<tr>
<td>POWER EQUIPMENT OPERATOR</td>
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<tr>
<td>(1) Tower Crane..............$ 29.00     10.60</td>
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<td>(2) Cranes with Pile Driving or Caisson Attachment and Hydraulic Crane 60 tons and above......$ 28.75 10.60</td>
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<td>(3) Hydraulic cranes 59 Tons and under...............$ 27.50 10.60</td>
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<tr>
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<tr>
<td>Trade Description</td>
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<td>BRICKLAYER</td>
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<td>CEMENT MASON/CONCRETE FINISHER</td>
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<td>DRYWALL HANGER AND METAL STUD INSTALLER</td>
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<td>ELECTRICIAN (Sound and Communication Systems Only)</td>
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<td>LABORER: Common or General</td>
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<td>LABORER: Mason Tender - Cement/Concrete</td>
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<td>LABORER: Pipelayer</td>
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<td>LABORER: Roof Tearoff</td>
<td>$ 11.28</td>
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<td>LABORER: Landscape and Irrigation</td>
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<td>Position</td>
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<td>----------------------------------</td>
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<tr>
<td>OPERATOR: Backhoe/Excavator/Trackhoe</td>
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<td>OPERATOR: Bobcat/Skid Steer/Skid Loader</td>
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<td>OPERATOR: Drill</td>
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<td>OPERATOR: Grader/Blade</td>
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<td>OPERATOR: Loader</td>
<td>12.89</td>
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<tr>
<td>OPERATOR: Mechanic</td>
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<tr>
<td>OPERATOR: Paver (Asphalt, Aggregate, and Concrete)</td>
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<td>OPERATOR: Roller</td>
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<tr>
<td>TRUCK DRIVER: Water Truck</td>
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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.
Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. Example: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

----------------------------------------------------------------

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests
for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations  
Wage and Hour Division  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

================================================================

END OF GENERAL DECISION
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PART 1 - GENERAL

1.1 SUMMARY
A. This Section covers the requirements and procedures if Allowances are included in the Contract.
B. Allowances are not included in the Lump Sum Base Bid for a Lump Sum contract.
C. Allowances have been set aside to complete elements of the Work that are within the general scope of work but are not shown on the Plans or specified in the Specifications. Any and all unused portions of the stipulated Allowances will not be paid to the Contractor and shall be deducted from the Contract Amount at the Final Completion of the Project.
D. Use of any funds allotted to Allowances is only for the Work of the Project, while Allowances are within the original Scope of Work, such items could not have been reasonably anticipated based upon the information available at the time the cost estimate was established. Use of such funds is not to be construed as including upgrading or enlarging the Scope of Work of the Project and its use is at the sole discretion of the Owner.
E. All price quotes and scopes of work requested by the Owner through the Owner’s Authorized Representative (OAR) for each Allowance item of work, shall be provided to and approved by the OAR prior to the Contractor proceeding with any such work. The Contractor shall provide a price quote within seven (7) Calendar Days of receipt of request by the OAR.
F. The OAR will approve an Allowance item of work by issuance of a Change Order prior to the Contractor proceeding with such work. The Change Order will clearly define the Allowance item scope and agreed to pay amount.
G. Contract Time extensions may not be executed under this process, but within the Change Order process. Any adjustment to the Contract Time shall be in accordance with Section 01 32 16, Construction Progress Schedule.

1.2 ALLOWANCE SCOPE
A. Owner's Allowance: Include a lump sum Owner’s Allowance of three-hundred-eighty and no/100 dollars ($ 380,000) to the bid price. This allowance will be used by the Owner to add work to the project via a Change Order.

1. PART 2 – PRODUCTS
Not Used.

PART 3 – EXECUTION
Not Used.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT
Price quote and scope of work requested by the OAR for each Allowance item, shall be provided to and approved by the OAR prior to the Contractor proceeding with such work.
4.2 PAYMENT

Payment will be made under the respective change order on the schedule of values as part of the monthly payment application request.

– END OF SECTION –
PART 1 – GENERAL

1.1 SUMMARY

This section covers the requirements for the contractor to acquire access to the airport’s airside and Revenue Area (RA) as identified in the section 01 11 00 Summary of Work.

1.2 IDENTIFICATION/ ACCESS BADGES

A. The Contractor and all Subcontractors must obtain and pay for all Airport Identification/Access Badges and Access Permits as required by the Airport. (A list of Fees & Charges can be found on Access DFW’s website: www.dfwairport.com/accessdfw under Fees & Charges.)

1. All appropriate forms and applications must be obtained, completed and submitted to Access DFW. Badging and AOA Vehicle Permits: The Contractor and all Subcontractors must be onboarded with the Access DFW and an Authorized Signatory must be assigned to request badging privileges and AOA permits. For further information contact ACCESS DFW at 972-973-5100

1.2.1 TERMINATING EMPLOYEES

A. The Authorized Signatory must immediately log in to SAFE and terminate the employee in SAFE immediately. All Airport ID Badge are property of the DFW Airport and must be returned to Access DFW. Badges can be returned 24 hours a day, 7 days a week by using the Airport ID drop box located outside the entrance of Access DFW. This is a TSA requirement and is very important to ensure that all Airport ID Badges at DFW are properly accounted for.

B. Failure to return a badge within 5 days after termination or access is no longer needed will result in a $120 non-refundable unreturned badge fee, billed to the company by DFW Airport

1.2.2 UNACCOUNTED FOR BADGES

An unaccountable ID badge is one that has been lost, stolen, or is missing, with an unexpired date on the front of the badge.

Access DFW monitors unaccountability percentages for each company and may suspend new badges and renewals until the company re-gains control of the badges issued to the company. You may also be required to meet with Access DFW and DFW management if unaccountable badges remain high. It is a key requirement of your Authorized Signatory job duties that each week you run the Unreturned Badges report (in the Reports tab in SAFE) and proactively recover all unaccountable badges, unless they have been lost or stolen. Failure to comply could result in the above consequences.
1.3 AOA VEHICLE ACCESS PERMITS

Air Operations Area (AOA) Permits, including AOA vehicle Access Permits, Temporary AOA Vehicle Access Permits, and AOA Equipment Permits are the means by which a motor vehicles and ground handling equipment signify that they are properly insured and authorized to enter and operate on the AOA and the SIDA.

All vehicles and ground handling equipment entering security gates, commonly referred to as “AOA gates” must comply with the following:

A. Must display valid, unexpired AOA Permits or be under escort by an agent of the Airport Board, a representative of the airlines, or a tenant responsible for the AOA gate through which the vehicle or ground handling equipment is entering.

B. Must be marked with the company name and/or logo for identification purposes.

C. Are subject to inspection by security personnel, and ground handling equipment being brought into the SIDA for the first time must be inspected by DPS security personnel at the AOA gate.

D. Must Affix the permit to the vehicle to which the AOA Permit was issued on the driver’s side front and rear bumper of the vehicle, or for tractor trailers, the AOA Permits must be affixed to the driver’s side front and driver’s side rear of the tractor.

1.3.1 VEHICLE PERMIT ISSUANCE

The following will help you determine which AOA permit application is needed:

A. Select “Annual Vehicle Permit” for Permit Type when the following conditions apply:
   1. Your company is an airline tenant, government agency, Airport concessionaire, or the Airport Board; OR
   2. Your company is a contractor or vendor for an airline tenant, government agency, Airport concessionaire, or the Airport Board whose contract/agreement expires on the last day of the calendar year (ex: contract term begins on 05/15/2019 and expires on 12/31/19).

B. Select “Temporary” for Permit Type when the following condition applies
   1. Your company is a contractor or vendor for an airline tenant, government agency, Airport concessionaire, or the Airport Board whose contract/agreement expires prior to the end of the last day of the calendar year (ex: contract term begins on 01/01/2019 and expires on 09/30/2019).

C. Select “Equipment” for Permit Type when the following condition applies
   1. Your company is an airline tenant, government agency, the Airport Board, or an Airport Board contractor that has ground handling equipment that will remain in the SIDA and the ground handling equipment does not traverse through AOA gates after being brought into the SIDA.
Please make sure you allow two to three business days for application processing and permit issuance. Access DFW will contact you when the permits are ready to be picked up.

1.3.2 VEHICLE PERMIT INSURANCE REQUIREMENTS

All policies must be written through a licensed company authorized by the Texas State Board of Insurance to transact that class of insurance business in the State of Texas, with a minimum rating of ‘A-‘, ‘VII’ by A. M. Best Company. If the rating of any insurer should fall below this standard, you shall cause the policy to be replaced promptly by an acceptable insurer.

- **Commercial General Liability (CGL)**
  
  **Limit Any One Occurrence**: $1,000,000
  
  CGL must be written on an "Occurrence Form."

- **Business Automobile Liability**
  
  **Combined Single Limit for Each Accident**: $500,000
  
  Coverage must apply to all vehicles (owned, non-owned, or hired) operating on our site/location, or transporting our people or property off our site.

- **Excess / Umbrella Liability**
  
  **Air Operations Area (within air operations area)**: $10,000,000
  
  Coverage must apply in excess of all required primary Liability insurance and must be at least as broad as the underlying Liability insurance.

  This coverage limit may be satisfied by adding the amounts of CGL and Excess/Umbrella Liability to arrive at a total of $10,000,000. The same would be applicable for Business Auto Liability and Excess/Umbrella Liability to arrive at a total of $10,000,000.

1.4 SECURITY

A. Security Violations:

  If an employee with your company receives a Violation Notice, the Authorized Signatory will also receive the notice and be responsible for ensuring that the proper follow-up and response to the Airport is provided by the employee. In all circumstances, DFW Airport reserves the right to penalize an individual for security violations. Penalties/fees may be assessed based on the consultation and coordination with TSA.

B. Pedestrian Traffic at AOA Vehicle gates:

  TSA Regulations prohibit pedestrian traffic through AOA vehicle gates. Violators may receive a Violation Notice.

C. DFW Violation Appeal Process:
If your company’s employee receives a Violation Notice, they have the ability to appeal it. Details explaining the violation appeal process are included in the original security Violation Notice letter.

1.5 REVENUE AREA ACCESS

It is the policy of the Owner to promote adequate and efficient vehicle services and operations at the Airport. To this end, Rules and Regulations for RA use is developed to protect the public health and safety, and promote public convenience and necessity, while minimizing adverse effect on public parking capacity and protection of revenues. Specifically, it is the policy of the Owner that all vehicles, including private vehicles, unless otherwise noted in Section 01 11 00 Summary of Work, shall enter and exit the RA via the North and South Control Plazas or via crossover gates as specified by the contract.

1.5.1 AUTHORITY FOR ENFORCEMENT

The Employee Parking Office (EPO) is designated to administrator the Airport Vehicle Rules and Regulations to control RA use. The EPO may, establish procedures consistent with the Rules and Regulations which EPO determines necessary. The Airport Department of Public Safety (DPS) shall be responsible for the enforcement of the Rules and Regulations.

1.5.2 OPERATING AUTHORITY

A. The EPO administers and Transportation Business Unit (TBU) approves all requests for access to the RA. The Contractor and his subcontractors must request approval for 24-hour access in designated RAs. Approval will be only for contract work for the duration of this contract.

B. Access to the RA is managed by the TBU at the EPO. Email the EPO at Prkpri@DFWAirport.com or call 972-973-8040 to start the request. The following documentation is required but not limited to:

1. Notice-To-Proceed (NTP) Letter
2. The Contract Agreement
3. Specifications Section 01 11 00 Summary of Work

C. Once all the above is received by the EPO, the Parking Guest Relations Manager will set up a meeting to instruct the Authorized Signatory on how to input vehicles into the system

D. At any point a change order (CO) is issued that effects this access, to include any extensions to the contract, Contractor must email the CO to the EPO for modification to the approved access. Any failure to inform the EPO in a timely manner will result in termination of access.

E. Any violations to policy and procedures presented by the TBU and/or EPO could result in termination of access to one or more of vehicles associated with this contact.
F. The prime contractor will be responsible for processing and access to all sub-contractors and will take on all responsibilities of their actions.

G. All access to the RA is based on each vehicle having an NTTA toll tag and each account MUST be associated to an active credit card (no cash accounts).

1.5.3 ENFORCEMENT

A. Violations

If TBU and/or EPO determines that the Contractor violates terms of its Operating Authority or the Code of Rules and Regulations, TBU and/or EPO may notify the Contractor, of the violation and may either deny or terminate access to RA based on the nature of violation.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

Not Used.

PART 4 – MEASUREMENT AND PAYMENT

Not Used.

- END OF SECTION -
PART 1 – GENERAL

1.1 This Section includes all the requirements for the staging areas to be required for the Project.

1.2 SUMMARY

A. The staging area(s) for the Project shall be assigned by the Airport Environmental Affairs Department (EAD) if shown on the Plans.

B. The staging area on the Airport shall not be used for the storage of chemicals, materials, and equipment related to any Contractor’s off-site work.

C. The Contractor shall submit an Erosion Control Plan (ECP) and a Storm Water Pollution Prevention Plan (SWPPP) to the Owner’s Authorized Representative (OAR) if the staging area(s) is/are not already included in the Plans ECP or SWPPP.

D. The Contractor shall comply with the EAD Administrative Policy Staging Yard Authorization and Utilization procedures, the International Building Code 2009 (IBC), and the International Fire Code 2009 (IFC) and Local Amendments.

1.2 DEFINITIONS

A. Final Stabilization: A construction site status where all soil disturbing activities at the site have been completed and a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as crushed stone, riprap, gabions, or geotextiles) have been employed.

B. Temporary Structure: A portable building, Conex container, or shade structure that will be on-site less than ninety-one (91) Calendar Days from the date of the letter of authorization to construct, deliver, or erect such a structure.

1.3 SUBMITTALS

A. Site Plan: The Contractor shall submit a proposed site plan to the OAR for review and approval after coordinating the site with the EAD. The site plan shall at a minimum, include the following.

1. Proposed location(s) and dimensions of any area to be fenced and used by Contractor for staging.

2. Location and dimensions of each temporary and permanent structures.

3. Avenues of ingress and egress.

4. Details of the fence and gate installation. Comply with IFC Chapter 506 which requires a Knox Lock at all gates to grant access to Emergency Personnel.

5. Methods or devices to be used at exits to prevent the tracking of mud.

6. Location of material storage areas.

7. Location of equipment storage, and vehicle parking.

8. Location of areas for fuel storage, fueling operations

9. Locations for vehicle or equipment maintenance, including areas for washing of equipment.
10. Location of storm drains and drainage channels that could receive runoff from the staging area.
11. Identify the Subcontractors or others that will share the staging area.
12. Location and methods of containment for any flammables, chemicals or hazmat materials that will be stored in the staging area. Include a Material Safety Data Sheet (MSDS) for all such materials.

B. The Contractor shall obtain the approval of the OAR for the Subcontractors or others that will share the staging area.

C. A structure over 1,000 square feet shall be provided with a fire alarm system. For a structure with less than 1,000 square feet, the Contractor shall obtain a determination through the OAR from the Airport Fire Marshal and Design, Code, and Construction Department (DCC) whether a fire alarm or other measures must be incorporated to ensure life safety.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

3.1 STAGING AREA

A. The Contractor shall obtain an EAD Construction Staging Yard Checklist from the OAR.

B. The entrance to the staging area shall be provided with signs including:
   1. The name of the Contractor and all Subcontractors.
   2. Address – To be provided by the OAR
   3. The Contractor’s 24 hour emergency contact number.

C. Project(s) Identifiers: Permit Number, Project Name, Contract Number, SWPPP and NOI notices.

D. A copy of the Contractor material and chemicals list and the Construction Staging Yard Application (which includes a list of material and chemicals to be stored) shall always be available at the staging area.

E. Implement erosion control measures in accordance with Section 01 57 13.

F. Arrange for a Life Safety Inspection by the DCC after setup, after tear down and annually while the staging area is in operation.

G. Enclose the staging area with a security fence.

H. Establish an all-weather access road to ensure emergency equipment access to structures, and material and equipment storage areas in accordance with IFC Chapter 5. Obtain approval of the temporary access road from OAR for the Design, Code, and Construction Department (DCC) and the Airport Fire Marshal.

I. Install construction exits in areas of ingress/egress, equipment service areas, and in parking areas to prevent rutting and the tracking of mud and in accordance with Section 01 57 13.
J. Obtain approval of separate and distinct storage areas, including employee parking from the OAR and the EAD.

K. Design and construct temporary and permanent structures in accordance with the IBC, IFC, and Local Amendments.

L. Obtain General Work Permits in accordance with IFC Chapter 105 from the OAR.

M. Stockpile all materials inside the Contractor staging area.

N. Provide each entrance to the primary staging area or all separate or distinct storage areas with an appropriate Knox Box in a location approved by the Fire Marshal in accordance with IFC Chapter 506. Provide a key to each structure inside the staging area in the Knox Box. Order boxes through the Fire Marshal’s office.

O. Park all mobile construction equipment within the staging area at the end of each Working Day.

P. Store salvageable materials resulting from demolition activities within the staging area or at a supplemental storage area approved by the EAD in accordance with the ECP and SWPPP.

Q. Stack stored materials and products off the ground within the staging area. Maintain stored materials and products in a neat and orderly method that allows ready access to materials and products.

R. Follow the IFC guidelines when using or storing hazardous, flammable or combustible materials. Specifically reference Chapter 34 which requires the NFPA 704 placard and proper labeling of all products. Store drums and containers off the ground and on pallets and properly seal containers and label each container. Provide any secondary containment as appropriate.

3.2 MAINTENANCE OF STAGING AREA

The Contractor shall maintain the staging area throughout the Project including, but not limited to the following:

A. Maintain the perimeter fence in good repair and proper alignment.

B. Check the staging area daily for spills, standing water, and other sources of contamination. Immediately implement reporting and removal procedures when found in accordance with Section 01 57 19.13.

C. Properly clean dirt or mud that becomes tracked out of staging area onto paved or surfaced roadways as soon as possible and no later than the same Working Day and eliminate the source of the tracking material.

3.3 RESTORATION OF STAGING AREA

At the end of the Project, the Contractor shall restore the staging area at Substantial Completion to its pre-existing condition, or as otherwise directed by the OAR, by performing the following:

A. Remove all structures, materials and equipment from within the staging area.

B. Remove all fencing and fence posts completely or as otherwise directed by the OAR.

C. Fill in all holes and depressions.

3.4 CLOSURE
A. The OAR will perform a Final Stabilization inspection and approval of the OAR is required prior to being approved for Construction Permit Closure.

B. A final fire and life safety inspection will be conducted by the DCC and Fire Marshal to determine if the site meets all relevant codes.

C. The Owner may, at their discretion, not require the staging area to be demobilized and restored if the staging area will subsequently be utilized to support in-progress Airport projects.

   In such case, the later contractor will be required to fulfill all of the guidelines to ensure the staging area is maintained and updated if the current Contractor is requested to turn over the staging area.

D. If the Contractor is involved in more than one contract on the Airport that warrants a staging area, the Contractor may transfer the staging area responsibilities into the most current SWPPP when the Contractor has completed the Project.

E. The OAR will be solely responsible for all interpretations of codes and guidelines, and will make the final determination. The Construction Permit Closure shall not be granted until all OAR approvals have been obtained.

PART 4 – MEASUREMENT AND PAYMENT

   Not Used.

- END OF SECTION -
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 01 10 00 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 01 73 29 "Cutting and Patching" for cutting and patching procedures.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Submit before Work begins.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.
F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 COORDINATION
   A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
   B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
   B. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
      1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
   C. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
      1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS
   A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

   a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
   c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
   f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
   g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least 2 hours after flame-cutting operations.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 74 19 "Construction Waste."

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS
A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   3. Comply with requirements specified in Section 01 74 19 "Construction Waste."
B. Burning: Do not burn demolished materials.

3.6 CLEANING
A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION
PART 1 – GENERAL

1.1 SUMMARY

A. This section includes the minimum requirements for the selective demolition of existing communications systems near Gates D12 and D14 within Terminal D.

B. Because Terminal D will continue to remain in operation during the construction project, some if not all work must be performed during off-peak hours in order to minimize interference with existing operations. The work schedule must be coordinated with, and approved by, the Owner’s Authorized Representative (OAR).

C. The following activities must be completed prior to the commencement of demolition activities.
   1. Identification and labeling of selected existing communications cabling and communications conduits within the areas of work.
   2. Completing a cabling spreadsheet

D. The following activities are to be performed during the course of general demolition.
   1. Demolition and removal of abandoned communications cabling
   2. Salvaging existing items to be reused or recycled

1.2 DEFINITIONS AND TERMS

A. Backbone Cabling: Cabling (either copper or fiber optic) that interconnects telecommunications spaces such as MCRs, CRs, telephone termination closets, etc.

B. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

C. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

D. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

E. Existing to Remain: Existing items of construction that are not to be permanently removed, and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
F. Owner’s Authorized Representative (OAR): Individual designated and possessing the authority to act on behalf of the Owner. The Owner’s Authorized Representative may be the Owner, the Architect, the Design Consultant, or other designated individuals.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste, including communications cabling, becomes the property of Contractor. Any demolition waste suitable for recycling shall be recycled through a properly licensed facility.

B. Drawings may indicate the removal of items other than cabling. Please refer to Key Notes for the disposition of these items.

C. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

   1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 COORDINATION OF WORK

A. Project Kickoff: A project kickoff meeting will be required and scheduled by the OAR.

   1. Meeting must be coordinated and scheduled with the OAR.
   2. The following attendees are required:

      a. Contractor
      b. DFW ITS
      c. OAR
      d. DFW Public Safety
      e. DFW Airport Operations

   3. Required meeting agenda items:

      a. Review progress reporting requirements.
      b. Review of work schedule and acceptable working hours.
      c. Review communications infrastructure labeling requirements.
      d. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
      e. Review requirements of work performed by other trades that affect labeling and selective cable demolition operations.

B. Pre-Activity Meetings: A pre-activity meeting must take place prior to the commencement of each phase of field work outlined in this scope.

   1. The following attendees are required:
a. Contractor
b. DFW ITS
c. OAR
d. DFW Public Safety
e. DFW Airport Operations

2. Required meeting agenda items:
   a. Identify areas work will be performed in.
   b. Identify working hours.
   c. Identify potential outages.
   d. Identify any scheduled and coordinated outages.
   e. Identify onsite contact person name and telephone number.
   f. Report on any accidents or unplanned outages that occurred in the previous work period.

C. In the event that a power outage or disruption must be performed, a completed Power Outage Request form must be submit to poweroutage@dfwairport.com at least 7 days in advance of the requested utility disruption. Forms may be found on the DFW Network P drive P:\Power Outages.

D. Other projects: OAR may require the Contractor to attend project meetings for any projects that are running concurrently or may impact the labeling and selective cable demo activities outlined in this scope.

1.5 INFORMATIONAL SUBMITTALS

A. Unless otherwise agreed to by OAR, all informational submittals must be reviewed and accepted prior to commencement of work.

B. A work plan must be submitted to the OAR each week prior to commencement of any work. Work plan must include the following:
   1. Identify areas work will be performed in.
   2. Identify working hours.
   3. Identify potential outages.
   4. Identify any scheduled and coordinated outages.
   5. Identify onsite contact person name and telephone number.
   6. Report on any accidents or unplanned outages that occurred in the previous work period.

C. Qualification Data: All labeling and selective demolition work must be performed under the direct (on-site) supervision of a qualified communications technician. This technician must possess detailed knowledge of the building and existing conditions within each work area. Submit a report detailing Communications Technician overall industry experience and experience and familiarity with each work area within scope for this project.
D. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and noise control. Indicate proposed locations and construction of barriers.

E. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's and Airline Tenants' on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

F. Pre-demolition Photographs or Video: Submit before Work begins.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of any items such as equipment racks, enclosures, ladder rack, etc. that have been removed and returned to the owner.

B. Complete Cabling List: Submit completed “CIRCUIT IDENTIFICATION” spreadsheet upon completion of each phase of the project. This spreadsheet catalogs the circuit identification assigned to each cable that was labeled during this project.

1.7 QUALITY ASSURANCE

A. This project must be supervised by an experienced telecom technician who demonstrates:

1. Proven and verifiable knowledge of telecom industry practices.
2. Detailed knowledge of DFW Terminal D facility.

1.8 FIELD CONDITIONS

A. This is an operational passenger terminal. Conduct labeling and selective cable demolition, so Owner's operations will not be disrupted.

B. This is an operational terminal at one of the world’s largest airports. Some if not all work must be performed during off-peak hours in order to minimize interference with terminal operations. Work schedule must be coordinated with and approved by the Owner's Authorized Representative (OAR).

C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
1. Before selective demolition, Owner will remove the following items:
   a. Network electronics to be removed by Owner.

D. Notify OAR of discrepancies between existing conditions and Drawings before proceeding with labeling and selective cable demolition.

E. Hazardous Materials: Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

F. Storage or sale of removed items or materials on-site is not permitted.

G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 – PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards:
   1. NEC 2002, Article 770.3(B) and 800.52(B)

PART 3 – EXECUTION

3.1 EXAMINATION

A. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

B. Survey existing conditions and correlate with requirements indicated to determine extent of communications conduit and cabling labeling.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective cable demolition required.

D. When unanticipated conditions occur or structural elements that conflict with intended labeling or selective cable demolition are encountered, investigate and measure the
nature and extent of conflict. Promptly submit a written report with recommendation for resolution to OAR.

3.2 PREPARATION

A. Site Access and Temporary Controls: Conduct backbone cable labeling and selective cable-removal operations to ensure minimum interference with terminal operations including roads, corridors, walks, walkways, and other adjacent occupied and used facilities.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
3. Cover and protect furniture, furnishings, and equipment that have not been removed.

3.3 SELECTIVE CABLE REMOVAL, GENERAL

A. General: Demolish and remove existing abandoned communications cabling as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Remove and dispose of demolished items and materials promptly.
2. It is the Contractor’s responsibility to verify cabling is not in use prior to removal.
3. Each work area must be returned to its pre-work condition at the conclusion of each work day.
4. When disturbing building elements such as ceiling tile or fire stopping in a fire rated enclosure/space during the course of labeling or selective cable removal these elements must be replaced/returned to a condition that maintains the fire rating for that space. This must be done at the end of each work day.
5. Proceed with selective cable removal systematically, from higher level to lower level. Complete work above each floor or tier before disturbing cabling systems on the next lower level.

B. Outages: If active cabling is cut, damaged, or otherwise rendered inoperable it is the contractor’s responsibility to IMMEDIATELY NOTIFY the emergency contacts listed below. The cable owner will instruct the contractor on next steps.

1. DFW Airport Operations Center (AOC) at (972) 973-3112
2. Contractor Emergency Contact: To Be Determined Upon Contract Execution
3. Cable Owner:
   a. DFW: DFW ITS Help Desk at (972) 973-9000
C. Mitigation:

1. Contractor is responsible to repair or replace damaged cable in a manner which meets or exceeds cable owner’s requirements within the following parameters:
   a. Cable owner determines type of repair that is acceptable:
      1) Generally, if damaged cable is permanent, backbone cable splicing will not be accepted and new cable must be installed per owner’s requirements.
      2) Generally, if damaged cable is temporary, splicing will be permissible.

D. Removed and Salvaged Items:

1. Pack or crate items after removal. Identify contents of containers.
2. Store items in a secure area until delivery to Owner.
3. Transport items to Owner’s storage area as designated by OAR.
4. Protect items from damage during transport and storage.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by OAR, items may be removed to a suitable, protected storage location during selective demolition, cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.4 SELECTIVE ABANDONED CABLE REMOVAL PROCEDURES

A. General: The general scope includes removal of only clearly abandoned cable that is obviously not in use. It is common to encounter bundles of cable that have been cut at one end and left in the cable trays or left coiled up in plenum spaces.

B. Optical Fiber: Once contractor has verified that the optical fiber is abandoned and should be removed it is up the contractor to remove optical fiber with care as not to damage any other active cabling system components. Contractor should begin on termination end and work back to point of origin cutting 3 to 5 foot sections of cable at a time until cable has been demolished back to the point of origin.

C. Copper Cabling: Once contractor has verified that the copper communications cabling is abandoned and should be removed it is up the contractor to remove the copper cabling with care as not to damage any other active cabling. If there is any question as to the status of cabling the contractor should consult with the OAR prior to its removal. Contractor should begin on termination end and work back to point of origin cutting 3 to 5 foot sections of cable at a time until cable has been demolished back to the point of origin.

D. Raceway: Contractor should remove raceway (conduit or cable tray) that is abandoned taking care not to damage raceway that is to remain in service. If there is any question as to the intent to reuse raceway the OAR should be consulted prior to its removal.
E. Active Communications Rooms: If abandoned cable originates or terminates in an active communications room contractor should demo all cables back to room location and coordinate access to active room with appropriate party (DFW ITS, etc.). Contractor should make every effort to minimize need for access to active rooms.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent damage to adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent. Removal method must be approved by the construction manager.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by labeling and selective cable demolition operations. Return adjacent areas to condition existing before selective demolition operations began.
SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY
   A. Section Includes:
      1. Non-load-bearing wall framing for temporary partition.

1.2 ACTION SUBMITTALS
   A. Product Data: For each type of cold-formed steel framing product and accessory.
   B. Shop Drawings:
      1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
      2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
   C. Delegated-Design Submittal: For cold-formed steel framing.

1.3 INFORMATIONAL SUBMITTALS
   A. Product test reports.

1.4 QUALITY ASSURANCE
   A. Product Tests: Mill certificates or data from a qualified independent testing agency.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. Delegated Design: Engage a qualified structural engineer Licensed in the State of Texas to design cold-formed steel framing.
   B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
1. Deflection Limits: Design framing systems to withstand without deflections greater than the following:
   a. Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft.

2. Design non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency.
   1. Indicate design designations from UL’s "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 COLD-FORMED STEEL FRAMING, GENERAL

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: As required by structural performance.

2.3 NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0329 inch.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
B. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200 and to manufacturer’s written instructions unless more stringent requirements are indicated.

C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

D. Install framing members in one-piece lengths.

E. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

F. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

G. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.2 NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

C. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
D. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

END OF SECTION
SECTION 05 70 00 - DECORATIVE METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Stainless Steel Base.

1.2 COORDINATION

A. Coordinate installation of anchorages for decorative metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including finishing materials.

B. Shop Drawings: Show fabrication and installation details for decorative metal.
   1. Include plans, elevations, component details, and attachment details.
   2. Indicate materials and profiles of each decorative metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
   1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store decorative metal in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.
1.6 FIELD CONDITIONS
   A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 METALS, GENERAL
   A. Metal Surfaces, General: Use materials with smooth, flat surfaces unless otherwise indicated. Use materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.2 STAINLESS STEEL
   A. Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304.
   B. Flat Bar: ASTM A666, Type 304.
   C. Bars and Shapes: ASTM A276, Type 304.

2.3 FASTENERS
   A. Fastener Materials: Unless otherwise indicated, provide the following:
      1. Stainless Steel Items: Type 304 stainless steel fasteners.
      2. Dissimilar Metals: Type 304 stainless steel fasteners.
   B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.
   C. Provide concealed fasteners for interconnecting components and for attaching decorative metal items to other work unless otherwise indicated.

2.4 FABRICATION, GENERAL
   A. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly.
   B. Form decorative metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.
   C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
D. Form simple and compound curves in bars, pipe, tubing, and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.

E. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

F. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.

G. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.

2.5 FABRICATION OF STAINLESS-STEEL BASE

A. Fabricate stainless steel base as indicated on drawings.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.7 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.

C. Stainless Steel Sheet and Plate Finishes:


D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Provide anchorage devices and fasteners where needed to secure decorative metal to in-place construction.

B. Perform cutting, drilling, and fitting required to install decorative metal. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.

D. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

E. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.

F. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.

1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.

3.3 INSTALLATION OF STAINLESS-STEEL BASE

A. Install stainless steel base at locations indicated on drawings.

3.4 CLEANING AND PROTECTION

A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.
B. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.

C. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION
SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wood blocking and nailers.
   2. Wood furring.

1.2 ACTION SUBMITTALS

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

   1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

   1. Fire-retardant-treated wood.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Furring.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

C. Concealed Boards: Construction or No. 2 Common with 15 percent maximum moisture content of any species:

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 PLYWOOD BACKING PANELS

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

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

B. Nails, Brads, and Staples: ASTM F1667.

C. Screws for Fastening to Metal Framing: ASTM C1002, length as recommended by screw manufacturer for material being fastened.

2.6 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA’s WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:


3.2 INSTALLATION OF WOOD BLOCKING AND NAILER

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring horizontally and vertically at 24 inches o.c.

END OF SECTION
SECTION 06 61 16 - SOLID SURFACING FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY
   A. Section Includes: Solid surface plastic countertops, with anchors and accessories.

1.2 SUBMITTALS
   A. Product Data: Submit manufacturer's technical data instructions for handling, storage, installation, and protection.
   B. Shop Drawings: Submit cutting and setting drawings showing sizes, dimensions, sections, and profiles; arrangement and provisions for jointing, anchoring, supports, and other necessary details for reception of work.
   C. Samples: Submit 12" x 12" sample of color for verification.

1.3 QUALITY ASSURANCE
   A. Fabricator Qualifications: Firm that has successfully fabricated material similar to quality specified for period of not less than five years.

1.4 PRODUCT HANDLING
   A. Handle and protect sheets during storage and construction against moisture, soiling, staining, breakage, and physical damage.
   B. Protect materials and accessories from weather, moisture, and contamination with earth and other foreign materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Available Manufacturers: Subject to compliance with requirements, acceptable solid surface manufacturers that may be incorporated in the Work includes, but are not limited to, manufacturers listed below.

2.2 MATERIALS
   A. Solid Surface Sheet:
1. Solid non-porous surfacing material, homogeneous composition of natural minerals and acrylic or polymers.

2. Sheet Thickness: 1/2" unless noted as 1/4".

3. Color:
   a. M-S4: Color: Sierra Mist, Style: Mist Collection by Formica, polished finish.

4. Acceptable Products:
   a. Avonite by Avonite, Inc.
   b. Corian by Corian Building Products.
   c. Surell by Formica
   d. Fountainhead by Nevamar Corporation.
   e. Gibraltor by Ralph Wilson Plastics Co.

B. Polishing Cream: Compatible polishing cream to achieve specified sheen.

C. Sealants and Adhesives: As recommended by solid surfacing material manufacturer.
   1. Color shall match sheet.

D. Cleaners: Soap, household ammoniated liquid detergent, or abrasive cleaner.

E. Fasteners: Stainless steel fasteners, tamper-resistant type, with neoprene washers.

2.3 FABRICATION

A. Finish exposed surfaces smooth with radius corners and edges and polish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that joint preparation and affected dimensions are acceptable.

3.2 INSTALLATION

A. Install components plumb and level in accordance with manufacturer's instructions.

B. Rigidly anchor to substrate to prevent misalignment.

3.3 TOLERANCES

A. Maximum Variation from True Dimension: 1/8".

B. Maximum Offset from True Position: 1/8".

3.4 CLEANING
A. Clean and polish fabrications in accordance with manufacturer’s instructions. Do not use strong acid drain cleaners. Do not use wire brushes.

END OF SECTION
SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetration firestopping systems for the following applications:
   a. Penetrations in fire-resistance-rated walls.
   b. Penetrations in horizontal assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approval according to FM Approval 4991, "Approval Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping
B. Install and cure penetration firestopping materials per manufacturer’s written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.

2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

   a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

      1) UL in its "Fire Resistance Directory."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. 3M Fire Protection Products.
   c. Construction Solutions.
   d. Grabber Construction Products.
   e. Hilti, Inc.
   f. HOLDRITE; Reliance Worldwide Company.
g. NUCO Inc.
i. RectorSeal Firestop; a CSW Industrials Company.
j. Specified Technologies, Inc.
k. STC Sound Control.
l. Tremco, Inc.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.

E. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.


2.4 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer’s written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Penetration Firestopping Systems with No Penetrating Items:

C. Penetration Firestopping Systems for Metallic Pipes, Conduit, or Tubing:

D. Penetration Firestopping Systems for Electrical Cables:

E. Penetration Firestopping Systems for Groupings of Penetrants:

END OF SECTION
SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nonstaining silicone joint sealants.
   2. Urethane joint sealants.
   3. Latex joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.

1.3 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.

B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Adfast.
   b. GE Construction Sealants; Momentive Performance Materials Inc.
   d. Pecora Corporation.
   e. Sika Corporation; Joint Sealants.
   f. The Dow Chemical Company.
   g. Tremco Incorporated.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. BASF Corporation.
   b. Pecora Corporation.
   c. Permathane®/Acryl-R®; ITW Polymers Sealants North America.
   d. Polymeric Systems, Inc.
   e. Sherwin-Williams Company (The).
2.4 LATEX JOINT SEALANTS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
a. Everkem Diversified Products, Inc.
b. Franklin International.
d. Pecora Corporation.
e. Sherwin-Williams Company (The).
f. Tremco Incorporated.

2.5 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   
a. Adfast.
b. Alcot Plastics Ltd.
c. BASF Corporation.
d. Construction Foam Products; a division of Nomaco, Inc.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), Type O (open-cell material) and Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
   a. Concrete.
   b. Masonry.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
   a. Metal.
   b. Glass.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.
3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes.
so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:
   a. Control and expansion joints in terrazzo flooring.
   b. Other joints as indicated on Drawings.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:
   a. Control joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints between interior wall surfaces and frames of interior doors.
   c. Other joints as indicated on Drawings.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION
SECTION 07 95 13.13 - INTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes interior expansion joint cover assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

B. Shop Drawings: For each expansion joint cover assembly.
   1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
   2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples: For each expansion joint cover assembly and for each color and texture specified, full width by 6 inches long in size.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.
B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Expansion joint cover assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 by a qualified testing agency.

C. Expansion Joint Design Criteria:

1. Type of Movement: Wind sway.
   a. Nominal Joint Width: As indicated on Drawings.
   b. Minimum Joint Width: As indicated on Drawings.
   c. Maximum Joint Width: As indicated on Drawings.

2. Type of Movement: Seismic.
   a. Joint Movement: As indicated on Drawings.

2.3 FLOOR EXPANSION JOINT COVERS

A. Metal-Plate Floor Joint Cover: Metal cover plate fixed on one side of joint gap and free to slide on other.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Architectural Art Manufacturing Inc.; a division of Pittcon Architectural Metals, LLC.
   b. Balco; a CSW Industrials Company.
   c. BASF Corp. - Watson Bowman Acme Corp.
   d. Construction Specialties, Inc.
   e. Inpro Corporation.
   f. MM Systems Corporation.
   g. Nystrom.

2. Application: Floor to floor.
3. Installation: Surface mounted.
4. Load Capacity:
   a. Uniform Load: 50 lb/sq. ft.
   b. Concentrated Load: 300 lb.
   c. Maximum Deflection: 0.0625 inch.
5. Fire-Resistance Rating: Not less than that indicated on Drawings.
6. Cover-Plate Design: Plain.
7. Exposed Metal:
   a. Stainless steel: No. 2B.

2.4 MATERIALS
A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304 for plates, sheet, and strips.
B. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.
C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.
D. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 STAINLESS-STEEL FINISHES
A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
B. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

2.6 ACCESSORIES
A. Manufacturer's stainless-steel attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.
B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.
C. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
   1. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
   2. Install frames in continuous contact with adjacent surfaces.
      a. Shimming is not permitted.
   3. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
   4. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
   5. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
   6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

C. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

D. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

E. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.
   1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.
3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION
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SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY
   A. Section Includes:
      1. Non-load-bearing steel framing systems for interior partitions.

1.2 ACTION SUBMITTALS
   A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS
   A. Product Certificates: For each type of code-compliance certification for studs and tracks.

1.4 QUALITY ASSURANCE
   A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.
   B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
   C. Horizontal Deflection: For non-composite wall assemblies, limited to 1/360 of the wall height based on horizontal loading of 5 lbf/sq. ft..
2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.

B. Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.

1. Steel Studs and Tracks:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) CEMCO; California Expanded Metal Products Co.
      2) ClarkDietrich.
      3) Custom Stud.
      4) Jaimes Industries.
      5) MarinoWARE.
      6) MBA Building Supplies.
      7) MRI Steel Framing, LLC.
      8) Phillips Manufacturing Co.
      9) SCAFCO Steel Stud Company.
      10) Steel Construction Systems.
      11) Telling Industries.
      12) The Steel Network, Inc.
   b. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection.
   c. Depth: As indicated on Drawings.

2. Embossed, High Strength Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally comparable to conventional ASTM C645 steel studs and tracks.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) CEMCO; California Expanded Metal Products Co.
      2) ClarkDietrich.
      3) MarinoWARE.
      4) MBA Building Supplies.
      5) Phillips Manufacturing Co.
      6) SCAFCO Steel Stud Company.
      7) Steel Construction Systems.
      8) Telling Industries.
      9) The Steel Network, Inc.
b. Minimum Base-Steel Thickness: As required by horizontal deflection performance requirements.
c. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide the following:
   1. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   1. Minimum Base-Steel Thickness: 0.0269 inch.

F. Hat-Shaped, Rigid Furring Channels: ASTM C645.
   1. Minimum Base-Steel Thickness: 0.0296 inch.
   2. Depth: As indicated on Drawings.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:
   1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Install studs so flanges within framing system point in same direction.

C. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
   3. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
      a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

D. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION
SECTION 09 27 13 - GLASS-FIBER-REINFORCED PLASTER FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes factory-fabricated, glass-fiber-reinforced plaster fabrications for interior applications.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, weights, dimensions of individual components and profiles, and finishes.

B. Shop Drawings:
   1. Include plans, elevations, sections, and attachment details, including locations of attachments for fabrications suspended by tie wires from structure.
   2. Detail fabrication and assembly of glass-fiber-reinforced plaster fabrications.
   4. Indicate location of control joints.

C. Samples: For each exposed product and for each color and texture specified.
   1. Linear Moldings: 24-inch-long section with finished joint. Show complete pattern.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with one another, using input from installers of the items involved:
   1. Ceiling suspension system members.
   2. Structural members to which glass-fiber-reinforced plaster fabrications will be attached and method of attachment.
   3. Items penetrating finished ceiling including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
4. Perimeter moldings.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to set quality standards for fabrication and installation.

1. Build mockup of each type of glass-fiber-reinforced plaster fabrication.
2. Paint mockups to match finish indicated and to comply with requirements specified in Section 09 91 23 "Interior Painting."
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Commissioner specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C 1467/C 1467M.

1.6 FIELD CONDITIONS

A. Environmental Conditions:

1. Comply with ASTM C 1467/C 1467M.
2. Do not deliver or install glass-fiber-reinforced plaster fabrications until building is enclosed, wet-work is complete, and HVAC system is operating and continuously maintaining temperature and relative humidity at levels intended for building occupants.

B. Conditioning: Acclimatize glass-fiber-reinforced plaster fabrications to ambient temperature and humidity of spaces in which they will be installed. Remove packaging and move units into installation spaces not less than 48 hours before installing them.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED PLASTER FABRICATIONS

A. Fabrications: Molded, glass-fiber-reinforced plaster units complying with ASTM C 1381/C 1381M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Architectural Reproductions Inc.
   b. Casting Designs, Inc.
   c. Felber Ornamental Plastering Corporation.
   d. First Class Building Products, Inc.
e. Formglas Products Ltd.

f. GRG Technologies, LLC.

g. Melton Classics, Incorporated.

h. Plasterform Inc.

i. Plastrglas, Incorporated.

j. Stromberg Architectural Products, Inc.

B. Embedments: As standard with glass-fiber-reinforced plaster fabrication manufacturer and as required for reinforcement and for anchorage to substrates and framing.

C. Finish: Smooth for paint finish.

2.2 AUXILIARY MATERIALS

A. Adhesives: As recommended in glass-fiber-reinforced plaster fabrication manufacturer’s written instructions.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Screws complying with ASTM C 954 for fastening glass-fiber-reinforced plaster fabrications to steel members from 0.033 to 0.112 inch thick.

C. Joint-Treatment Materials: ASTM C 475/C 475M.

D. Control Joints: ASTM C 1047, one-piece control joint with V-shaped slot and removable strip covering the slot opening.


E. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

2.3 FABRICATION

A. Fabricate glass-fiber-reinforced plaster units in factory to comply with ASTM C 1381/C 1381M, with smooth-finished surfaces; repair hollows, voids, scratches, and other surface imperfections. Fabricate units in lengths and sizes that will minimize number of joints between abutting units.

B. Embedments: Incorporate embedments into units to develop the full strength of glass-fiber-reinforced plaster fabrications. Cover embedments with not less than 3/16-inch thickness of glass-fiber-reinforced plaster composite.

C. Connection Hardware: Designed and fabricated to support and connect glass-fiber-reinforced plaster fabrications to hangers, support framing, and substrates.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with ASTM C 1467/C 1467M.

B. Install glass-fiber-reinforced plaster fabrications level, plumb, true, and aligned with adjacent materials. Use concealed shims where required for alignment.

C. Attach glass-fiber-reinforced plaster fabrications to framing and substrates with steel drill screws unless otherwise indicated. Do not use pneumatic staple guns. Countersink screw heads below adjoining finished surface.

1. Predrill fastener holes in units. Clean fastener holes to remove dirt and oil.
2. Locate fasteners not less than 5/16 inch from edges or ends of units.

D. Suspended Systems: Attach suspended glass-fiber-reinforced plaster fabrications to structure with tie wire at each attachment point indicated on approved Shop Drawings. Comply with requirements for hangers specified in Section 09 22  16 "Non-Structural Metal Framing."

E. Where glass-fiber-reinforced plaster fabrications are joined to form composite units, join fabrications with adhesive. Band or brace units together until adhesive cures.

F. Install control joints between glass-fiber-reinforced plaster fabrications where indicated.

G. Use joint-treatment materials to finish glass-fiber-reinforced plaster fabrications to produce surfaces ready to receive primers and paint finishes specified in Section 09 91 23 "Interior Painting."

1. Finish glass-fiber-reinforced plaster fabrications according to ASTM C 840 for Level 4 and to match surface texture of units.
2. Repair hollows, voids, scratches, and other surface imperfections on units.

END OF SECTION
SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior gypsum board.

B. Related Requirements:
   1. Section 09 22 16 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Gypsum board, Type X.

1.3 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.
PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Gypsum.
   b. CertainTeed Gypsum.
   c. Continental Building Products, LLC.
   d. Georgia-Pacific Gypsum LLC.
   e. National Gypsum Company.
   f. PABCO Gypsum.
   g. Panel Rey SA.
   h. USG Corporation.

2. Thickness: 5/8 inch.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:
   a. Cornerbead.
   b. L-Bead: L-shaped; exposed long flange receives joint compound.
   c. Expansion (control) joint.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.
B. Joint Tape:
   1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use drying-type, all-purpose compound.
   4. Finish Coat: For third coat, use drying-type, all-purpose compound.

2.6 AUXILIARY MATERIALS
   A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

   B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
      1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

   B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

   C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL
   A. Comply with ASTM C840.

   B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer’s written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

   1. Type X: As indicated on Drawings.

B. Single-Layer Application:

   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
   a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
   b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:
   1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
   2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
   3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners unless otherwise indicated.
   2. LC-Bead: Use at exposed panel edges.
   3. L-Bead: Use where indicated.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.
C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
   a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION
SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

1.2 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

1.3 CLOSEOUT SUBMITTALS
A. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE
A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockup of typical ceiling area as shown on Drawings.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING
A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E1264.
2. Smoke-Developed Index: 50 or less.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.3 ACOUSTICAL PANELS

A. Acoustical Tiles

1. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; Lyra (8382PB) or a comparable product by one of the following:

   a. CertainTeed Corporation.
   b. Chicago Metallic Corporation.
   c. United States Gypsum Company.

2. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

3. Classification: Provide panels as follows:

   a. Type and Form: Type XII, glass-fiber base with membrane-faced overlay; Form 3, other. Binder shall not contain urea formaldehyde.
   b. Pattern: E (lightly textured).
5. Light Reflectance (LR): Not less than 0.85.
6. Noise Reduction Coefficient (NRC): Not less than 0.90.
7. Articulation Class (AC): Not less than 190
8. Edge/Joint Detail: Beveled Tegular.
9. Thickness: 1 inch.
10. Modular Size: As indicated on Drawings.
11. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEM

A. Metal Suspension System

1. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; Interlude HRC XL 9/16-inch Dimensional Center Node or a comparable product by one of the following:
   a. CertainTeed Corporation.
   b. Chicago Metallic Corporation.
   c. United States Gypsum Company.

2. Metal Suspension-System Standard: Provide manufacturer's standard, directhung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.
   b. Painted to match color of acoustical unit

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:
   2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch-diameter wire.

C. Hold-Down Clips: Manufacturer's standard hold-down.
2.6 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. Fry Reglet Corporation.
4. Gordon, Inc.
5. Rockfon (Rockwool International).
6. USG Corporation.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.
3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C636/C636M and manufacturer's written instructions.

1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. Arrange directionally patterned acoustical panels as follows:
a. Install panels with pattern running in one direction parallel to long axis of space.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.

3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer’s written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION
SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Thermoset-rubber base.
   2. Thermoplastic-rubber base.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
C. Samples for Initial Selection: For each type of product indicated.
D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.
E. Product Schedule: For resilient base and accessory products.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.
1.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allstate Rubber Corp.
2. Armstrong World Industries, Inc.
3. Burke Mercer Flooring Products; a division of Burke Industries Inc.
4. Flexco.
5. Johnsonite; a Tarkett company.
7. Roppe Corporation, USA.
8. VPI Corporation.

B. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).

2. Style and Location:
   a. Style A, Straight: Provide in areas with carpet.
   b. Style B, Cove: Provide in areas with resilient floor coverings.

C. Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.

F. Outside Corners: Job formed or preformed.

G. Inside Corners: Job formed or preformed.
H. Colors: Match existing.

2.2 INSTALLATION MATERIALS

A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. Preformed Corners: Install preformed corners before installing straight pieces.

G. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
      a. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
      a. Miter or cope corners to minimize open joints.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:
   1. Remove adhesive and other blemishes from surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION
1.1 SUMMARY
A. Section Includes:
   1. Thin-set, epoxy-resin terrazzo flooring.
B. Related Requirements:
   1. Section 07 92 00 "Joint Sealants" for sealants installed with terrazzo.

1.2 PREINSTALLATION MEETINGS
A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to terrazzo including, but not limited to, the following:
      a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
      b. Review and finalize construction schedule and verify availability of materials, Installer’s personnel, equipment, and facilities needed to make progress and avoid delays.
      c. Review special terrazzo designs and patterns.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Shop Drawings: Include terrazzo installation requirements. Include plans, sections, component details, and relationship to other work. Show layout of the following:
   1. Divider strips.
   2. Control-joint strips.
   3. Accessory strips.
   4. Terrazzo patterns.
C. Samples for Initial Selection: NTMA’s "Terrazzo Color Palette" showing the full range of colors and patterns available for each terrazzo type.
D. Samples for Verification: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo Sample to identify manufacturer’s matrix color and
aggregate types, sizes, and proportions. Prepare Samples of same thickness and from same material to be used for the Work, in sizes indicated below:

1. Terrazzo: 6-inch-square Samples.
2. Precast Terrazzo: 6-inch-square Samples.
3. Accessories: 6-inch-long Samples of each exposed strip item required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.
B. Material Certificates: For each type of terrazzo material or product.
C. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
D. Preinstallation moisture-testing reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For terrazzo to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Engage installer that is a NTMA contractor member in good standing and has substantial experience in successfully completing jobs similar to the work required for this project.
B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockups for terrazzo including accessories.
      a. Size: Minimum 100 sq. ft. of typical poured-in-place flooring condition for each color and pattern in locations directed by Commissioner.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Commissioner specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.
B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.8 FIELD CONDITIONS
A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.
B. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.
C. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.
D. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.
E. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

PART 2 - PRODUCTS
2.1 MANUFACTURERS
A. Source Limitations: Obtain primary terrazzo materials from single source from single manufacturer that is a Supplier Member of NTMA in good standing. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from a Supplier Member of NTMA in good standing recommended by manufacturer of primary materials.
B. Source Limitations for Aggregates: Obtain each color, grade, type, and variety of granular materials from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS
A. NTMA Standards: Comply with NTMA's written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.3 EPOXY-RESIN TERRAZZO
A. Epoxy-Resin Terrazzo: Comply with manufacturer's written instructions for matrix and aggregate proportions and mixing.
B. Mix Color and Pattern: DFW representative has final approval of all terrazzo mixes.
1. TZ-1: Match existing as indicated in the inserted photo.
2. TZ-2: Match existing as indicated in the inserted photo.
3. TZ-3: Match existing as indicated in the inserted photo.

C. The following are design mixes from the original specification Section 09405 – “Epoxy Terrazzo” for terminal D, Contract No. 8500129, dated 15 May 2002, IFC/Rev. 00. MIXES ARE FOR REFERENCE ONLY AS A POSSIBLE STARTING POINT TO CREATE SAMPLES TO CONFIRM MATCH OF TERRAZZOS INDICTAED IN THE PHOTO.

1. F-T1:
   b. Chip Color and Size: 60% Georgia White (sizes 1 and 2); 20% Mother of Pearl (size 0); 20% Clear Glass Chips (size 0).

2. F-T2:
   b. Chip Color and Size: 50% Georgia White (sizes 1 and 2); 20% Mother of Pearl (size 0); 20% Clear Glass Chips (size 0); 10% Black Glass Chips (size 0).

3. F-T3:
   a. Matrix Binder: Yellow to match custom color on file in Architects office.
   b. Chip Color and Size: 40% Georgia White (sizes 1 and 2); 20% Mother of Pearl (size 0); 20% Clear Glass Chips (size 0); 20% Black Glass Chips (size 0).

4. F-T4:
   b. Chip Color and Size: 30% Georgia White (sizes 1 and 2); 20% Mother of Pearl (size 0); 30% Clear Glass Chips (size 0); 20% Black Glass Chips (size 0).

5. F-T5:
b. Chip Color and Size: 50% Georgia White (sizes 1 and 2); 20% Mother of Pearl (size 0); 20% Clear Glass Chips (size 0).

6. F-T6:
   a. Matrix Binder: Terra Cotta to match custom color on file in Architects office.
   b. Chip Color and Size: 40% Georgia White (sizes 1 and 2); 20% Mother of Pearl (size 0); 20% Clear Glass Chips (size 0); 20% Black Glass Chips (size 0).

7. F-T7:
   a. Matrix Binder: Purple to match custom color on file in Architects office.
   b. Chip Color and Size: 40% Georgia White (sizes 1 and 2); 20% Mother of Pearl (size 0); 20% Clear Glass Chips (size 0); 20% Black Glass Chips (size 0).

D. Materials:

1. Moisture-Vapor-Emission-Control Membrane: Two-component, high-solids, high-density, low-odor, epoxy-based membrane-forming product produced by epoxy terrazzo manufacturer that reduces moisture emission from concrete substrate to not more than 80 percent relative humidity based on in-situ probe testing.

2. Substrate-Crack-Suppression Membrane: Product of terrazzo-resin manufacturer, having minimum 120 percent elongation potential according to ASTM D 412.
   a. Reinforcement: Fiberglass scrim at 100 percent substrate coverage.

3. Primer: Manufacturer's product recommended for substrate and use indicated.

4. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated.
   a. Physical Properties without Aggregates:
      1) Hardness: 60 to 85 per ASTM D 2240, Shore D.
      2) Minimum Tensile Strength: 3000 psi per ASTM D 638 for a 2-inch specimen made using a "C" die per ASTM D 412.
      3) Minimum Compressive Strength: 10,000 psi per ASTM D 695, Specimen B cylinder.
      4) Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D 1308.
         a) Distilled water.
         b) Mineral water.
         c) Isopropanol.
         d) Ethanol.
         e) 0.025 percent detergent solution.
         f) 1.0 percent soap solution.
         g) 5 percent acetic acid.
         h) 10 percent sodium hydroxide.
         i) 10 percent hydrochloric acid.
         j) 30 percent sulfuric acid.
b. Physical Properties with Aggregates: For terrazzo blended according to manufacturer's recommendations with one part epoxy resin with three parts marble aggregate consisting of 60 percent No. 1 chips and 40 percent No. 0 chips that is ground and grouted to a 1/4-inch nominal thickness, and cured for 7 days at 75 deg F plus or minus 2 deg F and at 50 percent plus or minus 2 percent relative humidity.

1) Flammability: Self-extinguishing, maximum extent of burning 1/4 inch according to ASTM D 635.
2) Thermal Coefficient of Linear Expansion: 0.0025 inch/inch per deg F according to ASTM C 531.

5. Aggregates: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.

a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131/C 131M.
b. 24-Hour Absorption Rate: Less than 0.75 percent.
c. Dust Content: Less than 1.0 percent by weight.


2.4 STRIP MATERIALS

A. Thin-Set Divider Strips: L-type angle in depth required for topping thickness indicated.

1. Material: Match existing.
2. Top Width: Match existing.

B. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material and color of divider strips and in depth required for topping thickness indicated.

C. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:

1. Edge-bead strips for exposed edges of terrazzo.

2.5 MISCELLANEOUS ACCESSORIES

A. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use.

B. Anchoring Devices:

1. Strips: Provide mechanical anchoring devices or adhesives for strip materials as recommended by manufacturer and as required for secure attachment to substrate.
C. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

D. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

E. Resinous Matrix Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.

F. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect terrazzo color or physical properties; and is recommended by sealer manufacturer.
   1. Surface Friction: Not less than 0.6 according to ASTM D 2047.
   2. Acid-Base Properties: With pH factor between 7 and 10.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   B. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

3.2 PREPARATION
   A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.
   B. Concrete Slabs:
      1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.
         a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispersed shot within the apparatus, and recirculates the shot by vacuum pickup.
         b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written instructions.
         c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.
   C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
D. Preinstallation Moisture Testing:

1. Testing Agency: Engage a qualified testing agency to perform tests.
2. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
   a. Relative Humidity Test: Maximum 80 percent relative humidity measurement when tested according to ASTM F 2170 using in-situ probes.
3. Proceed with terrazzo installation only after concrete substrates pass moisture testing or after installation of moisture-vapor-emission-control membrane on substrate areas that fail testing.

E. Moisture-Vapor-Emission-Control Membrane: Install according to manufacturer's written instructions.

1. Install on concrete substrates that incorporate lightweight aggregates.
2. Install concrete substrates that fail preinstallation moisture testing.

F. Substrate-Crack-Suppression Membrane: Install to isolate and suppress substrate cracks according to manufacturer's written instructions.

1. Prepare and prefill substrate cracks with membrane material.
2. Install membrane to produce full substrate coverage in areas to receive terrazzo.
3. Reinforce membrane with fiberglass scrim.

G. Protect other work from water and dust generated by grinding operations. Control water and dust to comply with environmental protection regulations.

1. Erect and maintain temporary enclosures and other suitable methods to limit water damage and dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.3 EPOXY-RESIN TERRAZZO INSTALLATION

A. Comply with NTMA's written recommendations for terrazzo and accessory installation.

B. Strip Materials:

1. Divider and Control-Joint Strips:
   a. Locate divider strips in locations indicated.
   b. Install control-joint strips back to back and directly above concrete-slab control joints in locations indicated.
   c. Install control-joint strips with 1/4-inch gap between strips, and install sealant in gap.
   d. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
2. Accessory Strips: Install as required to provide a complete installation.

C. Apply primer to terrazzo substrates according to manufacturer's written instructions.

D. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions.

1. Installed Thickness: 3/8 inch nominal.
2. Terrazzo Finishing: Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.

a. Rough Grinding: Grind with 24-grit or finer stones or with comparable diamond abrasives. Follow initial grind with 60/80-grit stones or with comparable diamond abrasives.

b. Grouting: Before grouting, clean terrazzo with water, rinse, and allow to dry. Apply and cure epoxy grout.

c. Fine Grinding/Polishing: Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted. Polish with 200-grit diamond pads until grout is removed from surface.

3. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet; noncumulative.

3.4 REPAIR

A. Cut out and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Commissioner.

3.5 CLEANING AND PROTECTION

A. Cleaning:

1. Remove grinding dust from installation and adjacent areas.

2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.

B. Sealing:

1. Seal surfaces according to NTMA's written recommendations.

2. Apply sealer according to sealer manufacturer's written instructions.

C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION
SECTION 09 68 13 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY
   A. Section Includes:
      1. Modular carpet tile.
   B. Related Requirements:
      1. Section 02 41 19 "Selective Demolition" for removing existing floor coverings.
      2. Section 09 65 13 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.
      1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
         a. Review delivery, storage, and handling procedures.
         b. Review ambient conditions and ventilation procedures.
         c. Review subfloor preparation procedures.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
      1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
      2. Include manufacturer's written installation recommendations for each type of substrate.
   B. Shop Drawings: For carpet tile installation, plans showing the following:
      1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
      2. Carpet tile type, color, and dye lot.
      3. Type of subfloor.
      4. Type of installation.
      5. Pattern of installation.
      6. Pattern type, location, and direction.
      7. Pile direction.
      8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.  
10. Transition details to other flooring materials.

C. Samples for Initial Selection: For each type of carpet tile.
   1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.

D. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.

E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..
1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

   1. Build mockups at locations and in sizes shown on Drawings.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Carpet and Rug Institute's CRI 104.

1.9 FIELD CONDITIONS

A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, the following:

      a. More than 10 percent edge raveling, snags, and runs.
      b. Dimensional instability.
      c. Excess static discharge.
      d. Loss of tuft-bind strength.
      e. Loss of face fiber.
      f. Delamination.

   3. Warranty Period: 10 years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 CARPET TILE

A. Basis-of-Design Product: Subject to compliance with requirements, provide Mohawk Group (The); Mohawk Carpet, LLC; GT413 Urban Terrain Tile 12BY36 or a comparable product by one of the following:

1. Atlas Carpet Mills, Inc.
2. Beaulieu Group LLC.
3. Bentley Prince Street, Inc.
4. Interface, LLC.
7. Mannington Mills, Inc.
9. Patcraft; a division of Shaw Industries, Inc.
11. Schönox; HPS North America, Inc.
12. Shaw Contract Group; a Berkshire Hathaway company.
13. Tandus; a Tarkett company.

B. Color: As selected by Architect from manufacturer's full range.

C. Fiber Content: 100 percent nylon 6.

D. Fiber Type: Premium Nylon

E. Pile Characteristic: Textured patterned loop pile.

F. Density: 7,058.

G. Stitches: 12.2 (48.03 per 10 cm).

H. Gage: 1/12" (47.00 rows per 10cm)

I. Surface Pile Weight: 20 oz/yd2 (678 g/m2).

J. Primary Backing/Backcoating: Manufacturer's standard composite materials.

K. Secondary Backing: Manufacturer's standard material.

L. Size: 12 by 36 inches.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

   1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

      a. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

      b. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.

B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION
SECTION 09 68 19 - SHOCK ABSORBING CARPET SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes shock absorbing carpet systems.
B. Related Requirements:
   1. Section 11 61 23 “Folding and Portable Stages” for application to stage platforms.

1.2 ACTION SUBMITTALS
A. Product Data: For each type of product indicated.
B. Shop Drawings: Show the following:
   1. Type of installation.
   2. Pattern of installation.
C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS
A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS
A. Maintenance data.

1.5 QUALITY ASSURANCE
A. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Comply with CRI 104.

1.7 FIELD CONDITIONS
A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of shock absorbing carpet systems installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of face fiber, and delamination.
3. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHOCK ABSORBING CARPET SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, provide SafeLandings, shock absorbing carpet systems or comparable product.

B. Color: As selected by Architect from manufacturer's full range.

C. Pattern: Match Architect's samples.

2.2 INSTALLATION ACCESSORIES

A. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Preparation: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
D. Installation: Comply with CRI 104 and with shock absorbing carpet systems manufacturer's written installation instructions.

E. Installation Method: As recommended in writing by shock absorbing carpet systems manufacturer.

F. Install pattern per Architects direction.

G. Perform the following operations immediately after installing carpet tile:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
   2. Remove yarns that protrude from carpet tile surface.

H. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:
   1. Steel and iron.
   2. Gypsum board.

1.2 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
   2. Indicate VOC content.
B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Apply coats on Samples in steps to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.
C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.
1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.

   b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Behr Paint Company; Behr Process Corporation.
2. Benjamin Moore & Co.
3. Coronado Paint; Benjamin Moore & Co.
5. PPG Paints.
7. Sherwin-Williams Company (The).
8. Valspar Corporation (The).

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As selected by Architect from manufacturer's full range.

1. Ten percent of surface area will be painted with deep tones.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint.
surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in occupied spaces:
   a. Uninsulated metal piping.
   b. Uninsulated plastic piping.
   c. Pipe hangers and supports.
   d. Metal conduit.
   e. Plastic conduit.
   f. Other items as directed by Architect.

2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing.
and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. High-Performance Architectural Latex System MPI INT 5.1RR:
   a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
   c. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.

B. Gypsum Board Substrates:

1. High-Performance Architectural Latex System MPI INT 9.2B:
   a. Prime Coat: Primer sealer, latex, interior, MPI #50.
   c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.

END OF SECTION
SECTION 11 61 23 - FOLDING AND PORTABLE STAGES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes engineering, fabrication, furnishing, delivery and installation of stage platform equipment as specified.

B. The equipment shall consist of a system of interlocking stage platforms of appropriate construction on a support system to provide the height and configuration indicated.

1.2 SCOPE OF WORK

A. Comply with state, local, and jurisdictional codes.

B. Work consists of fabrication of stage platforms and installation of staging platforms. Work shall include the installation of all materials and equipment necessary for the proper operation of the equipment.

C. Preparation and submission of complete engineered shop drawings for approval.

D. Submission of required record documents.

E. Coordination of other affected work, trades, and inspections.

F. Final Assembly of components to provide a complete operable system.

1.3 RELATED SECTIONS

A. Section 09 68 19 “Shock Absorbing Carpet Systems” for carpeting applied to top and sides of staging platforms.

1.4 REFERENCES

A. The Engineered Wood Association
   1. Voluntary Product Standard PS 1-95

B. Aluminum Association
   1. AA Standard AA-M12CCA41
   2. AA Standard AA-M12C22A42/44

C. American Institute of Steel Construction
   1. AISC Manual of Steel Construction

D. IBC and ASTM Load Ratings Standards
1. 2015 International Building Code; Section 1607 “Live Loads; Table 1607.1 Minimum Uniformly Distributed Loads and Minimum Concentrated Live Loads”

2. 2015 International Building Code; Section 1604 “General Design Requirements; Table 1604.3 Deflection Limits

3. 2015 International Building Code; Section 1709 “Preconstruction Load Tests”; Section 1709.3 “Load Test Procedures Not Specified”

E. American Society for Testing and Materials (ASTM) Materials Definitions

1. ASTM A36: Standard Specification for Structural Steel


3. ASTM A307: Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

4. ASTM A325: Standard Specification for High-Strength Bolts and Structural Steel Joints

5. ASTM A500: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing

6. ASTM A501 Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing


8. ASTM B209 Standard Specification for Aluminum-Alloy Sheet and Plate

9. ASTM B 221: Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

10. ASTM B 429: Specification for Aluminum and Aluminum Alloy Extruded Structural Pipe and Tube


F. American Society for Testing and Materials (ASTM) Testing Specifications

1. ASTM D257: Standard Test Methods for DC Resistance or Conductance of Insulating Materials


15. ASTM D746-14: Standard Test Method for Britleness Temperature of Plastics and Elastomers by Impact

G. American Society for Testing and Materials (ASTM) Load Ratings Standards
   1. ASTM E2322-03: Standard Test Method for Conducting Transverse and Concentrated Load Tests on Panels used in Floor and Roof Construction Section 10 “Applying Uniform Load Via Air Bag”, Section 11 “Applying Concentrated Load via 25.4mm Diameter Pin, Measurement Method, Max Load”
   2. ASTM E611-03: Standard Test Method for Performance of Wood and Wood-Based Floor and Roof Sheathing Under Concentrated and Impact Loads. Section 4, 6 “Applying Concentrated Load Via 25mm and 76mm Diameter Loading Disks, Loading Location”
   3. ASTM Standard for Stair and Tread Loads

H. NFPA International.

I. U.S. Department of Commerce, National Institute of Standards and Technology.

J. American Welding Society.
   1. AWS D1.1 Structural Welding Code-Steel.

K. Americans with Disabilities Act.


M. Steel Structures Painting Council.
   1. SSPC SP3: Power Tool Cleaning.

1.5 SUBMITTALS

A. Product Data: Staging specifications and technical data including the following:
   1. Detailed specification of construction and fabrication.
   2. Staging installation instructions.
   3. Certified engineer’s reports indicating compliance with performance requirements
   4. Description of operations, including step-by-step setup and take-down tasks
B. Shop Drawings: Include dimensioned plans, sections, and elevations showing component sizes, arrangements, and details of each condition of installation. Drawings show fabrication and installation details for each platform type, understructure and accessories.

C. Samples: Provide samples as requested by Architect.

D. Contract Closeout Submittals:
   1. Project Record Documents.
   2. Operating and Maintenance Manuals.

1.6 PERFORMANCE REQUIREMENTS

A. Stage Platforms and Risers: Standard Uniform Load 4’x8’ Deck: 200lb/ft^2.

B. Stage Platforms and Risers: Dynamic Live Load: Side load of 15% of total uniform live load: 960 lbs. on a 4’ x 8’ platform under a total uniform live load of 6,400 lbs.

C. Stage Platforms and Risers: Point Load: 1,500 lbs. applied via 1” diameter pin.

D. Stage Platforms and Risers: Fully replaceable components including corners, frame and wood deck. Replaceable in field with common tools.

E. Treads of Stairs: Uniform Load: 100 lbs./ft^2 per stair tread (meets all 2015 IBC Standards). Concentrated Load: 300 lbs. per stair tread applied in a 2 inch by 2 inch area (meets all 2015 IBC Standards).

F. Guardrail linear (Uniform) Loading: 50 plf (pounds per linear foot) in accordance with Section 4.5.1 of ASCE 7.

G. Guardrail Concentrated Load: Designed to resist a concentrated load of 200 pounds in accordance with Section 4.5.1 of ASCE 7.

H. Guardrail Intermediate Rails: Designed to resist a concentrated load of 50 pounds in accordance with Section 4.5.1 of ASCE 7.

I. Guard Rail In-Fill Panel compliant with IBC 4” sphere code.

1.7 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Not less than 10 years of experience in the manufacture of stages, platforms, and risers in use in similar environments.

B. Installer’s Qualifications: Not less than 3 years of experience in installation and application of systems similar in complexity to those required for this project.

C. Submit substitution request not less than 15 days prior to bid date.

1.8 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, and handle stage platforms and risers in accordance with Staging Dimensions’ recommendations.
   1. Ship to jobsite only after roughing-in, painting work, and other related finish work has been completed.
   2. Ensure installation areas are ready to accept units and recommended temperature and humidity levels will be maintained during the remainder of construction.

B. Storage and protection: Comply with Staging Dimensions’ recommendations.
   1. Store in a cool, dry place out of direct sunlight.
   2. Protect from the elements and from sun damage.

1.9 WARRANTY

A. Special Warranty: Staging Dimensions written warranty indicating Staging Dimensions’ intent to repair or replace seating riser components that fail in materials or workmanship within three (3) years from the date of shipment (with the exception of the SD6000 Weather Resistant Deck which is guaranteed for a period of one (1) year from date of shipment). This warranty does not apply to the buyer’s misuses, damages, improper maintenance, repairs or replaces with a part not of STAGING DIMENSIONS manufacture. Paint and exterior surfaces are excluded. Failures are defined to include, but not limited to the following:
   1. Fracturing or breaking of unit components which results from normal wear and tear and normal use.
   2. Delamination or others or other failures of glue bond of components.
   3. Warping of components not resulting from leaks, flooding, or other uncontrolled moisture or humidity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Stage Platform and riser design is based upon products of the manufacturer listed below. Provide basis of design product or approved comparable product.

B. Staging Dimensions, New Castle, DE, Telephone: (866) 591-3471, Email: Sales@stagingdimensions.com, Website: www.stagingdimensions.com.

2.2 COMPONENTS

A. SD 5000 Stage Deck.
   1. Edging: 3.782” High extruded 6005-T5 (4) sided aluminum frame (including protective edge), mill finish (standard), powder coat and anodizing as an option. Frame is designed to accept:
      a. Built-in Dual Lock System.
      b. Skirting via Velcro.
      c. Guardrail.
d. Closure Panels.
e. Stair Units.
f. ADA Compliant Ramps.

2. Subfloor: 1 inch thick 9-ply marine grade, Douglas Fir plywood
3. Deck will support a uniform live load of 200 psf. Lateral sway-bracing loads: 24 lbf/ft applied parallel to and 10 lbf/ft applied perpendicular to platforms. (Standard). Additional support beams can be installed to increase load rating.

B. SD 5000 Leg supports: For use with the SD 5000 stage deck. Support system to include the following:
   1. 1-1/4” (nominal size) SCH 40 aluminum pipe. System joins to stage deck in a compression-loading condition. Leg supports are secured to the stage deck by (4) 3/8-16 thumb screws.
      a. Fixed Heights: 4 inches and above (diagonal leg braces required at heights of 36 inches and over). Custom heights available upon request.
      b. Adjustable Heights: 16 inches to 24 inches, 24 inches to 36 inches (diagonal leg bracing required), 36 inches to 56 inches (diagonal leg bracing required), 48 inches to 78 inches (diagonal leg bracing required).
      c. Each leg terminates with a non-marring Neoprene leveling foot to allow for 2 inches of fine height adjustment.
      d. Each leg is capable of being erected without the use of tools.
      e. Finish: Mill (standard), powder coat and anodizing as options.

C. Diagonal Leg Brace (When Required): 1-1/4 inch square 6061 aluminum tube and 3/16 x 2 inch aluminum flat bar. Connect to leg supports.

D. Wunderstructures:
   1. For use with SD 5000 stage decks. Support system permits bridging of platforms between Wunderstructures. The structure meets the following specifications:
      a. Adjustable heights: 24 inches to 36 inches, 36 inches to 56 inches, 48 inches to 78 inches, 78 inches to 108 inches.
      b. Adjust course height by 2 inch increments using hand-actuated steel plungers.
      c. Adjust fine height over a span of 3 inches by use of integrated ACME thread adjustable screw foot. Adjustable screw foot mounted to bottom of vertical member.
      d. Capable of being erected without the use of tools.
      e. Finish: Mill (standard), powder coat and anodizing as an option.
   3. Main horizontal members: 2 inch OD x 1/8 inch wall thickness 6061-T6 Aluminum square tubing.
   4. Telescoping columns: 2 inch schedule 80 6061-T6 aluminum pipe – telescoping columns allow for independent control to use Wunderstructures in all terrain situations.
      a. Hand-actuated monkey claw structural fitting welded to each end of pipe.

E. I-Beam Spanning Support System:
   1. General: For use with SD 5000 stage decks. Compatible with the Wunderstructure support system. Used to improve access below stage and for larger spans. Support system meets the following:
2. Main support beams: Extruded 6061-T6 Aluminum bridging beams with locator plates for stage deck-to-beam connection. Plates attach with a 3/8-16 bolted connection to Wunderstructures and to decks via 1-1/4” diameter gray PVC rod.

2.3 ACCESSORIES

A. Closure Panels
   1. Material: Black Luan or milk plexi.
   3. Integration: Leg clamps and Velcro.

B. Leg Storage Clips
   1. Material: Nickel Plated Spring Steel, treated to a Rockwell of C42-46.
   2. Finish: mill.

2.4 FINISHES

A. Aluminum Framing: Mill Finish (standard).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
   1. Do not proceed until unsatisfactory conditions have been corrected.
   2. Field verify dimensions for all units prior to fabrication is indicated by the owner, architect, or consultant.

3.2 INSTALLATION

A. Comply with manufacturer’s recommendations.
   1. Install units in location as directed to verify components are complete and operational.
   2. Train owner’s personnel to adjust, operate, and maintain units.
   3. Deliver operation and maintenance instructions to Owner.

3.3 TRAINING

A. Train owner’s personnel to assemble, adjust, operate, and maintain theatre and stage system

END OF SECTION
SECTION 12 52 13 - CHAIRS

PART 1 - GENERAL

1.1 SUMMARY
   A. Section includes manufactured chairs and ottomans.
   B. Related Requirements:
      1. Section 12 59 83 – “Custom Systems Furniture” for custom furniture.

1.2 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS
   A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS
   A. Maintenance data.

1.5 WARRANTY
   A. Manufacturer’s Warranty: Manufacturer agrees to repair or replace chairs and ottomans that fail(s) in materials or workmanship within specified warranty period.
      1. Warranty Period: two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIRS (CH-1)
   A. Basis-of-Design Product: Subject to compliance with requirements, provide Arconas; Place Chairs or a comparable product of other furniture manufacturers.
B. Supporting Beam  
1. Supporting beam is 5 1/4" x 4 3/8" triangular aluminum extrusion with 3/16" thick walls. Heat treated to T5 temper.  
2. Front and bottom surfaces of beam with four T-Slot grooves used to attach the legs, seats, arm, tablets and tables.  
3. Ends of the beams closed with molded ABS end caps.  

C. Legs  
1. Single arch T-shaped casting.  
2. Legs bolt to the T-Slot grooves on the bottom of the beam.  
3. Each leg casting includes 2 die cast adjustable glides.  

D. Seats  
1. Seat position consists of a seat pan, a back pan, 2 hanger castings and 2 seat clamps.  
2. Seat and back pans are made from formed 3/4" x 16-gauge steel tube welded to a formed 16-gauge sheet. Each has 4 weld nuts for attachment to the aluminum hanger castings.  
3. Hanger castings include 2 cantilever hooks on the rear surface. Seat and back are attached to castings (four 1/4"-20 screws) and castings are hooked into the front T-Slots on the beam.  
4. Casting is secured to beam by a seat clamp attached to the T-Slots on underside of beam.  

E. Seat and Back Cushions  
1. Seat and back cushions are made of molded high resiliency polyurethane foam over seat and back pans. A thin layer of foam is added to underside of seat and the rear of back.  
2. Seat cushion is 2-1/2" thick and back cushion is 2" thick.  

F. Upholstery  
1. Seat and back cushions are upholstered using slip covers. This will allow field replacement of damaged or worn upholstery by trained personnel.  
2. There are no seams in the seat and back slipcover design in the high wear areas in the center. The front and top edges use a waterfall approach to minimize wear on those edges. The seams are sewn using French stitching.  
3. Zipper closures are hidden to minimize tampering and vandalism.
G. Arms and Tablets
   1. Aluminum arm casting is used to support either a dense self-skinning polyurethane arm cap or a tablet. The arm casting attaches to the 2 T-Slots on the front face of beam.
   2. Tablet surface size: 19" by 6".
   3. Tablet is made from 1/2" phenolic core paneling mounted on a 10-gauge steel base.

H. Tables
   1. Tables are supported by 2 aluminum castings styled like the arm castings. The table supports attach to 2 T-Slots on the front face of the beam.
   2. Tables size: 20" by 20".
   3. Tables are constructed from 1/2" phenolic core paneling.

I. Integrated Power
   1. Electrical connections are housed within power pods at the base of each arm.
   2. Each pod is equipped with an AC connection and 2 USB power ports. A blue LED pilot lamp indicates that power is available.
   3. AC socket is the typical 120 VAC 3-prong style (NEMA 5-15R).
   4. USB ports provide up to 2.1A of 5 VDC.
   5. Combination switch, circuit breaker and power inlet are mounted on the underside of each beam. The switch is illuminated when the power is on. The inlet is an IEC C14 socket. The circuit breaker limits the total current to 12 A.
   6. Six-foot power cord is used to connect to a wall or floor socket.
   7. Opposite the inlet, each beam is equipped with a C13 outlet connection. Using a jumper cable, the power pods on 2 units can be powered from a single source. The total current to both units is limited by the inlet circuit breakers to 12 A. All cords have 14-gauge conductors.
   8. Raceway for electrical wiring is located in an opening in the bottom of the beam. It is hidden from sight and cannot be accessed without tools.
   9. Electrical assembly will be inspected and labeled to the National Electrical Code (USA).

J. Assembly
   1. Units are shipped knocked-down (KD). Modules can be switched out without disassembling units. Detailed assembly instructions are provided.

K. Finish
   1. Aluminum Castings – Bright polish and/or shot blast with clear coat
   2. Aluminum Extrusions – Clear anodized

L. Specifications for Aluminum
   1. Castings are cast with an Aluminum alloy exhibiting the following minimum properties.
      a. Tensile Strength: 40,000 PSI
      b. Yield Strength: 27,000 PSI
      c. Elongation: 1.0%
      d. Brinell Hardness: 90 (500 kg/10 mm Ball)
      e. Shear Strength: 24,000 PSI
2.2 POWER STOOLS (CH-2)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Arconas; InPower™ Stool or a comparable product of other furniture manufacturers.

B. Construction:
1. All metal parts are made from steel.
2. Cushion: 2.25" foam pad, supported by 1/4" plywood.

C. Dimensions:
1. Seat height: 28"
2. Seat width: 17"
3. Seat depth: 15"
4. Footrest height: 9.5"

D. Finishes:
1. Cloud silver powder coat
2. Upholstery: Arconas standard textiles or COM.

2.3 LOUNGE SEATING (CH-3)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Massaud; lounge seating or a comparable product of other furniture manufacturers.
B. Backrest features an articulating headrest with removable pillow.

C. Flat base is 3/8" thick and allows users to rotate 95 degrees left or right to prevent cords from wrapping around base of a fully rotating seat.

D. Swivel-return base with auto-return mechanism returns chair to front-facing alignment.

E. Plastic glides are 11/32" thick to allow cords to pass safely underneath without causing damage to the floor.

F. Dimensions:
   1. Overall: 33" deep by 41-1/3" wide by 41-1/3" high
   2. Seat Height: 15"

2.4 SIDE TABLE (O-1A)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Arconas; Twenty Twenty Ottoman or a comparable product of other furniture manufacturers.

B. Construction:

Note: Image shows fabric covered Ottoman. Side table type required.
1. Made from molded polyurethane foam over a core. The core is made from a reclaimed bonded fiber caped top and bottom with plywood (1/2" top, 3/4" bottom). The core is glued and screwed together.
2. The polyurethane foam exceeds CAL-117 flammability.
3. The bottom plate is fitted with 4 adjustable nylon glides.

C. Upholstery:
   1. Upholstered with a customer chosen fabric. The seams around the top edge are French stitched. The cover is stapled to the base and fitted with a dust cover on the bottom surface.

D. Top: Quartz top - snow white
E. Size: 20" deep by 20" wide by 17-1/2" high.

2.5 OTTOMAN (O-1B)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Arconas; Twenty Twenty Ottoman or a comparable product of other furniture manufacturers.

B. Construction:
   1. Made from molded polyurethane foam over a core. The core is made from a reclaimed bonded fiber caped top and bottom with plywood (1/2" top, 3/4" bottom). The core is glued and screwed together.
   2. The polyurethane foam exceeds CAL-117 flammability.
   3. The bottom plate is fitted with 4 adjustable nylon glides.

C. Upholstery:
   1. Upholstered with a customer chosen fabric. The seams around the top edge are French stitched. The cover is stapled to the base and fitted with a dust cover on the bottom surface.

D. Size: 20" diameter by 17-1/2" high.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine furniture before installation. Reject components that are blemished, or damaged.

3.2 INSTALLATION

A. As recommended in writing by furniture manufacturer.

END OF SECTION
SECTION 12 59 83 - CUSTOM SYSTEMS FURNITURE

PART 1 - GENERAL

1.1 SUMMARY
   A. Section includes custom systems furniture as shown on the plans and as specified herein.
   B. Related Requirements:
      1. Section 12 52 13 - "Chairs" for non-custom furniture.

1.2 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Shop Drawings:
      1. Include plans, elevations, sections, and attachment details.
      2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
      3. Detail fabrication and assembly of systems furniture.
      4. Include diagrams for power, signal, and control wiring.
   C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS
   A. Sample warranty.

1.5 CLOSEOUT SUBMITTALS
   A. Maintenance data.
   B. Operation and maintenance data.

1.6 QUALITY ASSURANCE
A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 WARRANTY

A. Manufacturer’s Warranty: Manufacturer agrees to repair or replace components of systems furniture that fail(s) in materials or workmanship within specified warranty period.

1. Warranty Period: two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings by Agati; custom systems furniture manufacturer as specified herein and indicated on the drawings or a comparable product of other custom systems furniture Manufacturers.

2.2 CUSTOM SEATING SPINE WALLS

A. Custom Seating Spine Wall – (CFG-1) Agati

1. Dimensions:
   a. Width: 460”
   b. Depth: 255”
   c. Height: 48”
   d. Seat Height: 18”
   e. Seat Depth: 18.5”
   f. Arm Height: 26”

2. Description: Concaved and convex curved spine wall system made up of six wall section, upholstered seating area for six people, planter box section on one of
outer curve section of the wall, side entrance work areas for four people and one ADA section, and quartz counter top seating at bar height. Wall system will house hardwire electrical system and travel access to power. Wall system will also integrate a vendor supplied light to be mounted on the top surface of the wall.

3. Materials:
   a. Wall: Plywood inner frame structure with horizontal grade plastic laminate outer surface
   b. Legs: Cold 14 gauge rolled metal tubing
   c. Top – Bar: 2cm quartz surface built up to 4cm on the edge
   d. Top – Nook: 45lb particle board with horizontal grade plastic laminate surface
   e. Plinth: Plywood with cold rolled steel skin.
   f. Top Cap and Reveal: 11-gauge cold rolled steel

4. Finishes:
   a. Wall: Horizontal grade plastic laminate– Maple with matt finish.
   d. Top – Nook: Horizontal grade plastic laminate – Designer white with matt finish.
   e. Plinth: Powder coat white.
   f. Top Cap and Reveal: Powder coat white.
   g. Base: Brushed stainless steel.

B. Custom Seating Spine Wall – (CFG-2) Agati

1. Dimensions:
   a. Width: 244"
   b. Depth: 93"
   c. Height: 48"
   d. Seat Height: 18"
   e. Seat Depth: 18.5"
   f. Arm Height: 26"

2. Description: Concaved and convex curved spinewall system made up of three wall section, upholstered seating area for six people, planter box section on one of outer curve section of the wall, and quartz counter top seating at bar height. Wall system will house hardwire electrical system and travel access to power. Wall system will also integrate a vendor supplied light to be mounted on the top surface of the wall.

3. Materials:
a. Wall: Plywood inner frame structure with horizontal grade plastic laminate outer surface
b. Legs: Cold 14 gauge rolled metal tubing
c. Top – Bar: 2cm quartz surface built up to 4cm on the edge
d. Top – Nook: 45lb particle board with horizontal grade plastic laminate surface
e. Plinth: Plywood with cold rolled steel skin.
f. Top Cap and Reveal: 11-gauge cold rolled steel

4. Finishes:
   a. Wall: Horizontal grade plastic laminate– Maple with matt finish
   b. Legs: Powder Coat White
c. Top – Bar: Quartz – Snow White
d. Plinth: Powder Coat white
e. Top Cap and Reveal: Powder Coat white

C. Custom Seating Spine Wall – (CFG-3) Agati

1. Dimensions:
   a. Width: 350”
   b. Depth: 147”
   c. Height: 48”
   d. Seat Height: 18”
   e. Seat Depth: 18.5”
   f. Arm Height: 26”

2. Description: Concaved and convex curved spine wall system made up of five wall section, upholstered seating area for thirteen people, and quartz counter top seating at bar height. Wall system will house hardwire electrical system and travel access to power. Wall system will also integrate a vendor supplied light to be mounted on the top surface of the wall.

3. Materials:
   a. Wall: Plywood inner frame structure with horizontal grade plastic laminate outer surface
   b. Legs: Cold 14 gauge rolled metal tubing
   c. Top – Bar: 2cm quartz surface built up to 4cm on the edge
   d. Plinth: Plywood with cold rolled steel skin.
   e. Top Cap and Reveal: 11-gauge cold rolled steel

4. Finishes:
   a. Wall: Horizontal grade plastic laminate– Maple with matt finish
   b. Legs: Powder Coat White
c. Top – Bar: Quartz – Snow White

d. Top – Nook: Horizontal grade plastic laminate – Maple with matt finish

e. Plinth: Powder Coat white

f. Top Cap and Reveal: Powder Coat white

D. Custom Seating Spine Wall – (CFG-4) Agati

1. Dimensions:
   a. Width: 277”
   b. Depth: 277”
   c. Height: 48”
   d. Seat Height: 18”
   e. Seat Depth: 18.5”
   f. Arm Height: 26”

2. Description: Concaved and convex curved spine wall system made up of five wall section, upholstered seating area for sixteen people, and quartz counter top seating at bar height. Wall system will house hardwire electrical system and travel access to power. Wall system will also integrate a vendor supplied light to be mounted on the top surface of the wall.

3. Materials:
   a. Wall: Plywood inner frame structure with horizontal grade plastic laminate outer surface
   b. Legs: Cold 14 gauge rolled metal tubing
   c. Top – Bar: 2cm quartz surface built up to 4cm on the edge
   d. Top – Nook: 45lb particle board with horizontal grade plastic laminate surface
   e. Plinth: Plywood with cold rolled steel skin.
   f. Top Cap and Reveal: 11-gauge cold rolled steel

4. Finishes:
   a. Wall: Horizontal grade plastic laminate– Maple with matt finish
   b. Legs: Powder Coat White
   c. Top – Bar: Quartz – Snow White
   d. Top – Nook: Horizontal grade plastic laminate – Maple with matt finish
   e. Plinth: Powder Coat white
   f. Top Cap and Reveal: Powder Coat white
g. Base: Brushed stainless steel.

E. Custom Seating Spine Wall – (CFG-5) Agati

1. Dimensions:
   a. Width: 153"
   b. Depth: 57"
   c. Height: 48"
   d. Seat Height: 18"
   e. Seat Depth: 18.5"
   f. Arm Height: 26"

2. Description: Concaved and convex curved spine wall system made up of two wall sections, and upholstered seating area for four people. Wall system will house hardwire electrical system and travel access to power. Wall system will also integrate a vendor supplied light to be mounted on the top surface of the wall.

3. Materials:
   a. Wall: Plywood inner frame structure with horizontal grade plastic laminate outer surface
   b. Legs: Cold 14 gauge rolled metal tubing
   c. Top – Bar: 2cm quartz surface built up to 4cm on the edge
   d. Top – Nook: 45lb particle board with horizontal grade plastic laminate surface
   e. Plinth: Plywood with cold rolled steel skin.
   f. Top Cap and Reveal: 11-gauge cold rolled steel

4. Finishes:
   a. Wall: Horizontal grade plastic laminate – Maple with matt finish
   b. Legs: Powder Coat White
   c. Top – Bar: Quartz – Snow White
   d. Top – Nook: Horizontal grade plastic laminate – Designer white with matt finish
   e. Plinth: Powder Coat white
   f. Top Cap and Reveal: Powder Coat white
   g. Base: Brushed stainless steel.

F. Custom Seating Spine Wall – (CFG-6) Agati
1. Dimensions:
   a. Width: 142"
   b. Depth: 26"
   c. Height: 48"
   d. Seat Height: 18"
   e. Seat Depth: 18.5"
   f. Arm Height: 26"

2. Description: Straight spine wall system made up of three wall section and upholstered seating area for three people. Wall system will house hardwire electrical system and travel access to power. Wall system will also integrate a vendor supplied light to be mounted on the top surface of the wall.

3. Materials:
   a. Wall: Plywood inner frame structure with horizontal grade plastic laminate outer surface
   b. Legs: Cold 14 gauge rolled metal tubing
   c. Top – Bar: 2cm quartz surface built up to 4cm on the edge
   d. Plinth: Plywood with cold rolled steel skin.
   e. Top Cap and Reveal: 11-gauge cold rolled steel

4. Finishes:
   a. Wall: Horizontal grade plastic laminate– Maple with matt finish
   b. Legs: Powder Coat White
   c. Top – Bar: Quartz – Snow White
   d. Plinth: Powder Coat white
   e. Top Cap and Reveal: Powder Coat white

G. Custom Seating Spine Wall – (CFG-7) Agati

1. Dimensions:
   a. Width: 200"
   b. Depth: 24"
   c. Height: 48"

2. Description: Straight spine wall system made up of three wall section, and quartz counter top seating at bar height. Wall system will house hardwire electrical system and travel access to power. Wall system will also integrate a vendor supplied light to be mounted on the top surface of the wall.
3. Materials:
   a. Wall: Plywood inner frame structure with horizontal grade plastic laminate outer surface
   b. Legs: Cold 14 gauge rolled metal tubing
   c. Top – Bar: 2cm quartz surface built up to 4cm on the edge
   d. Plinth: Plywood with cold rolled steel skin.
   e. Top Cap and Reveal: 11-gauge cold rolled steel

4. Finishes:
   a. Wall: Horizontal grade plastic laminate– Maple with matt finish
   b. Legs: Powder Coat White
   c. Top – Bar: Quartz – Snow White
   d. Plinth: Powder Coat white
   e. Top Cap and Reveal: Powder Coat white

2.3 CUSTOM SEATING SPINE WALL COMPONENT DESCRIPTIONS

A. Curved Walls:
   1. The curved wall is built with a hollow cavity structure with vertical and horizontal ribs made from CARB Phase 2 compliance 7 ply. 5 core and 2 veneers C- through D- birch veneer, on full 3/4” standard CPI Core, with all veneer voids filled and sanded. There is a minimum of five vertical supports and five horizontal ribs for each wall section. Wall’s outer skin is 1/4” MDF with horizontal grade plastic laminate finished face. On seat side there are three access panels to mount wall to leveling plinth base. On planter wall side there is one access panel for electrical infeed for the side entrance work areas. On work surface side there are three access panels to mount wall to leveling plinth base and connect the electrical from work surface to electrical system.
   2. The walls are connected together with hidden Mod-Ezz fastener and four hidden 5/6"-18 bolts. There is an 11-gauge cold rolled steel plate between each wall set back 1/8” from all side to create a reveal. Reveal is held on with #10 counter sunk screws. The Wall is capped at each end with an 11-gauge cold rolled steel plate with a powder coat finish. End plate overhangs the wall by 1/8” on all sides and is held on with hidden fastens.
   3. The wall is mounted to a leveling plinth base that is constructed from CARB Phase 2 compliance 7 ply. 5 core and 2 veneers C- through D- birch veneer, on full 3/4” standard CPI Core, with all veneer voids filled and sanded. The base is skinned with 18-gauge cold rolled steel with a powder coat finish. The plinth base is shimmed and leveled to the floor and anchored with 5/16”-18 floor anchor in three locations.
   4. Wall houses hardwire electrical system for traveler power hookup and vendor provided light hookup. The wall also houses light drivers and control boxes in various areas.

B. Straight Walls:
   1. The straight wall is built with a hollow cavity structure with vertical and horizontal ribs made from CARB Phase 2 compliance 7 ply. 5 core and 2 veneers C- through D- birch veneer, on full 3/4” standard CPI Core, with all veneer voids filled and sanded. There is a minimum of five vertical supports and five horizontal ribs for each wall section. Wall’s outer skin is 1/4” MDF with horizontal grade plastic laminate finished face.
laminate finished face. On seat side there are three access panels to mount wall to leveling plinth base. On planter wall side there is one access panel for electrical infeed for the side entrance work areas. On work surface side there are three access panels to mount wall to leveling plinth base and connect the electrical from work surface to electrical system.

2. The walls are connected together with hidden Mod-Ezz fastener and four hidden 5/6"-18 bolts. There is an 11-gauge cold rolled steel plate between each wall set back 1/8" from all side to create a reveal. Reveal is held on with #10 counter sunk screws. The Wall is capped at each end with an 11-gauge cold rolled steel plate with a powder coat finish. End plate overhangs the wall by 1/8" on all sides and is held on with hidden fastens.

3. The wall is mounted to a leveling plinth base that is constructed from CARB Phase 2 compliance 7 ply. 5 core and 2 veneers C- through D- birch veneer, on full 3/4" standard CPI Core, with all veneer voids filled and sanded. The base is skinned with 18-gauge cold rolled steel with a powder coat finish. The plinth base is shimmed and leveled to the floor and anchored with 5/16"-18 floor anchor in three locations.

4. Wall houses hardwire electrical system for traveler power hookup and vendor provided light hookup. The wall also houses light drivers and control boxes in various areas.

C. Plant Walls:
1. The Plant wall is built with a hollow cavity structure with vertical and horizontal ribs made from CARB Phase 2 compliance 7 ply. 5 core and 2 veneers C- through D- birch veneer, on full 3/4" standard CPI Core, with all veneer voids filled and sanded. There is a minimum of five vertical supports and five horizontal ribs for each wall section. Wall's outer skin is 1/4" MDF with horizontal grade plastic laminate finished face. On work station side there are two access panels to mount wall to leveling plinth base. The top of the wall has a recess cavity to hold seven to eight 16-gauge water tight stainless steel plant holders.

2. The Plant Holders are made from 16-gauge stainless steel. Plant holders are to be folded and welded so they are water tight.

3. The Plant Walls are connected together with hidden Mod-Ezz fastener and four hidden 5/6"-18 bolts. There is an 11-gauge cold rolled steel plate between each wall set back by 1/8" from all side to create a reveal. Reveal is held on with #10 counter sunk screws. The Wall is capped at each end with an 11-gauge cold rolled steel plate with a powder coat finish. End plate overhangs the wall by 1/8" on all sides and is held on with hidden fastens.

4. The Plant Wall has a 1-1/4" by 1-1/4" 14-gauge cold metal tube spacer between the backside of the Plant Wall and the Curved Wall. Tub is caped with a 14-gauge cold rolled steel plate welded and ground down so no welds are visible. Tube has a powder coat finish.

5. Plate wall has a 14-gauge stainless steel top cap mounted with #8 stainless steel countersunk screws. The top cap overhangs the wall by 1/8" on all sides. The top cap has 7 to 8 cutouts per wall for the stainless-steel planters to sit on top.

6. The wall is mounted to a leveling plinth base that is constructed from 7 ply. 5 core and 2 veneers C- through D- birch veneer, on full 3/4" standard CPI Core, with all veneer voids filled and sanded. The base is skinned with 18-gauge cold rolled steel with a powder coat finish. The plinth base is shimmed and leveled to the floor and anchored with 5/16"-18 floor anchor in three locations.
D. Work Areas:
1. The work area is a side entrance work station with a cantilever work surface, seat and side shelf. The work area is made for one person to sit with access to power on the work surface. Cantilevered seat needs to handle 500lbs static load. Cantilevered work surface needs to handle 500lbs static load.
2. The Work Area Wall is layered 45lbs particle board to be 2-1/4" and finished with a horizontal grade plastic laminate face. The Wall has cold rolled 11-gauge steel top cap and edge that is attached with #8 counter sunk screws. The Wall is Mod-Ezz clipped to the Plant Wall and is mounted to a Leveling Plinth Base that is constructed from 7 ply. 5 core and 2 veneers. C- through D- birch veneer, on full 3/4" standard CPI Core, with all veneer voids filled and sanded. The base is skinned with 18-gauge cold rolled steel with a powder coat finish. The plinth base is shimmed and leveled to the floor and anchored with 5/16-18 floor anchor in three locations.
3. The Side Shelf and Work Surface are constructed of 1-1/4" CARB Phase 2 compliance 45lbs particle board with a horizontal grade plastic laminate finished top face, phenolic backer, and 3mm PVC edge. They are attached with a 14 gauge formed metal brackets 8" to 14" deep by 3-1/2" wide by 5-1/2" high and mounted to the Work Area Wall and Plant Wall with #10 screws.
4. The work station seat and back are mounted with hidden fasteners to the Side Shelf and the Work Station Wall.

E. Seats:
1. The seat frame is constructed with grade 7/8" thick hardwood plywood. All frame joints have interlocking tenons glued and secured with mechanical fasteners. The seat frame joints are reinforced with corner blocks. The seat is constructed with CAL-117-2013 high-density polyurethane foam over a layer of Dymetrol sheet webbing attached to the hardwood plywood frame. The exterior of the seat is covered with the specified upholstery material.
2. Seat Back:
   a. The back frame is constructed with grade 7/8" thick hardwood plywood. All frame joints have interlocking tenons glued and secured with mechanical fasteners. The tight back is constructed with CAL-117-2013 high-density polyurethane foam over a layer of Propex webbing attached to the hardwood frame. The exterior of the back is covered with the specified upholstery material.

F. Arm Assemblies:
1. The arm assembly is constructed from 11-gauge cold rolled steel and capped with an upholster arm pad. Arm pad is 2" thick and is made up of grade hardwood plywood layered with CAL-117-2013 high-density polyurethane foam on five sides. Arm pad is mounted to underside of arm assembly with four #10 screws and overhangs arm assembly so upper metal support is not visible. Front of arm assembly has a smooth face with no visible welds. Upper Center of arm rest is supported with 11-gauge cold rolled steel plate welded in the center with no visible welds. Lower arm assembly is folded 14-gauge cold rolled steel welded to upper half with no visible welds. Arm assembly mounts to either Legs or Seat Surface with 5/16"-18 bolts. All metal is finish with powder coat.

G. Seat Legs:
1. The seat leg is made of 6" by 2" 14-gauge cold rolled metal tubing welded together with no visible welds. The bottom of the leg has an 11-gauge cold rolled metal plate flow drilled with a 5/16"-18 threaded hole and has a 5/16"-18 by 1-1/4" leveler with nylon glide. The leg has 14-gauge cold rolled steel 90° bracket welded on either one or two sides to attach the seat surface. Bracket is 16" by 1-1/4" by 1-1/4" with four blind holes for #10 screws. The leg is mounted to the arm rest with four 5/16"-18 hidden bolts.

H. Legs for Stone Top:
1. The leg is made of 2-1/2" by 1-1/4" 14-gauge cold rolled metal tubing welded together with no visible welds. The bottom of the leg has two flow drilled 5/16"-18 threaded holes and has two 5/16"-18 by 1-1/4" leveler with nylon glide. The leg has two blind fasteners to connect to the back wall and three hidden holes to mount to underside of top surface for #10 screws.

I. Upholstery:
1. All upholstery to be COM (Customer's Own Material) unless otherwise specified. All seams to have a single or double needle self-locking top stitch.

J. Quartz Tops:
1. Tops are made of 2cm quartz material and built up to 4cm on the edge. Front edge buildup depth is at least 2" deep. Side buildup depth is at least 1/2" deep. Top is mounted to plywood or MDF sub top. Top is attached to the wall with Legs and metal Support Bracket. See Legs for Stone Top section for specification on leg. Top Support Bracket is made up of 14-gauge cold rolled steel. Bracket is 8" deep and 2" high and formed into a U shape. Bracket tapers down to 1/2" high on the 8" side and is mounted to the wall with two #10 1-1/4" long screws. Each top has at least two support brackets.

K. Seat Surfaces:
1. The Seat Surface is made of 1-1/4" CARB Phase 2 compliance 45lbs particle board with a horizontal grade plastic laminate top face and phenolic backer and 3mm PVC edge.

L. Electrical - Seating:
1. The electrical unit in the seating area is a face mounted plug seat unit with two 110V outlets and two charging USB ports. Unit is mounted with hidden mounts. The electrical plugs into a 4TAC hardwired electrical system inside of the wall.

M. Electrical – Quartz Top:
1. The electrical unit in the quartz top area is a face mounted plug seat unit with two 110V outlets and two charging USB ports. Unit is mounted on to the underside of the top with #10 screws. The electrical units plug into a 4-TRAC hardwired electrical system inside of the wall.

N. Electrical – Work Area:
1. The electrical unit is the work area is face mounted plug seat unit with two 110V outlets and two charging USB ports. The electrical units plug into a 4-TRAC hardwired electrical system inside of the wall.

O. Electrical – Inside Wall:
1. The electrical in the wall is the 4Trac hardwired electrical system from Byrne. This is a 2-circuit prefabricated system. Each wall will have 4 to 6 two outlet simplexes connected with a jumper between walls. Each run of electrical terminates with a 72” long whip connected to the ground by a licensed electrician.

2.4 POWER TABLES

A. Power Table – (T-1A) Agati

1. Dimensions:
   a. Width: 96”
   b. Depth: 96”
   c. Height: 39”
2. Description: Round plastic laminate drum base power table with quartz top to fit around column.
3. Materials:
   a. Drum Base: 45lbs particle board with MDF outer skin with plastic laminate face
   b. Top – Bar: 2cm quartz surface built up to 4cm on the edge
   c. Plinth: Plywood with cold rolled steel skin.
4. Finishes:
   a. Wall: Horizontal grade plastic laminate Designer White
   b. Top – Bar: Quartz – Snow White
   c. Plinth: Powder Coat White

B. Power Table – (T-1B) Agati

1. Dimensions:
   a. Width: 96”
   b. Depth: 96”
c. Height: 39"

2. Description: Round plastic laminate drum base power table with quartz top to fit around column.

3. Materials:
   a. Drum Base: 45lbs particle board with MDF outer skin with plastic laminate face
   b. Top – Bar: 2cm quartz surface built up to 4cm on the edge
   c. Plinth: Plywood with cold rolled steel skin.

4. Finishes:
   a. Wall: Horizontal grade plastic laminate Designer White
   b. Top – Bar: Quartz – Snow White
   c. Plinth: Powder Coat White

C. Power Table – (T-2A) Agati

1. Dimensions:
   a. Width: 188"
   b. Depth: 70"
   c. Height: 39"

2. Description: Oval plastic laminate drum base power table with quartz top.

3. Materials:
   a. Drum Base: 45lbs particle board with MDF outer skin with plastic laminate face
   b. Top – Bar: 2cm quartz surface built up to 4cm on the edge
   c. Plinth: Plywood with cold rolled steel skin.
   d. Planter: 14-gauge stainless steel

4. Finishes:
   a. Wall: Horizontal grade plastic laminate Designer White
   b. Top – Bar: Quartz – Snow White
   c. Plinth: Powder Coat White

D. Power Table – (T-2B) Agati
1. Dimensions:
   a. Width: 188"
   b. Depth: 70"
   c. Height: 39"
2. Description: Oval plastic laminate drum base power table with quartz top field fitted around column.
3. Materials:
   a. Drum Base: 45lbs particle board with MDF outer skin with plastic laminate face
   b. Top – Bar: 2cm quartz surface built up to 4cm on the edge
   c. Plinth: Plywood with cold rolled steel skin.
   d. Planter: 14-gauge stainless steel
4. Finishes:
   a. Wall: Horizontal grade plastic laminate Designer White
   b. Top – Bar: Quartz – Snow White
   c. Plinth: Powder Coat White

2.5 POWER TABLES COMPONENT DESCRIPTIONS

A. Bases:
1. The curved base is built in two sections with a hollow cavity structure with vertical ribs made from CARB Phase 2 compliance 7 ply. 5 core and 2 veneers C- through D- birch veneer, on full 3/4" standard CPI Core, with all veneer voids filled and sanded and top and bottom caps built from CARB Phase 2 compliance 45lbs particle board. There is a minimum of four vertical supports in each section. Base’s outer skin is 1/4” MDF with horizontal grade plastic laminate finished face. The bases are connected together with four hidden 5/6”-18 bolts.
2. The base is mounted to a plinth base that is constructed from CARB Phase 2 compliance 7 ply. 5 core and 2 veneers C- through D- birch veneer, on full 3/4” standard CPI Core, with all veneer voids filled and sanded. The base is skinned with 18-gauge cold rolled steel with a powder coat finish. The plinth base is shimmed and leveled to the floor and anchored with 5/16”-18 floor anchor in three locations.
3. Base houses hardwire electrical system for traveler power hookup and vendor provided light hookup. The wall also houses light drivers and control boxes in various areas.

B. Planters:
1. Planter is built from 14-gauge stainless steel formed into a cylinder with a lip at the top to rest on top of Quartz Top. All prices are welded together to be water tight.
C. Quartz Tops:
   1. Tops are made of 2cm quartz material and built up to 4cm on the edge. Front edge build up depth is at least 2” deep. Side buildup depth is at least 1/2” deep. Top is mounted to plywood or MDF sub top. Top is attached to the wall with Legs and metal Support Bracket. See Legs for Stone Top section for specification on leg. Top Support Bracket is made up of 14-gauge cold rolled steel. Bracket is 13” deep and 2” high and formed into a U shape. Bracket tapers down to 1/2” high on the 13” side and is mounted to the wall with two #10 by 1-1/4” long screws. Each top has at least two support brackets.

D. Electrical – Quartz Tops:
   1. The electrical unit is the seating area is faced mounted plug seat unit with two 110V outlets and two charging USB ports. Unit is mounted on to the underside of the top with #10 screws. The electrical units plug into a 4-TRAC hardwired electrical system inside of the wall.

E. Electrical – Inside Walls:
   1. The electrical in the base is the 4Trac hardwired electrical system from Byrne. This is a 2-circuit prefabricated system. Each wall base has 2 to 4 two outlet simplexes connected with a jumper between walls. Each run of electrical terminates with a 72” long whip connected to the ground by a licensed electrician.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine custom systems furniture before installation. Reject components that are blemished, or damaged.

3.2 INSTALLATION

A. As recommended in writing by custom systems furniture manufacturer.
SECTION 21 05 17 - SLEEVES AND SLEEVE SEALS FOR FIRE SUPPRESSION PIPING

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section includes:
      1. Sleeves.
      2. Grout.

1.3 SUBMITTALS
   A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE
   A. Installer Qualifications:
      1. Installer’s responsibilities include preparing shop drawing submittals, fabricating, and installation and providing professional engineering services needed to assume engineering responsibility.
         a. Installer shall be State and Locally Licensed.
   B. References: Sleeves and sleeve seals, installation, and testing shall comply with all applicable codes and referenced design standards:
      4. DFW International Airport Design Criteria Manual
   C. Equipment and components not specifically specified shall be UL Listed for fire protection systems installation.
D. All components shall be installed free of rust, corrosion, or visible damage. All items not complying with this requirement shall be replaced without cost to the Owner.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Galvanized Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.2 GROUT


B. Characteristics: Non-shrink; 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 where required.

B. 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."

END OF SECTION
SECTION 21 05 18 - ESCUTCHEONS FOR FIRE SUPPRESSION PIPING

PART 1 - GENERAL

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

1.2 SUMMARY
   A. Section includes:
      1. Escutcheons
      2. Floor plates

1.3 SUBMITTALS
   A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE
   A. Installer Qualifications:
      1. Installer’s responsibilities include preparing shop drawing submittals, fabricating, and installation and providing professional engineering services needed to assume engineering responsibility.
      2. Installer shall be State and Locally Licensed.

1.5 References: Escutcheons, installation, and testing shall comply with all applicable codes and referenced design standards:
   D. DFW International Airport Design Criteria Manual
1.6 Equipment and components not specifically specified shall be UL Listed for fire protection systems installation.

1.7 All components shall be installed free of rust, corrosion, or visible damage. All items not complying with the requirement shall be replaced without cost to the Owner.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS
   A. One Piece, Stamped Steel Type.
   B. Split Plate, Stamped Steel Type.

2.2 FLOOR PLATES
   A. One Piece Floor Plates.
   B. Split Casting Floor Plates.

PART 3 - EXECUTION

3.1 INSTALLATION
   A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
   B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
   C. Install floor plates for piping penetrations of equipment room floors.
   D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

3.2 FIELD QUALITY CONTROL
   A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION
SECTION 21 13 13 - WET PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section may include any or all of the following:
   1. Pipes, fittings, and specialties.
   2. Fire protection valves:
   4. Test connections, main drains and auxiliary drains.
   5. Backflow Preventers.
   6. Fire Department Connections.
   7. Alarm Devices.
   8. Pressure Gauges.
B. Related Sections:
   1. Section 210517 “Sleeves and Sleeve Seals for Fire Suppression Piping.”
   2. Section 210518 “Escutcheons for Fire Suppression Piping.”

1.3 DESCRIPTION OF WORK
A. Provide all required labor, materials, equipment, testing and services necessary to modify the existing fire protection system as described herein and as shown on the schematic drawings.

1.4 DEFINITIONS
A. Standard Pressure Sprinkler Piping: Listed for 175 psi minimum working pressure.

1.5 SYSTEM DESCRIPTION
A. Fire sprinkler design criteria shall be strictly per this specification.
1. Sprinkler Occupancy Hazard Classifications:
   a. Building Service Areas: Ordinary Hazard, Group 1.
   b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
   c. General Storage Areas: Ordinary Hazard, Group 1.
   e. Mechanical Equipment Rooms: Ordinary Hazard, Group 2.
   f. Office and Public Areas: Light Hazard.

2. Minimum Density for Automatic-Sprinkler Piping Design:
   a. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
   b. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
   c. Special Occupancy Hazard: As determined by authorities having jurisdiction.

3. Maximum Protection Area per Sprinkler:
   a. Office Spaces: 130 sq. ft.
   b. Storage Areas: 130 sq. ft.
   c. Mechanical Equipment Rooms: 130 sq. ft.
   d. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

4. Total Combined Hose-Stream Demand Requirement: According to NFPA unless otherwise indicated:
   a. Ordinary-Hazard Occupancies: 250 gpm

B. Sprinkler locations are shown on the engineering drawings for design guidance and coordination. The Contractor shall be responsible for sprinkler placement and spacing conforming to the requirements of NFPA 13.

1. Acoustical Tile - Locate sprinklers in accordance with the schematic design drawings. Not more than a 3 in. radius tolerance about the point identified by dimension will be accepted. Where rows of sprinklers are provided within the same ceiling plane, any part of the tolerance used for one sprinkler shall be the same for all others in that same row.

2. Hard Ceilings - Locate sprinklers in accordance with the schematic design drawings. Sprinklers shall be in line with light fixtures and other sprinklers where indicated on the drawings. Coordinate closely with the electrical contractor.

3. Unfinished Areas - Locate sprinklers as shown on the schematic design drawings.

C. Provide all necessary offsets, raises or drops in main or branch line piping and auxiliary drains required by building conditions whether or not shown on the schematic design drawings.
D. Examine the job conditions and verify all measurements, distances, elevations, clearances, pipe sizes, etc.

E. It is understood, unless specifically indicated otherwise, that the pipe sizes as shown on the schematic design drawings will be used.

1.6 PERFORMANCE REQUIREMENTS

A. Standard Pressure Piping System Component: Listed for 175 psi minimum working pressure.

1.7 SUBMITTALS

A. The schematic design drawings have been prepared using AUTOCAD. These documents will be made available to the successful fire sprinkler contractor in either electronic form or hard copy. Utilization of these documents for the development of shop drawings and submittals does not relieve the fire sprinkler contractor from any of his responsibilities required herein.

B. Submittals shall be in accordance with requirements of the General Conditions of the Contract.

C. Product Literature: For all wet pipe sprinkler system equipment.

D. Literature shall clearly identify exactly what components are being provided and shall include: finish, size, type, etc. Literature which is not clearly identified will be rejected.

E. Shop Drawings:

1. Drawings must be comprehensive of entire project, demonstrating coordination with other disciplines, complete in all detail and the same scale as the schematic design drawings.

2. Hydraulic calculations. Calculations shall include peaking information.

3. Two (2) samples of each type of fire sprinkler. All submitted escutcheons/coverplates shall have a label/stamp which identifies manufacturer and model number.

F. Field Test Reports and Certificates: Indicate test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

G. Field quality control reports.

H. The Engineer will review this submittal for consistency with the Engineer’s Construction Documents.

I. After the satisfactory review by the Engineer, provide submittals to the Authority Having Jurisdiction (AHJ) and the insurance underwriter for approval.
The fire sprinkler contractor shall be responsible for responding, in writing, to any comments from the AHJ or the insurance underwriter within ten (10) working days after the receipt of their comments. Copies of the response shall be sent to the General Contractor and the Engineer.

Provide record documents in accordance with requirements of Division 1.

Provide operating and maintenance instructions to the Owner in accordance with requirements of the General Conditions of the Contract.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer's responsibilities include preparing shop drawing submittal, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on water supply coordinates provided herein.
   2. Installer shall be State and Locally Licensed.

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. References: Fire sprinkler system equipment, specialties, accessories, installation, and testing shall comply with all applicable codes and referenced design standards:
   4. DFW International Airport Design Criteria Manual

D. Equipment and components shall be UL Listed for fire protection systems installation.

E. All fire sprinkler system components shall be installed free of any rust, corrosion or visible damage. All items not complying with this requirement shall be replaced without cost to the Owner.

1.9 PROJECT CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
1. Notify Construction Manager, Owner, Insurance Underwriter and AHJs 48-hours in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Construction Manager's and Owner's written permission.
3. Provide temporary piping, fittings and valves as required to maintain sprinkler service.

1.10 COORDINATION
   A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
   B. Coordinate installation of system with all other disciplines.

1.11 EXTRA MATERIALS
   A. Provide at the riser manifold spare sprinkler cabinet all sprinklers and escutcheon assemblies proportionate to those provided in the building and all necessary sprinkler wrenches as required by NFPA 13.

1.12 REGULATORY REQUIREMENTS
   A. All work shall meet the requirements of Section 1.8.
   B. The fire sprinkler contractor shall not pursue any approvals or interpretations of the Engineer’s Construction Documents except through the Engineer.
   C. Sprinkler piping shall not be concealed where it is inaccessible unless it is first inspected and accepted by a representative of the authority having jurisdiction.
   D. Any work performed prior to the satisfactory review by the Engineer and approval by the authority having jurisdiction and the insurance underwriter, will be solely at the fire sprinkler contractor’s risk.
   E. The system will not be acceptable until final testing and receipt of the Contractor’s Material and Test Certificate has been obtained.

1.13 WARRANTY
   A. Repair all defective workmanship or replace all defective materials for a period of one year from the date of acceptance by the Owner. Workmanship or equipment found to be defective during that period shall be replaced without cost to the Owner.
PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Per local requirements and NFPA 13. All pipe shall have a Corrosion Resistance Ratio (CRR) equal to or greater than 1.00. Refer to the current UL Fire Protection Equipment Directory - Steel Sprinkler Pipe for acceptable manufacturers, sizes, and joining methods.

B. All wet pipe system risers, feed and cross mains and branch lines 2 ½ in. and larger shall be schedule 10 pipe. All piping smaller than 2 ½ in. shall be schedule 40 pipe.

C. Fittings shall be screwed or flanged black cast iron or approved equal such as mechanical, grooved, plain end or welded connections.

D. Pressure Rating: 175 psi.

E. All interior pipe and fittings prior to the backflow prevention device shall be acceptable for use in potable water systems per local requirements (e.g. cement lined ductile iron, galvanized, etc.)

2.2 JOINING OF PIPE AND FITTINGS

A. All pipe shall be joined in accordance with NFPA 13 and manufacturers recommendations.

B. Where grooved fittings and couplings are used together they shall be of the same manufacturer.

C. Bushings shall not be used. (Exception: Hexagonal bushings shall be permitted for temporary sprinklers on exposed systems in unfinished lease spaces only. Refer to NFPA 13 for guidelines.)

2.3 HANGERS

A. All hangers to be of approved materials and spaced in accordance with NFPA 13 and the piping manufacturer's specifications.

B. The section modulus required by NFPA 13 shall be provided for all trapeze members supporting piping.

2.4 LISTED FIRE PROTECTION VALVES

A. General Requirements:

1. Pressure Rating: 175 psi minimum.
B. Indicating Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Gruvlock.
   b. Nibco.
   c. Tyco.
   d. Victaulic.
   e. Viking.

2. Body Material: Cast or Ductile Iron.

3. Supervisory Switch.

C. Check Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Milwaukee Valve.
   b. Mueller Co.
   c. Nibco.
   d. Stockham.
   e. Tyco.
   f. United Brass Works.
   g. Victaulic.

2. Type: Swing check or wafer.


D. OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Milwaukee Valve.
   b. Mueller Co.
   c. Nibco.
   d. Stockham.
   e. Viking.

2. Body Material: Cast or Ductile Iron.

3. Supervisory Switch.
2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Pressure Rating: 175 psi minimum.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Milwaukee Valve.
   b. Nibco.
   c. United Brass Works.

C. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Milwaukee Valve.
   b. Nibco.
   c. United Brass Works.
   d. Victaulic.

D. Globe Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Crane.
   b. Milwaukee Valve.
   c. Nibco.

2.6 SPRINKLER SPECIALTY PIPE FITTINGS

A. General Requirements:

1. Pressure Rating: 175 psi minimum.

B. Flow Detection and Test Drain Assemblies:

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. AGF Manufacturing Inc. – Model 1011 with relief
2. Size: 2 in.
3. Inlet and Outlet: Threaded.

C. Sprinkler Test Fittings:

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. AGF Manufacturing Inc.
   b. Reliable.
   c. Tyco.
   d. Victaulic.

2. Body Material: Cast or ductile iron housing with sight glass.
3. Size: Same as connected piping.
4. Inlet and Outlet: Threaded.

D. Flexible, Sprinkler Hose Fittings:

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. Fivalco Inc.
   b. FlexHead Industries, Inc.
   c. SprinkFLEX, Inc.

2. Type: Flexible braided hose for connection to sprinkler, with bracket for connection to ceiling grid.
3. Size: Same as connected piping, for sprinkler.

2.7 SPRINKLERS

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. Reliable.
2. Tyco.
3. Victaulic.

B. General Requirements:

1. Pressure Rating: 175 psi minimum.
2. Only sprinklers manufactured after January 1, 2010 will be accepted for use.
3. Only sprinklers manufactured utilizing Belleville spring seals will be acceptable for use.
4. If dry pendent or recessed sprinklers are protecting a walk-in cooler, freezer or similar area and the piping supplying these sprinklers is in a conditioned space the Tyco Dry Sprinkler Boot (DSB-2) shall be used.

C. Sprinkler Types:

1. Chrome Recessed - Glass Bulb Quick Response Recessed Sprinkler with polished chrome recessed escutcheon.
2. Semi-Recessed - Glass Bulb Quick Response Recessed Sprinkler with factory applied black painted deflector, frame and escutcheon. Match color and finish to black Tech Strips in Concourse Level ceilings.
6. Chrome Horizontal Sidewall - Glass Bulb Quick Response Horizontal Sidewall Sprinkler with polished chrome flat escutcheon.
7. Chrome Pendent - Glass Bulb Quick Response Pendent Sprinkler with polished chrome flat escutcheon.
8. Dry Horizontal Sidewall Quick Response Dry Horizontal Sidewall Sprinkler.
9. Concealed – Glass Bulb Quick Response Concealed Sprinkler with factory painted cover plate. Custom colors shall be coordinated with the architect as required.

D. Sprinkler Escutcheons: Materials, types, and finishes shall match sprinklers.

1. Escutcheons shall be listed for use with the sprinkler it is installed with.

E. Sprinkler Guards:

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. Globe.
   b. Reliable.
   c. Tyco.
   d. Victaulic.
   e. Viking.

2. Type: Wire cage with fastening device for attaching to sprinkler.

2.8 ALARM DEVICES

A. Alarm device types shall match piping and equipment connections.

B. Waterflow Switches - Vane Type:
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. Guardian.
   b. Potter Electric.
   c. System Sensor.

2. Waterflow Detector: Electrically supervised.
3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 24-volt D.C. or 110-volt A.C.; complete with factory set, field-adjustable retard element to prevent false signals and tamperproof cover; corrosion resistant components in waterway; dust tight construction.
4. Type: Paddle operated.
5. Pressure Rating: 175 psi
6. Design Installation: Horizontal or vertical.
7. Signals waterflow that equals or exceeds 10 gpm.
8. 0 to 120 seconds adjustable range.
9. Detector shall be furnished and installed by the fire sprinkler contractor and wired complete by the electrical contractor.

C. Valve Supervisory Switches:

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. Guardian.
   b. Potter Electric.
   c. System Sensor.

2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts; 24-volt D.C. or 110-volt A.C.; tamper proof cover; dust tight construction.
4. Design: Signals that controlled valve is in other than fully open position.
5. The supervisory switch shall be furnished and installed by the fire sprinkler contractor and wired complete by the electrical contractor.

2.9 PRESSURE GAGES

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. AMETEK; U.S. Gauge Division.
2. Brecco Corporation.
3. WIKA Instrument Corporation.
B. Dial Size: 3½ to 4½-inch diameter.

C. Pressure Gage Range: 0 to 250 psi minimum.

D. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

2.10 SIGNS

A. Approved enameled metal signs shall be securely attached at all main drains, auxiliary drains, test connections and control valves. (Signs shall indicate which zone they serve.)

B. Provide a permanently attached placard indicating hydraulic design criteria placed on each system riser.

C. Provide in each sprinkler riser room a plan indicating the areas served by each control valve. The plan shall also include the location of each low point or auxiliary drain valve. The plan shall clearly identify the system associated with each low point or auxiliary drain valve. This plan shall be framed with a Plexiglas cover and shall be permanently attached to a wall. Plan shall be large enough to clearly define the areas protected by each system.

PART 3 - EXECUTION

3.1 COORDINATION WITH OTHER TRADES

A. Coordinate closely with all other trades to expedite construction and avoid interference.

3.2 SYSTEM INSTALLATION

A. Deviations from schematic design documents require prior written approval from the Engineer of Record.

B. Piping Standard: Comply with requirements in NFPA 13 for installation of sprinkler piping.

C. Install Test Connections in sprinkler system piping as required.

D. Auxiliary drains consisting of plugs, or globe valves and plugs where capacity of trapped pipe section exceeds 5 gallons, shall be provided to drain all points in the system that cannot be drained back to main riser.

E. Install alarm devices in piping systems.

F. Install hangers and supports for sprinkler system piping according to NFPA 13.
G. Install pressure gages where required by NFPA 13. Include pressure gages with connection not less than NPS ¼ and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

H. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in SECTION 210517 - SLEEVES AND SLEEVE SEALS FOR FIRE SUPPRESSION PIPING.

I. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in SECTION 210518 - ESCUTCHEONS FOR FIRE SUPPRESSION PIPING.

J. Fire-stop all penetrations of fire rated assemblies.

3.3 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping as according to ANSI/ASME A13.1.

3.4 PAINTING

A. Painting of sprinkler piping is not included in this contract.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, hydrostatically test all systems and test for leaks by charging system to 200 psi, or 50 psi above maximum working pressure if over 150 psi, in accordance with NFPA 13. Repair leaks and retest until no leaks exist.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.

4. Coordinate with fire alarm tests. Operate as required.

5. Verify that equipment hose threads are same as those used by the local fire department equipment.

6. Tests shall be witnessed by the authority having jurisdiction and Owner’s authorized agent.

7. Preliminary testing procedures shall be conducted as mentioned above to assure proper operation when the final testing is performed.
8. The Contractor’s Material and Test Certificates as shown in NFPA 13 must be completed and submitted to the Engineer before final acceptance may be given.

3.6 CLEANING

A. Dust or blow away dirt and debris from sprinklers. Sprinklers with foreign materials that cannot be readily dusted or blown away must be replaced.

B. Remove and replace sprinklers with paint, other than factory finish, including overspray.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire sprinkler system components.

END OF SECTION
SECTION 22 05 17
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Pipe sleeves.
B. Manufactured sleeve-seal systems.

1.02 RELATED REQUIREMENTS
A. Section 07 84 00 - Firestopping.
B. Section 22 05 23 - General-Duty Valves for Plumbing Piping.
C. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Piping identification.
D. Section 22 07 19 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS
A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2016.

1.04 SUBMITTALS
A. Product Data: For each type of product indicated.

1.05 QUALITY ASSURANCE
A. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.
B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

PART 2 PRODUCTS

2.01 PIPE SLEEVES
A. Vertical Piping:
1. Sleeve Length: 1 inch above finished floor.
2. Provide sealant for watertight joint.
4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.
B. Clearances:
1. Provide allowance for insulated piping.
2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
3. All Rated Openings: Caulked tight with fire stopping material conforming to ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

2.02 MANUFACTURED SLEEVE-SEAL SYSTEMS
A. Modular/Mechanical Seal:
1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.
3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass reinforced plastic pressure end plates.
PART 3 EXECUTION

3.01 PREPARATION
A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION
A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
B. Install piping to conserve building space, to not interfere with use of space and other work.
C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
D. Provide sleeves when penetrating footings, floors, walls, partitions, and roofs. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
   2. Aboveground Piping:
      a. Pack solid using mineral fiber conforming to ASTM C592.
      b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
   3. All Rated Openings: Caulk tight with fire stopping material conforming to ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.
   4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.
E. Manufactured Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
   3. Locate piping in center of sleeve or penetration.
   4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
   5. Tighten bolting for a water-tight seal.
   6. Install in accordance with manufacturer's recommendations.
F. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING
A. Upon completion of work, clean all parts of the installation.
B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION 22 05 17
SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applications.
B. General requirements.
C. Ball valves.
D. Check valves.

1.02 RELATED REQUIREMENTS

A. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
B. Section 22 07 19 - Plumbing Piping Insulation.
C. Section 22 10 05 - Plumbing Piping.

1.03 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.
B. EPDM: Ethylene propylene copolymer rubber.
C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
D. NRS: Non-rising stem.
E. OS&Y: Outside screw and yoke.
F. PTFE: Polytetrafluoroethylene.
G. RS: Rising stem.
H. SWP: Steam working pressure.
I. TFE: Tetrafluoroethylene.

1.04 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch); 2013.
D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
E. ASME B31.9 - Building Services Piping; 2014.
H. AWWA C606 - Grooved and Shouldered Joints; 2015.
I. MSS SP-45 - Bypass and Drain Connections; 2003 (Reaffirmed 2008).
K. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.
L. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

1.05 SUBMITTALS

A. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
B. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.06 QUALITY ASSURANCE

A. Manufacturer:
   1. Obtain valves for each valve type from single manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
   2. Protect valve parts exposed to piped medium against rust and corrosion.
   3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
   4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
   5. Secure check valves in either the closed position or open position.

B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Provide the following valves for the applications if not indicated on drawings:
   1. Shutoff: Ball.
   2. Swing Check (Pump Outlet):
      a. 2 NPS and Smaller: Bronze swing check valves with bronze disc.
      b. 2-1/2 NPS and Larger for Domestic Water: Iron swing check valves with closure control, metal seat check valves.

B. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

C. Required Valve End Connections for Non-Wafer Types:
   1. Copper Tube:
      a. 2 NPS and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
      b. 2-1/2 NPS to 4 NPS: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
      c. 5 NPS and Larger: Grooved or flanged ends.

D. Domestic, Hot and Cold Water Valves:
   1. 2 NPS and Smaller:
      a. Bronze and Brass: Provide with solder-joint ends.
      b. Bronze Angle: Class 125, bronze disc.
      c. Ball: Two piece, full port, brass or bronze with brass trim.
      d. Bronze Swing Check: Class 125, bronze disc.
      e. Bronze Gate: Class 125, NRS.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:
D. Valves in Insulated Piping: With 2 NPS stem extensions and the following features:
   1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Valve-End Connections:
   5. Grooved End Connections: AWWA C606.

F. General ASME Compliance:


H. Bronze Valves:
   1. Fabricate from dezincification resistant material.
   2. Copper alloys containing more than 15 percent zinc are not permitted.

I. Valve Bypass and Drain Connections: MSS SP-45.

J. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRASS BALL VALVES
A. Two Piece, Full Port with Stainless Steel Trim:
   1. Comply with MSS SP-110.
   2. SWP Rating: 150 psig.
   3. CWP Rating: 600 psig.
   5. Ends: Threaded.
   6. Seats: PTFE.
   7. Stem: Stainless Steel.
   8. Ball: Chrome-plated brass.

B. Three Piece, Full Port with Stainless Steel Trim:
   1. Comply with MSS SP-110.
   2. SWP Rating: 150 psig.
   3. CWP Rating: 600 psig.
   5. Ends: Threaded.
   6. Seats: PTFE.
   7. Stem: Stainless steel.
   8. Ball: Chrome-plated brass.

2.04 BRONZE BALL VALVES
A. Two Piece, Full Port with Stainless Steel Trim:
   1. Comply with MSS SP-110.
   2. SWP Rating: 150 psig.
   3. CWP Rating: 600 psig.
   5. Ends: Threaded.
   6. Seats: PTFE.
   7. Stem: Stainless steel.
   9. Manufacturers:
      a. Apollo Flow Controls; Conbraco Industries.
b. Milwaukee Valve Company.
c. NIBCO Inc.
d. Watts.

2.05 BRONZE SWING CHECK VALVES
A. Class 125: CWP Rating: 200 psig (1380 kPa).
   1. Comply with MSS SP-80, Type 3.
   2. Design: Horizontal flow.
   4. Ends: Threaded as indicated.
   5. Disc: Bronze.
   6. Manufacturers:
      a. American Valve, Inc.
      b. Crane Co.; Crane Valve Group; Crane Valves.
      c. Milwaukee Valve Company.
      d. NIBCO Inc.
      e. Red-White Valve Corporation.

2.06 IRON SWING CHECK VALVES WITH CLOSURE CONTROL
A. Class 125 with Lever and Weight-Closure Control.
   1. Comply with MSS SP-71, Type I.
   2. Description:
      a. CWP Rating: 200 psig.
      b. Design: Clear or full waterway.
      c. Body: ASTM A126, gray iron with bolted bonnet.
      d. Ends: Flanged as indicated.
      e. Trim: Bronze.
      f. Gasket: Asbestos free.
      g. Closer Control: Factory installed, exterior lever, and weight.
   3. Manufacturers:
      a. Crane Co.; Crane Valve Group; Crane Valves, Jenkins Valves and Stockham Division.
      b. Grinnel Corporation.
      c. Hammond Valve.
      d. Milwaukee Valve Company.
      e. Mueller Company.
      f. NIBCO Inc.
      g. Watts Industries.

PART 3 EXECUTION
3.01 EXAMINATION
A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
B. Verify valve parts to be fully operational in all positions from closed to fully open.
C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION
A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

D. Install check valves where necessary to maintain direction of flow as follows:
   1. Swing Check: Install horizontal maintaining hinge pin level.

E. Provide chainwheels on operators for valves 4 NPS and larger where located 96 NPS or more above finished floor, terminating 60 NPS above finished floor.

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HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
Section: 22 05 29

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Support and attachment components for equipment, piping, and other plumbing work.

1.02 REFERENCE STANDARDS
   E. MFMA-4 - Metal Framing Standards Publication; 2004.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS
   A. General Requirements:
      1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
      2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
      3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
      4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
         a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
         b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
   B. Metal Channel (Strut) Framing Systems:
      1. Manufacturers:
         a. Cooper B-Line, a division of Eaton Corporation.
         b. Power-Strut Div.; Tyco International Ltd.
         c. Thomas & Betts Corporation.
         d. Tolco, Inc.
         e. Unistrut, a brand of Atkore International Inc.
      2. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   C. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
      1. Minimum Size, Unless Otherwise Indicated or Required:
         a. Equipment Supports: 1/2 inch diameter.
         b. Piping up to 1 inch (27 mm) nominal: 1/4 inch diameter.
         c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch diameter.
         d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.
   D. Thermal Insulated Pipe Supports:
      1. General Construction and Requirements:
a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch iron pipes.
d. Insulation inserts to consist of polyisocyanurate (urethane) insulation surrounded by a 360 degree, PVC jacketing.

E. Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
   b. Empire Industries.
   c. Hilti, Inc.
   d. ITW Red Head, a division of Illinois Tool Works, Inc.
   e. Powers Fasteners, Inc.
   f. Simpson Strong-Tie Company Inc.
2. Manufacturers - Powder-Actuated Fastening Systems:
   a. Hilti, Inc.
   b. ITW Ramset, a division of Illinois Tool Works, Inc.
   c. Masterset Fastening Systems, Inc.
   d. Powers Fasteners, Inc.
   e. Simpson Strong-Tie Company Inc.
3. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
4. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that field measurements are as indicated.
B. Verify that mounting surfaces are ready to receive support and attachment components.
C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
A. Install products in accordance with manufacturer's instructions.
B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
H. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.

4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

   I. Secure fasteners according to manufacturer's recommended torque settings.

   J. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

   A. Inspect support and attachment components for damage and defects.

   B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

   C. Correct deficiencies and replace damaged or defective support and attachment components.
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SECTION 22 05 33
HEAT TRACING FOR PLUMBING PIPING

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Self-regulating parallel resistance electric heating cable.
B. Accessories.
C. Controls.

1.02 RELATED REQUIREMENTS
A. Section 22 10 05 - Plumbing Piping.
B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

1.03 REFERENCE STANDARDS
B. ITS (DIR) - Directory of Listed Products; current edition.
C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS
A. Product Data: Provide data for electric heat tracing.
B. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions of equipment and controls, maintenance and repair data, and parts listings.

1.05 WARRANTY
A. Provide ten year manufacturer warranty for cables.

PART 2 PRODUCTS
2.01 SELF-REGULATING PARALLEL RESISTANCE ELECTRIC HEATING CABLE
A. Manufacturers:
   1. Chromalox, Inc.
   2. Delta-Therm Corporation.
   3. Raychem; a division of Tyco Thermal Controls.
B. Provide products listed, classified, and labeled by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction (AHJ).
D. Heating Element:
   1. Provide pair of parallel No.16 tinned stranded copper bus wires embedded in cross linked conductive polymer core with varying heat output in response to temperature along its length.
   2. Terminations: Waterproof, factory assembled, non-heating leads with connector at one end and water-tight seal at opposite end.
   3. Capable of crossing over itself without overheating.
E. Insulated Jacket: Flame retardant polyolefin.
F. Cable Cover: Provide tinned copper and polyolefin outer jacket with UV inhibitor.
G. Maximum Power-On Operating Temperature: 150 degrees F.
H. Maximum Power-Off Exposure Temperature: 185 degrees F.
I. Electrical Characteristics:
   1. 5 W/lineal ft.
   2. 277 volts, single phase, 60 Hz.

2.02 ACCESSORIES
   A. Provide Accessories As Indicated or As Required for Complete Installation, Including but Not Limited To:
      1. High temperature, glass filament tape for attachment of heating cable to metal piping.
      3. Cable ties.
      4. Silicone end seals and splice kits.
      5. Installation clips.

2.03 CONTROLS
   A. Pipe Mounted Thermostats:
      1. Remote bulb on capillary, resistance temperature device (RTD) or thermistor for direct sensing of pipe wall temperature.
      2. Control Enclosure: Corrosion resistant and waterproof.
      3. Provide a single set of dry contacts for general fault alarm condition.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify that piping and equipment are ready to receive work.
   B. Verify field measurements are as indicated on shop drawings.
   C. Verify required power is available, in proper location, and ready for use.

3.02 PREPARATION
   A. Clean exposed surfaces prior to installation.
   B. Prepare surfaces using approved methods as recommended by manufacturer.

3.03 INSTALLATION
   A. Install in accordance with manufacturer's written installation instructions.
   B. Comply with installation requirements of IEEE 515.1 and NFPA 70, Article 427.
   C. Apply heating cable linearly on pipe with fiberglass tape only after piping has successfully completed any required pressure testing.
   D. Comply with applicable local building codes and requirements of authorities having jurisdiction.
   E. Grounding: Refer to Section 26 05 26.
   F. Identification:
      1. After thermal insulation installation, apply external pipeline decals to indicate presence of the thermal insulation cladding at intervals not to exceed 20 ft including cladding over each valve or other equipment that may require maintenance.
   G. Electrical Connections: Refer to Section 26 05 19.

3.04 FIELD QUALITY CONTROL
   A. Field Testing and Inspections:
      1. Test heating cable integrity with megohmmeter at the following intervals:
         a. Before installing the cable.
         b. After cable has been installed onto the piping.
         c. After the installation of thermal insulation onto the piping.
      2. Measure voltage and current at each unit.
      3. Controls:
         a. Verify control parameters are set to the application requirements.
3.05 PROTECTION
   A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 22 05 33
SECTION 22 05 48

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Vibration isolators.

1.02 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data:
   1. Provide manufacturer’s product literature documenting compliance with PART 2 PRODUCTS.
   2. Include seismic rating documentation for each isolator and restraint component accounting for horizontal, vertical, and combined loads.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS
A. General:
   1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
   2. Steel springs to function without undue stress or overloading.
   3. Steel springs to operate in the linear portion of the load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
   4. Lateral to vertical stiffness ratio to not exceed 0.08 with spring deflection at minimum 75 percent of specified deflection.
   5. All equipment mounted on vibration isolated bases to have minimum operating clearance of 2 inches between the base and floor or support beneath unless noted otherwise.

2.02 VIBRATION ISOLATORS
A. Non-Seismic Type:
   1. Elastomeric Hangers:
      a. Housing: Steel construction containing elastomeric isolation element to prevent rod contact with housing and short-circuiting of isolating function.
      b. Incorporate steel load distribution plate sandwiching elastomeric element to housing.
   2. Spring Hanger:
      a. Housing: Steel construction containing stable steel spring and integral elastomeric element preventing metal to metal contact.
      b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.
   3. Combination Elastomeric-Spring Hanger:
      a. Housing: Steel construction containing stable steel spring with elastomeric element in series isolating upper connection of hanger box to building structure.
      b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL
A. Install in accordance with manufacturer’s instructions.
B. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
C. Support piping connections to equipment mounted on isolators using isolators or resilient hangers for scheduled distance.
   1. Up to 4 Inches Pipe Size: First three points of support.

END OF SECTION 22 05 48
SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Nameplates.
   B. Tags.
   C. Pipe markers.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
   A. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
   B. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS
   A. Piping: Pipe markers.
   B. Water Heaters and All Other Plumbing Equipment: Nameplates.

2.02 NAMEPLATES
   A. Minimum Size: Length and width vary for required label content, but not less than 2-1/2 inch by 1 inch.
   B. Description: Laminated three-layer plastic with engraved letters.
      2. Letter Height: 1/4 inch.
   C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is identified (plans, details, and schedules), plus the specification number and title where the equipment is specified.

2.03 TAGS
   A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
   B. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS
   A. Comply with ASME A13.1.
   B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
   C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
   D. Label Contents: Include identification of piping system service using same designations as used on the 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 a separate unit on each pipe label to indicate flow direction.
      2. Lettering Size: 1-1/2 inch minimum.
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
Section: 22 05 53

PART 3 EXECUTION
3.01 PREPARATION
   A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION
   A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
   B. Install tags with corrosion resistant chain.
   C. Install plastic pipe markers in accordance with manufacturer's instructions.
   D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

END OF SECTION 22 05 53
PLUMBING PIPING INSULATION
Section: 22 07 19

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1  GENERAL

1.01 SECTION INCLUDES
A. Piping insulation.
B. Piping insulation for supplies and drains for handicap-accessible lavatories and sinks.
C. Jackets and accessories.

1.02 RELATED REQUIREMENTS
A. Section 07 84 00 - Firestopping.
B. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS
B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
J. ICC A117.1 - Supply and Drain Protective Shield Covers.

1.04 SUBMITTALS
A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 QUALITY ASSURANCE
A. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

PART 2  PRODUCTS

2.01 REGULATORY REQUIREMENTS
A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER
A. Manufacturers:
   1. CertainTeed Corporation.
3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation.
4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ.
5. Manson Insulation Inc.; Alley-K.
6. Owens Corning Corporation; VaporWick Pipe Insulation.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.03 JACKETS

A. PVC Plastic.
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.

   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.04 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:
   1. Manufacturers:
      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, trap, and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
   3. Construction: 1/8 inch PVC with antimicrobial, antifungal and UV resistant properties.
      a. Comply with ASME A112.18.9 for covers on accessible lavatory piping.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.
B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

D. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

E. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

F. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert Location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

I. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

J. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULES

A. Plumbing Systems:
   1. Domestic Cold Water, all sizes: preformed glass fiber, 1 inch thick.
   2. Domestic Hot and Recirculated Water: NPS 1-1/4 and smaller, preformed glass fiber, 1 inch thick; NPS 1-1/2 and larger, preformed glass fiber 1-1/2 inches thick.
   3. Roof Drain and Overflow Drain Bodies, all sizes: preformed glass fiber, 1 inch thick.
   4. Stormwater and Overflow, all sizes: preformed glass fiber, 1 inch thick.
   5. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities, all sizes: preformed glass fiber, 1 inch thick.

END OF SECTION 22 07 19
PLUMBING PIPING
Section: 22 10 05

SECTION 22 10 05
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Pipe, pipe fittings, specialties, and connections for piping systems.
      1. Sanitary sewer.
      2. Domestic water.
      3. Pipe hangers and supports.
      4. Manufactured sleeve-seal systems.
      5. Valves.

1.02 REFERENCE STANDARDS
   A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
   B. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; 2013.
   C. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV; 2016.
   D. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; 2012.
   E. ASME B31.9 - Building Services Piping; 2014.
   F. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems; 2009.
   K. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.
   L. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2013.
   V. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

1.03 SUBMITTALS
   A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.04 QUALITY ASSURANCE
   A. Perform work in accordance with applicable codes.

1.05 DELIVERY, STORAGE, AND HANDLING
   A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
   B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS
   A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING
   A. Cast Iron Pipe: ASTM A74 service weight.
      1. Fittings: Cast iron.
      2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
   B. Cast Iron Pipe: CISPI 301, hubless.
      1. Fittings: Cast iron.
      2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

2.03 SANITARY SEWER PIPING, ABOVE GRADE
   A. Cast Iron Pipe: ASTM A74, service weight.
      1. Fittings: Cast iron.
      2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.
   B. Cast Iron Pipe: CISPI 301, hubless, service weight.
      1. Fittings: Cast iron.
   C. Copper Tube: ASTM B306, DWV.
   D. PVC Pipe: ASTM D2665.
      1. Fittings: PVC.
      3. PVC piping installed in return air plenums shall be wrapped to meet ASTM E84 25/50 rating or shall be manufactured to meet applicable ratings to be installed in plenums.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING
   A. Copper Pipe: ASTM B42, annealed.
      1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE
   A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
      1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
3. Mechanical Press Sealed Fittings: Double pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, non toxic synthetic rubber sealing elements.
   a. Manufacturers:
      1) Elkhart Products Corporation.
      2) Grinnell Products, a Tyco Business.
      3) NIBCO Inc.
      4) Viega LLC.

2.06 PIPE HANGERS AND SUPPORTS
   A. Provide hangers and supports that comply with MSS SP-58:
      1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
      2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
      3. Trapeze Hangers: Welded steel channel frames attached to structure.
   B. Plumbing Piping - Water:
      1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel, adjustable swivel, split ring.
      2. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
      4. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron pipe roll, double hanger.
      5. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.07 MANUFACTURED SLEEVE-SEAL SYSTEMS
   A. Modular/Mechanical Seal:
      1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
      2. Provide watertight seal between pipe and wall/casing opening.
      3. Elastomer element size and material in accordance with manufacturer's recommendations.
      4. Glass reinforced plastic pressure end plates.

2.08 BALL VALVES
   A. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

2.09 PIPING SPECIALTIES
   A. Flow Controls:
      1. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.
      2. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

2.10 WATER PRESSURE REDUCING VALVES
   A. Up to 2 Inches:
      1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.

2.11 STRAINERS
   A. Size 2 inch and Under:
      1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
      2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
C. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
D. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as indicated.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   8. Provide copper plated hangers and supports for copper piping.
E. Manufactured Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
   3. Locate piping in center of sleeve or penetration.
   4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
   5. Tighten bolting for a water-tight seal.
   6. Install in accordance with manufacturer's recommendations.
F. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

3.04 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inches to 1-1/4 inches:
         1) Maximum Hanger Spacing: 6.5 ft.
         2) Hanger Rod Diameter: 3/8 inches.
      b. Pipe Size: 1-1/2 inches to 2 inches:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 3/8 inch.
      c. Pipe Size: 2-1/2 inches to 3 inches:
1) Maximum Hanger Spacing: 10 ft.
2) Hanger Rod Diameter: 1/2 inch.
d. Pipe Size: 4 inches to 6 inches:
   1) Maximum Hanger Spacing: 10 ft.
   2) Hanger Rod Diameter: 5/8 inch.
e. Pipe Size: 8 inches to 12 inches:
   1) Maximum hanger spacing: 14 ft.
   2) Hanger Rod Diameter: 7/8 inch.

B. Piping Applications:
   1. Under slab, domestic water piping, NPS 2 and smaller, shall be: Type L, drawn-temper copper tubing, wrought-copper fittings, brazed or mechanical pressure-seal joints.
   2. Under slab, domestic water, building service piping, NPS 3 to NPS 6, shall be: Type K, wrought copper tubing, solder joint fittings, brazed or mechanical pressure-seal joints.
   3. Above ground, domestic water piping, all sizes, shall be: Type L, drawn-temper copper tubing, wrought-copper fittings, soldered or mechanical pressure-seal joints.
   4. Under slab, soil, waste and vent piping, all sizes, shall be one of the following:
      a. Cast iron, hub-and-spigot, gaskets, and gasketed joints.
      b. Cast iron, hubless, CISPI hubless couplings, and coupled joints.
      c. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
   5. Above ground, soil and waste piping, all sizes, shall be one of the following:
      a. Cast iron, hub-and-spigot, gaskets, and gasketed joints.
      b. Cast iron, hubless, sovent stack fittings, CISPI hubless couplings, and coupled joints.
      c. Copper DWV tube, copper drainage fittings, and soldered joints.
      d. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
   6. Above ground, vent piping, all sizes, shall be one of the following:
      a. Cast iron, hub-and-spigot, gaskets, and gasketed joints.
      b. Cast iron, hubless, CISPI hubless couplings, and coupled joints.
      c. Copper DWV tube, copper drainage fittings, and soldered joints.
      d. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 22 10 05
SECTION 22 10 06
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Drains.
B. Cleanouts.
C. Stainers.

1.02 REFERENCE STANDARDS
A. ASME A112.6.3 - Floor and Trench Drains; 2016.

1.03 SUBMITTALS
A. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS
A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS
A. Manufacturers:
2. Josam Company.
3. MIFAB, Inc.
4. Tyler Pipe; Wade Division.
5. Watts Drainage Products Inc.
6. Zurn Industries, LLC.
B. Floor Drain:
1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

2.03 CLEANOUTS
A. Manufacturers:
2. Josam Company.
3. MIFAB, Inc.
4. Tyler Pipe; Wade Division.
5. Watts Drainage Products Inc.
6. Zurn Industries, LLC.
B. Cleanouts at Interior Finished Floor Areas:
1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.
C. Cleanouts at Interior Finished Wall Areas:
1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.
D. Cleanouts at Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.
2.04 STRainers FOR DOMESTic WATER PIPING

A. Y-Pattern Strainers:
   1. Pressure Rating: 125 psig minimum unless otherwise indicated.
   2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
   3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   4. Screen: Stainless steel with round perforations unless otherwise indicated.
   5. Perforation Size:
      a. Strainers NPS 2 and Smaller: 0.033 inch.
      b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be a source of contamination. Comply with authorities having jurisdiction.
   1. Locate backflow preventers in same room as connected equipment or systems.
   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 unacceptable for this application.
   3. Do not install bypass piping around backflow preventers.
C. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
D. Install Y-pattern strainers for water on supply side of each control valve, water pressure reducing valve, solenoid valve, and pump.
E. Install draining-type post hydrants with 1 cu.yd. of crushed gravel around drain hole. Set post hydrants in concrete paving or in 1 cu.ft. of concrete block at grade.
F. Install floor cleanouts at elevation to accommodate finished floor.
G. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.
H. Pipe relief from backflow preventer to nearest drain.
I. Install water hammer arrestors in water piping according to PDI-WH 201.
J. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.
K. 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.

END OF SECTION 22 10 06
SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1  GENERAL

1.01  SECTION INCLUDES

A.  Testing, adjustment, and balancing of air systems.

1.02  REFERENCE STANDARDS


1.03  SUBMITTALS

A.  TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1.  Submit six weeks prior to starting the testing, adjusting, and balancing work.
   2.  Include at least the following in the plan:
      a.  List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b.  Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c.  Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      d.  Final test report forms to be used.
      e.  Time schedule for deferred or seasonal TAB work, if specified.
      f.  False loading of systems to complete TAB work, if specified.
      g.  Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
      h.  Procedures for formal progress reports, including scope and frequency.
      i.  Procedures for formal deficiency reports, including scope, frequency and distribution.

B.  Field Logs: Submit at least twice a week to the Commissioning Authority.

C.  Progress Reports.

D.  Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1.  Revise TAB plan to reflect actual procedures and submit as part of final report.
   2.  Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
   3.  Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   4.  Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   5.  Units of Measure: Report data in I-P (inch-pound) units only.

PART 2  PRODUCTS - NOT USED

PART 3  EXECUTION

3.01  GENERAL REQUIREMENTS

A.  Perform total system balance in accordance with one of the following:
   2.  SMACNA (TAB).

B.  Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
C. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. NEBB, National Environmental Balancing Bureau: www.nebb.org/
         Institute: www.tabbcertified.org/

D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION
A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air outlets are installed and connected.
   9. Duct system leakage is minimized.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 AIR SYSTEM PROCEDURE
A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Measure air quantities at air inlets and outlets.

C. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

D. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

E. On fan powered VAV boxes, adjust air flow switches for proper operation.

3.04 SCOPE
A. Test, adjust, and balance the following:
   1. Air Terminal Units.
   2. Air Inlets and Outlets.

3.05 MINIMUM DATA TO BE REPORTED
A. Electric Motors:
   1. Manufacturer.
   2. Model/Frame.
   3. HP/BHP.
   4. Phase, voltage, amperage; nameplate, actual, no load.
   5. RPM.

B. Terminal Unit Data:
   1. Manufacturer.
   2. Type, constant, variable, single, dual duct.
   3. Identification/number.
   4. Location.
5. Model number.
7. Minimum static pressure.
8. Minimum design air flow.
9. Maximum design air flow.
10. Maximum actual air flow.

END OF SECTION 23 05 93
SECTION 23 07 13
DUCT INSULATION

PART 1  GENERAL

1.01  SECTION INCLUDES
A.  Duct insulation.

1.02  RELATED REQUIREMENTS
A.  Section 23 31 00 - HVAC Ducts and Casings: Glass fiber ducts.

1.03  REFERENCE STANDARDS

1.04  SUBMITTALS
A.  See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B.  Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05  DELIVERY, STORAGE, AND HANDLING
A.  Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
B.  Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06  FIELD CONDITIONS
A.  Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
B.  Maintain temperature during and after installation for minimum period of 24 hours.

PART 2  PRODUCTS

2.01  REGULATORY REQUIREMENTS
A.  Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02  GLASS FIBER, FLEXIBLE
A.  Manufacturer:
B.  Insulation: ASTM C553; flexible, noncombustible blanket.
   1.  'K' value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
   2.  Maximum Service Temperature: 1200 degrees F.
   3.  Maximum Water Vapor Absorption: 5.0 percent by weight.
C.  Vapor Barrier Jacket:
   1.  Kraft paper with glass fiber yarn and bonded to aluminized film.
DUCT INSULATION
Section: 23 07 13

2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that ducts have been tested before applying insulation materials.
   B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Insulated ducts conveying air below ambient temperature:
      1. Provide insulation with vapor barrier jackets.
      2. Finish with tape and vapor barrier jacket.
      3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
      4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

END OF SECTION 23 07 13
SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Metal ductwork.
B. Nonmetal ductwork.

1.02 RELATED REQUIREMENTS
A. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.
B. Section 23 07 13 - Duct Insulation: External insulation and duct liner.
C. Section 23 33 00 - Air Duct Accessories.
D. Section 23 37 00 - Air Outlets and Inlets.

1.03 REFERENCE STANDARDS
E. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2015.
H. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).
J. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.04 SUBMITTALS
A. Product Data: Provide data for duct materials.
B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 FIELD CONDITIONS
A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS
2.01 DUCT ASSEMBLIES
A. Regulatory Requirements: Construct ductwork to NFPA 90A standards.
B. Ducts: Galvanized steel, unless otherwise indicated.
C. Low Pressure Supply (System with Cooling Coils): 2 inch w.g. pressure class, galvanized steel.
D. Medium and High Pressure Supply: 4 inch w.g. pressure class, galvanized steel.

2.02 MATERIALS
A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
HVAC DUCTS AND CASINGS
Section: 23 31 00

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and
      compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. VOC Content: Not more than 250 g/L, excluding water.
   3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero,
      when tested in accordance with ASTM E84.
   4. For Use With Flexible Ducts: UL labeled.
C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or
   continuously threaded.
D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
   5. Other Types: As required.
   6. Manufacturers:
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 DUCTWORK FABRICATION
A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
C. Construct T’s, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline.
   Where not possible and where rectangular elbows must be used, provide air foil turning vanes of
   perforated metal with glass fiber insulation.
D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30
   degrees divergence upstream of equipment and 45 degrees convergence downstream.
E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

2.04 MANUFACTURED DUCTWORK AND FITTINGS
A. Flexible Ducts: Two ply vinyl film supported by helically wound spring steel wire.
   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   2. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
   4. Temperature Range: Minus 10 degrees F to 160 degrees F.
B. Flexible Ducts: Black polymer film supported by helically wound spring steel wire.
   1. UL labeled.
   2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   3. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.
   5. Temperature Range: Minus 20 degrees F to 175 degrees F.

PART 3 EXECUTION
3.01 INSTALLATION
A. Install, support, and seal ducts in accordance with SMACNA (DCS).
B. Install in accordance with manufacturer's instructions.
C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to
   prevent construction dust from entering ductwork system.
D. Flexible Ducts: Connect to metal ducts with draw bands.
E. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
G. Use double nuts and lock washers on threaded rod supports.
H. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

END OF SECTION 23 31 00
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SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Volume control dampers.
   B. Miscellaneous products:
      1. Duct opening closure film.

1.02 RELATED REQUIREMENTS
   A. Section 23 31 00 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS
   B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

1.04 SUBMITTALS
   A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
   C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.

1.05 DELIVERY, STORAGE, AND HANDLING
   A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 VOLUME CONTROL DAMPERS
   A. Fabricate in accordance with SMACNA (DCS) and as indicated.
   B. Single Blade Dampers:
      1. Fabricate for duct sizes up to 6 by 30 inch.
      2. Blade: 24 gage, 0.0239 inch, minimum.
   C. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

2.02 MISCELLANEOUS PRODUCTS
   A. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
      1. Thickness: 2 mils.
      2. High tack water based adhesive.
      3. UV stable light blue color.

PART 3 EXECUTION

3.01 INSTALLATION
   A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 31 00 for duct construction and pressure class.
   B. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
   C. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 23 33 00
PART 1  GENERAL
1.01  SECTION INCLUDES
   A. Diffusers.

1.02  REFERENCE STANDARDS
   A. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2011 with Addendum 1.
   B. ASHRAE Std 130 - Methods of Testing Air Terminal Units; 2016.
   C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

1.03  SUBMITTALS
   A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
   B. Project Record Documents: Record actual locations of air outlets and inlets.

PART 2  PRODUCTS
2.01  MANUFACTURERS

2.02  CEILING SLOT DIFFUSERS
   A. Type: Continuous 1 inch wide slot, two slots wide, with adjustable vanes for left, right, or vertical discharge.
   B. Fabrication: Aluminum extrusions with factory clear lacquer finish.
   C. Color: To be selected by Architect from manufacturer's standard range.
   D. Frame: 1 inch margin with support clips for T bar mounting and gasket, mitered end border.
   E. Plenum: Integral, galvanized steel, insulated.

PART 3  EXECUTION
3.01  INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
   C. Install diffusers to ductwork with air tight connection.
   D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

END OF SECTION 23 37 00
SECTION 26 01 00 – GENERAL REQUIREMENTS FOR ELECTRICAL WORK

PART 1 – GENERAL

1.1 DESCRIPTION

A. General Requirements for Electrical Work are intended to be complementary to General Requirements of Construction Contract.

B. Work Included: Provide complete electrical items where shown on Drawings, as specified herein, and as needed for complete and proper installation including, but not necessarily limited to the following summary of Work.

1. A complete electrical system including power, lighting and low voltage systems.
2. A complete system of feeders and branch circuits to supply electrical power for the entire facility.
3. Demolition of existing electrical systems.
4. Interior luminaries and lamps.
5. Emergency egress luminaries.
6. Wiring devices, outlets, disconnect switches, coverplates, etc.
7. Hangers, anchors, sleeves, chases, supports for fixtures, and other electrical materials and associated equipment.
8. Motor starters and controls for motors provided under the Contract, but for which motor starters and controls are not otherwise provided.
10. Other items and services as required for a complete electrical system.

1.2 QUALITY ASSURANCE AND APPLICABLE STANDARDS

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the Work of this Section.

B. Without additional cost to the Engineer/Owner, provide such other labor and materials as are required to complete the Work of this Section in accordance with the requirements of Governmental Agencies having jurisdiction, including DFW board construction standards available for review at www.dfwairport.com regardless of whether materials and associated labor are delineated elsewhere in these Contract Documents.

C. When requested, provide the Owner’s Authorized Representative with manufacturer’s certificate that materials meet or exceed minimum requirements as specified.

D. Electrical Work shall conform to requirements and recommendations of the latest edition of the National Electrical Code and local codes and ordinances. When codes conflict, the more stringent requirements shall govern.
E. Specifications and Standards of the following organizations are by reference made part of these Specifications. Electrical Work, unless otherwise indicated, shall comply with requirements and recommendations wherever applicable:

1. Association of Edison Illuminating Companies (AEIC)
2. American National Standards Institute (ANSI)
3. American Society for Testing and Materials (ASTM)
4. Certified Ballast Manufacturers (CBM)
5. Electrical Testing Laboratories (ETL)
6. Institute of Electrical and Electronic Engineers (IEEE)
7. Insulated Power Cable Engineers Association (IPCEA)
8. National Bureau of Standards (NBS)
9. National Electrical Contractors Association (NECA)
10. National Electrical Manufacturer's Association (NEMA)
11. National Fire Protection Association (NFPA)
12. Radio-Television Manufacturer's Association (RTMA)
13. Reflector Luminaire Manufacturers (RLM)
14. Underwriters' Laboratories, Inc. (UL)

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. Requirements and recommendations of the latest editions of the Occupational Safety and Health Act (OSHA), Americans with Disabilities Act (ADA), and the Texas Accessibility Standards (TAS) are by reference made part of these Specifications. Work shall comply with requirements and recommendations wherever applicable.

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. Other Sections of Divisions 23 and 26.

B. Other Divisions of Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.5 SUBMITTALS

A. Comply with pertinent provisions of Division 01.

B. Submittals required of materials and equipment include following:

1. Materials list of items proposed to be provided under Division 26.
2. Manufacturer's specifications and other data needed to prove compliance with specified requirements. The term "Compliance" shall mean that the Contractor certifies that submitted equipment meets or exceeds Contract Document requirements. Items that do not clearly meet this definition should be identified and explained as required in the following paragraph.
3. Explain with enough detail so that it can easily be determined that the item complies with the functional intent. List disadvantages or advantages of proposed item versus specified item. Submit technical data sheets and pictures and diagrams to support and clarify. Organize in a clear and concise
format. Substitutions must be approved in writing by the Engineer. The Engineer's decision shall be final.

4. Allow a minimum of ten (10) working days for review of each submittal and resubmittal.

5. Items of equipment that are not accepted in writing as "approved equal" shall be replaced or revised to comply with the Contract Documents at the Contractor's expense.

6. The manufacturer's recommended installation procedures shall become the basis for accepting or rejecting actual installation procedures used on the Work.

7. Shop drawings shall consist of detailed drawings with dimensions, schedules, weights, capacities, installation details and pertinent information needed to describe the material or equipment.

C. Submittals required of materials and equipment under this Division includes the following listed items not supplied by the Owner. These submittal requirements are intended to be complimentary to the requirements that may be listed in the individual sections. In the event of conflict, more stringent requirement shall apply.

1. Conductors and Cabling
   a. Submit product data for each specified product.

2. Raceways and Boxes
   a. Submit product data for surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
   b. Submit Shop Drawings including layout drawings showing components and wiring for nonstandard boxes, enclosures, and cabinets.

3. Wiring Devices
   a. Product Data: For each product type indicated.
   b. Submit operation and maintenance data for wiring devices, for inclusion in "Operating and Maintenance Manual" specified in this section.

4. Hangers and Supports
   a. Product Data: For the following:
      1. 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.

5. Conductors and Cables for Electronic Safety and Security
   a. Submit product data for each product and component specified.

6. Electrical Identification
   a. Submit product data for each product and component specified.

7. Mechanical Equipment and Controls
   a. Submit product data for each product and component specified.

8. Grounding and Bonding
   a. Submit product data for grounding rods, connectors and connection materials, and grounding fittings.

9. Interior Lighting
   a. Submit product data describing fixtures, lamps, LED drivers, and emergency lighting units. Arrange product data for fixtures in order of fixture designation. Include data on features and accessories.
   b. Submit outline drawings indicating dimensions and principal features of fixtures.
   c. Submit electrical ratings and photometric data including certified results of laboratory tests for fixtures and lamps.
   d. Submit battery and charger data for emergency lighting units.
   e. Submit Shop Drawings detailing nonstandard fixtures and indicating dimensions, weights, and methods of field assembly, components, features, and accessories.
   f. Submit wiring diagrams detailing wiring for control system showing both factory-installed and field-installed wiring for each specific system which differentiates between factory-installed and field-installed wiring.
   g. Submit air and thermal performance data for air-handling fixtures.
   h. Submit sound performance data for air-handling fixtures.
   i. Submit maintenance data for fixtures to include in the Operation and Maintenance Manual as specified in this Section.
   d. Close-out Submittals: Digital copies of following Manual shall be delivered to the Engineer at the time of system acceptance in a digital format approved by the Engineer in advance. Close out submittals shall include:

   1. Operating manuals covering installed Life Safety System.
   2. Point-to-point diagrams of the entire Life Safety System as installed. This shall include connected smoke detectors and addressable field modules. Drawings shall be provided in
digital format to match the job specific CADD software. System-generated point-to-point diagrams are required to ensure accuracy.

3. An application program listing for the system as installed at the time of acceptance.

4. Name, address, and telephone number of the authorized factory representative.

5. Drawings must reflect the device address and programmed characteristics as verified in presence of the Engineer and the Owner’s Authorized Representative.

6. “As-Built” riser and wiring diagrams reflecting T-taps and each programmed device characteristic including detector type, base type, address, sensitivity setting, and wire configurations shall be provided to the Engineer.

10. Record Documents. Refer to the “Project Record Documents” paragraph of this Section.

11. Operation and Maintenance Data. Refer to the “Operation and Maintenance Data” paragraph of this Section.

D. Resubmittals of rejected submittals shall be limited to one (1) in number. Costs for processing subsequent resubmittals in excess of the first resubmittal, resulting from the Contractor’s disregard of the Architect/Engineer’s primary submittal rejection comments, shall be borne by the Contractor. Costs shall be based on the Architect/Engineer’s hourly rates as published in their current professional fee schedules and shall also include reimbursable costs for delivery, mailing, and photocopies at direct cost plus ten percent (10%).

1.6 SUBSTITUTIONS

A. The Contract Documents list manufacturers' names and catalog numbers followed by the phrase "or equal" are to establish a standard of quality and utility for the specified items and to provide a dimensional reference to the scaled drawings.

B. Submittals for "equal" items shall include the following data, which is not necessarily required for specified items which list the manufacturer and catalog number:

1. Performance characteristics.
3. Finish.
5. Manufacturer’s specifications and other data needed to prove compliance with the specified requirements. The term "compliance" is understood to mean that the submitted equipment will meet or exceed the Contract Document requirements. Items that do not clearly meet this definition shall be identified and explained as required in the following Paragraph.
6. Identify the difference between specified equipment and proposed substituted equipment. Explain with enough detail so that the Engineer/Owner can easily determine that the item complies with the functional intent. List disadvantages or advantages of the proposed item.
versus the specified item. Submit technical data sheets and pictures and diagrams to support and clarify. Organize in a clear and concise format. The Engineer shall approve substitutions in writing. The Engineer’s decision shall be final.

C. Submittals of "equal" components or systems may be rejected if:

1. The material or equipment would necessitate alteration of the mechanical, electrical, architectural, or structural design.
2. Dimensions vary from specified material or equipment so that accessibility or clearances are impaired or Work of other trades is adversely affected.

D. Proposed substitutions for materials or equipment must be submitted ten (10) days prior to final bid date for consideration as approved equals. Otherwise, substitutions will not be permitted. Only prime bidders shall make proposals for substitutions.

E. No substitution shall be made unless authorized in writing by the Engineer. Should substitution be accepted and should substitute material prove defective or otherwise unsatisfactory for service intended, and within guarantee period, replace this material or equipment with material or equipment specified, to the satisfaction of the Engineer and at no cost to the Engineer/Owner.

1.7 ORDINANCES, PERMITS, METERS, UTILITIES AND ROYALTIES

A. Purchase all necessary permits and licenses necessary for completion of the Work. Pay all lawful fees required and necessary pursuant in obtaining said permits and licenses. Certificates of approvals and inspections by local governing and regulating authorities are required.

B. Pay royalty payments or fees required for the use of patented equipment or systems. Defend lawsuits or claims for infringement of the patent rights and hold the Engineer/Owner harmless from loss as result of said suits or claims.

1.8 COMPATIBILITY OF EQUIPMENT

A. Assume full responsibility for the satisfactory operation of component parts of the electrical systems. Assure compatibility of equipment and performance of the integrated systems in accordance with the requirements of the Construction Documents. Notify the Engineer before submitting a bid should the Specifications or Drawings make acceptance of responsibility impossible, prohibitive, or restrictive. The bid shall be accompanied by a written statement listing any objections or exceptions to the applicable specification section and drawing.

1.9 FLASHINGS, SLEEVES, AND INSERTS

A. Provide flashings where conduits pass through outside walls. Flashings shall be properly formed to fit around conduit and shall be caulked, with 790 Silicone Building Sealant by the Dow Corning Corporation, so as to make a watertight seal between conduit and building.
B. Unless otherwise specified, install sleeves for each conduit where it may pass through interior walls or floors. Galvanized 22 gage sheet iron sleeves shall be used. Finish flush with each finished wall surface. In pipe chases, the sleeve shall extend 1-1/2 inches above the floor slab and shall be watertight.

C. Raceways that pass through concrete beams or walls and masonry exterior walls shall be provided with galvanized wrought iron pipe sleeves, unless shown otherwise on drawings. Inside diameter of these sleeves shall be at least 1/2 inch greater than outside diameters of service pipes. After pipes are installed in these sleeves, fill annular space between the pipes and sleeves with 790 Silicone Building Sealant by the Dow Corning Corporation. Completed installation shall be watertight.

D. Roof penetrations shall be provided with counter flashings arranged to provide weatherproof installation.

E. Penetrations through walls, floors, and ceilings shall be done in manner to maintain integrity of fire rating of the respective wall, floor, or ceiling.

1.10 SURFACE CONDITIONS

A. Examine the areas and conditions under which the Work of this Division will be performed. Work required to correct conditions detrimental to timely and proper completion of Work shall be included as part of the Work of this Division. Do not proceed until unsatisfactory conditions are corrected.

1.11 CONSTRUCTION REQUIREMENTS

A. The drawings show arrangements of the Work. Rearrangement of the spaces and equipment will be considered when the Project conditions make this necessary and materials or equipment can be installed to better advantage. Prior to proceeding with the Work, coordinate with the various trades to prepare and submit five (5) copies of Drawings of the proposed arrangement for the Engineer’s review. Allow a minimum of ten (10) working days for review.

B. Installation or rearrangement of the equipment and space for the Contractor’s convenience or to accommodate the material or equipment substitutions will be considered. Assume responsibility for rearrangement of equipment and space and have the Engineer review change before proceeding with the Work. Request for changes shall be accompanied by Shop Drawings of the affected equipment and space. Identify proposed monetary credits or other benefits. Allow a minimum of ten (10) working days for review.

C. Properly locate and size all required pipe sleeves and slots, holes, or openings in structure.

1.12 PREPARATION AND COORDINATION

A. Coordinate the work in strict accordance with the Contract Documents as follows:
1. Where lighting fixtures and other electrical items are shown in conflict with locations of structural members and mechanical or other equipment, provide required supports and wiring to clear encroachment. Shop drawings shall be furnished by this section, indicating all changes to meet space requirements, code requirements, and as necessary to resolve all space conflicts.

2. Install power and control wiring for installation of equipment furnished under Division 23. Furnish disconnect switches and other equipment as required for the proper operation of equipment unless equipment is specified to be factory mounted.

B. Information on the Drawings and in these Specifications is reasonably accurate, but absolute accuracy is not guaranteed. The drawings are diagrammatic, and the exact locations, distances, levels, and other conditions shall be governed by actual construction.

C. Where receptacles are not specifically located on the Drawings, locate as determined in field by the Engineer. Where convenience receptacles are installed without the Engineer’s specific direction, relocate as directed by the Engineer at no additional cost to the Owner.

D. Field-verify measurements. No extra compensation will be allowed because of differences between the Work shown on Drawings and actual site measurements.

E. Branch circuit wiring and arrangement of home runs have been designed for maximum economy consistent with adequate sizing and other considerations. Increase size of wiring and wiring systems to accommodate more stringent requirements listed in these Specifications or on the Drawings. Install wiring with circuits arranged as shown on the Drawings, except as otherwise approved in advance by the Engineer.

F. Equipment Layout:

1. The physical location and arrangements of electrical equipment is shown on the Plans and is to be used by the Contractor as a guideline in construction. It is the responsibility of the Contractor to review the Plans with the proposed equipment and equipment of the other trades that are affected, and to ensure that all Code required clearances, wiring distances and maintenance accesses, including equipment heights, of all items are maintained.

2. Alternate arrangements to accomplish the above due to field conditions or changes in physical size of the equipment proposed for the project are to be submitted to the Architect for review before any work is begun or equipment ordered.

3. The alternate arrangement is to be presented in a 1/4 inch scaled drawing showing all equipment, including those of other contractors. Include shop drawing cut sheets and applicable information.

4. Indicate on the drawing by dimension all required Code clearances, wiring distances and maintenance access requirements. Where equipment heights are required to be coordinated with architectural or other items, indicate revised heights.
1.13 PROJECT RECORD DOCUMENTS

A. Provide Project record documents associated with Work in accordance with the provisions of these Specifications.

B. Throughout progress of the Work, maintain accurate record of all changes in Contract Documents (Drawings and Specifications). Changes shall include Addendums issued during bidding and location of the electrical service lines, receptacles, and outside utilities.

C. Delegate responsibility for maintenance of record documents to one person on the Contractor's staff.

D. Accuracy of Records

1. Thoroughly coordinate changes, making adequate and proper entries on each page of the Specifications and each sheet of the Drawings and other documents. Match symbology and format of base documents.

2. Accuracy of records shall be such that future searches for items shown in Contract Documents may rely reasonably on the information obtained from approved Project record documents.

E. Maintain a job set of record documents protected from deterioration and from loss and damage until completion of Work. Transfer all recorded data to the final Project record documents.

F. Making Entries on Drawings

1. Using erasable colored pencil (not ink or indelible pencil), clearly describe the changes by graphic line and note as required.

2. Date entries.

3. Call attention to the entry by "cloud" drawn around area or areas affected.

4. In event of overlapping changes, use different colors for overlapping changes.

5. Make entries within twenty-four (24) hours after receipt of information that changes have occurred.

6. Maintain base drawing format and use same symbology.

7. Convert field mark-ups to finished CADD record drawings when required in this Section.

8. Convert Schematic Layouts to represent the final installed conditions.

G. Final Project Record Documents

1. 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.

2. Provide CADD electronic files using AutoCAD or Revit software to match the project specific release. Upon written request, completion of the release form, and payment of the Engineer's standard fee of $250 for set-up charge and $25 per drawing for copies of such files, the Engineer will provide AutoCAD
electronic files of the base Contract Drawings. When applicable, the Engineer will also provide a list of the drawing layers and names that shall be maintained.

3. Provide a complete set of record drawings on electronic storage media approved by the Engineer.

1.14 OPERATION AND MAINTENANCE DATA

A. Submit digital files of the preliminary draft of the proposed manual or manuals to the Engineer for review and comments. Allow a minimum of ten (10) working days for review.

B. Submit approved manual to the Engineer prior to the indoctrination of the operation and maintenance personnel.

C. Where instruction manuals are required for submittal, they shall be prepared in accordance with the following:

Format Size: 8-1/2-inch by 11-inch

Text: Neatly written or printed

Drawings: Match the project dimensions.

Flysheets: Separate each section of the Manual briefly describing the contents of ensuing section; flysheets shall be in color.

Measurements: Provide measurements in U.S. standard units (e.g., feet, inches, and pounds). Where items may be expected to be measured within ten (10) years in accordance with the metric formulae, provide additional measurements in "International System of Units" (SI).

Provide identification for each manual, using a format approved by the Engineer, with at least the following information:

OPERATING AND MAINTENANCE INSTRUCTIONS
Name and Address of Work
Name of the Contractor
General subject of this manual
Space for approval signature of the Engineer and approval date(s)

D. Contents: Include at least the following:

1. Neatly typewritten index near the front of the Manual, giving immediate information as to the location within the manual of the emergency information regarding installation.

2. Complete instructions regarding the operation and maintenance of the equipment involved including lubrication, disassembly, and reassembly.

3. Complete nomenclature of the parts of equipment.
4. Complete nomenclature and part number of the replaceable parts, name and address of nearest vendor and other data pertinent to the procurement procedures.

5. Copy of guarantees and warranties issued.

6. Manufacturer's bulletins, cuts, and descriptive data, where pertinent, clearly indicating precise items included in this installation and deleting, or otherwise clearly indicating, manufacturers' data with which this installation is not concerned.

7. Other data as required in pertinent Sections of these Specifications.

1.15 EQUIPMENT FOUNDATIONS

A. Provide equipment foundations in accordance with the provisions of these Specifications.

1.16 TESTING AND INSPECTION

A. Provide personnel and equipment, make required tests, and secure required approvals from the Engineer and Governmental Agencies having jurisdiction.

B. Make written notice to the Engineer adequately in advance of each of the following stages of construction:

1. When rough-in is complete, but not covered.
2. At completion of the Work of this Division.

C. When material or workmanship is found to not comply with specified requirements, remove items from the job site and replace them with items complying with the specified requirements at no additional cost to the Owner. This shall be performed within three (3) days after receipt of the written notice of noncompliance.

D. In the Engineer's presence, test parts of electrical system and prove that items provided under this Division function electrically in required manner.

1.17 WARRANTY

A. Warrant equipment and workmanship for a period of one (1) year after the date of substantial completion and replace or repair faulty equipment or installation at no cost to the Owner for service during this period, in accordance with the requirements of Division

B. Warranty shall not void specific warranties issued by the manufacturers for greater periods of time or void rights guaranteed to the Owner by law.

C. Warranties shall be in writing in form satisfactory to the Owner, and shall be delivered to the Owner before final payment is made.

1.18 PROJECT COMPLETION
A. Upon completion of the Work of this Division, thoroughly clean exposed portions of the electrical installation, removing traces of soil, labels, grease, oil, and other foreign material, and using only type cleaner recommended by the manufacturer of item being cleaned.

B. Thoroughly indoctrinate the Owner's operation and maintenance personnel in the contents of the operations and maintenance manual required to be submitted as part of this Division of these Specifications.

END OF SECTION
SELECTIVE DEMOLITION FOR ELECTRICAL
Section: 26 05 05

SECTION 26 05 05
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Electrical demolition.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT
   A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that abandoned wiring and equipment serve only abandoned facilities.
   B. Demolition drawings are based on casual field observation and existing record documents.
   C. Report discrepancies to Architect before disturbing existing installation.
   D. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION
   A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
   B. Coordinate electrical outages with owner.
   C. Provide temporary wiring and connections to maintain existing systems in service during construction.
      When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
   D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
      1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
      2. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK
   A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
      1. PCB- and DEHP-containing lighting ballasts.
      2. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.
   B. Remove, relocate, and extend existing installations to accommodate new construction.
   C. Remove abandoned wiring to source of supply.
   D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
   E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
   F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
   G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
   H. Repair adjacent construction and finishes damaged during demolition and extension work.
   I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION 26 05 05
SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Single conductor building wire.
B. Metal-clad cable.
C. Wiring connectors.
D. Electrical tape.
E. Heat shrink tubing.
F. Oxide inhibiting compound.
G. Wire pulling lubricant.
H. Cable ties.

1.02 REFERENCE STANDARDS
F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
G. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); 2012.
I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
M. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
O. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
P. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS
   A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
   B. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.

1.05 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.
   B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
   C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
   D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

PART 2 PRODUCTS
2.01 CONDUCTOR AND CABLE APPLICATIONS
   A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
   B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
   C. Metal-clad cable is permitted only as follows:
      1. Where not otherwise restricted, may be used:
         a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
            1) Maximum Length: 6 feet.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS
   A. Provide products that comply with requirements of NFPA 70.
   B. Provide products listed, classified, and labeled as suitable for the purpose intended.
   C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
   D. Comply with NEMA WC 70.
   E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
   F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
   G. Conductor Material:
      1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
      2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
      3. Tinned Copper Conductors: Comply with ASTM B33.
   H. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
3. Color Code:
   a. 480Y/277 V, 3 Phase, 4 Wire System:
      1) Phase A: Brown.
      2) Phase B: Orange.
      3) Phase C: Yellow.
      4) Neutral/Grounded: Gray.
   b. 208Y/120 V, 3 Phase, 4 Wire System:
      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.
      4) Neutral/Grounded: White.
   c. Equipment Ground, All Systems: Green.

2.03 SINGLE CONDUCTOR BUILDING WIRE
A. Description: Single conductor insulated wire.
B. Conductor Stranding:
   1. Feeders and Branch Circuits:
      b. Size 8 AWG and Larger: Stranded.
C. Insulation Voltage Rating: 600 V.
D. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
      a. Size 4 AWG and Larger: Type XHHW-2.

2.04 METAL-CLAD CABLE
A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
B. Conductor Stranding:
   2. Size 8 AWG and Larger: Stranded.
C. Insulation Voltage Rating: 600 V.
D. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
E. Grounding: Full-size integral equipment grounding conductor.
F. Armor: Steel, interlocked tape.

2.05 WIRING CONNECTORS
A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
B. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Size 8 AWG and Smaller: Use mechanical connectors or compression connectors.
C. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.

4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.

D. Mechanical Connectors: Provide bolted type or set-screw type.

E. Compression Connectors: Provide circumferential type or hex type crimp configuration.

2.06 WIRING ACCESSORIES

A. Electrical Tape:
   1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
   2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

E. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   5. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install metal-clad cable (Type MC) in accordance with NECA 120.
E. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

G. Terminate cables using suitable fittings.
   1. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

H. Install conductors with a minimum of 12 inches of slack at each outlet.

I. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

J. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

K. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
   5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

L. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

M. Insulate ends of spare conductors using vinyl insulating electrical tape.

N. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

O. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

END OF SECTION 26 05 19
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SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Grounding and bonding requirements.
B. Conductors for grounding and bonding.
C. Connectors for grounding and bonding.

1.02  REFERENCE STANDARDS
A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
C. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.03  SUBMITTALS
A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

1.04  QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.

PART 2  PRODUCTS

2.01  GROUNDING AND BONDING REQUIREMENTS
A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
D. Service-Supplied System Grounding:
   1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
   2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
E. Separately Derived System Grounding:
   1. Separately derived systems include, but are not limited to:
      a. Transformers (except autotransformers such as buck-boost transformers).
   2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
   3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
   4. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
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5. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

F. Bonding and Equipment Grounding:
   1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
   2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
   3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
   4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
   5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
   6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
   7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
      a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:
   1. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
         1) Use bare copper conductors where installed underground in direct contact with earth.
         2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections or compression connectors for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors or compression connectors for accessible connections.

PART 3 EXECUTION
3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D. Identify grounding and bonding system components in accordance with Section 26 05 53.

END OF SECTION 26 05 26
SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1  GENERAL

1.01  REFERENCE STANDARDS

D. MFMA-4 - Metal Framing Standards Publication; 2004.
E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.02  SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems and post-installed concrete and masonry anchors.

1.03  QUALITY ASSURANCE

A. Comply with NFPA 70.
B. Comply with applicable building code.

PART 2  PRODUCTS

2.01  SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 1.4. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   2. Channel Material:
a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
H. Secure fasteners according to manufacturer's recommended torque settings.
I. Remove temporary supports.

END OF SECTION 26 05 29
1.01 SECTION INCLUDES
   A. Galvanized steel rigid metal conduit (RMC).
   B. Intermediate metal conduit (IMC).
   C. Flexible metal conduit (FMC).
   D. Liquidtight flexible metal conduit (LFMC).
   E. Conduit fittings.

1.02 REFERENCE STANDARDS
   A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2015.
   B. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.
   C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
   D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
   E. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
   F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
   G. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
   H. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
   I. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
   J. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
   K. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
      2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
      3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
      4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
   B. Sequencing:
      1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.04 SUBMITTALS
   A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

1.05 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS
2.01 CONDUIT APPLICATIONS
   A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

D. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

E. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

F. Exposed, Exterior: Use galvanized steel rigid metal conduit.

G. Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit.
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
   3. Maximum Length: 6 feet unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.

2.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4 inch (21 mm) trade size.

E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

B. Fittings:
   1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:
   1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.
2.05 FLEXIBLE METAL CONDUIT (FMC)
   A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
   B. Fittings:
      1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
      2. Material: Use steel or malleable iron.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)
   A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
   B. Fittings:
      1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
      2. Material: Use steel or malleable iron.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that field measurements are as indicated.
   B. Verify that mounting surfaces are ready to receive conduits.
   C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
   A. Install products in accordance with manufacturer's instructions.
   B. Perform work in accordance with NECA 1 (general workmanship).
   C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
   D. Install intermediate metal conduit (IMC) in accordance with NECA 101.
   E. Conduit Routing:
      1. Unless dimensioned, conduit routing indicated is diagrammatic.
      2. When conduit destination is indicated without specific routing, determine exact routing required.
      3. Conceal all conduits unless specifically indicated to be exposed.
      4. Conduits in the following areas may be exposed, unless otherwise indicated:
         a. Electrical rooms.
   F. Conduit Support:
      1. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
      2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
      3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
      4. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
      5. Use conduit clamp to support single conduit from beam clamp or threaded rod.
      6. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
      7. Use of wire for support of conduits is not permitted.
   G. Connections and Terminations:
      1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

H. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

I. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.

J. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

K. Provide grounding and bonding in accordance with Section 26 05 26.

3.03 CLEANING
A. Clean interior of conduits to remove moisture and foreign matter.

3.04 PROTECTION
A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 26 05 33.13
SECTION 26 05 33.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1  GENERAL

1.01  SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

1.02  REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.
E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
I. UL 508A - Industrial Control Panels; 2013.
J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.03  SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for outlet and device boxes, junction and pull boxes, and cabinets and enclosures.
B. Project Record Documents: Record actual locations for outlet and device boxes, junction boxes, pull boxes, and cabinets and enclosures.

1.04  QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2  PRODUCTS

2.01  BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use suitable masonry type boxes where flush-mounted in masonry walls.
4. Use raised covers suitable for the type of wall construction and device configuration where required.
5. Use shallow boxes where required by the type of wall construction.
6. Do not use "through-wall" boxes designed for access from both sides of wall.
7. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
8. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
9. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
   a. Indoor Clean, Dry Locations: Type 1, painted steel.
   b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
   a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
D. Box Locations:
   1. Locate boxes to be accessible.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26.
   4. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   5. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
E. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
F. Install boxes plumb and level.
G. Flush-Mounted Boxes:
   1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
   2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

H. Install boxes as required to preserve insulation integrity.

I. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

J. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

K. Close unused box openings.

L. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

M. Provide grounding and bonding in accordance with Section 26 05 26.

3.02 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.
SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Electrical identification requirements.
B. Identification nameplates and labels.
C. Wire and cable markers.
D. Voltage markers.
E. Warning signs and labels.

1.02 REFERENCE STANDARDS
C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS
A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

1.04 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS
A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Panelboards:
         1) Identify power source and circuit number. Include location.
         2) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
         3) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
         4) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
      b. Transformers:
         1) Identify kVA rating.
         2) Identify voltage and phase for primary and secondary.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Identify load(s) served. Include location when not within sight of equipment.
   B. Identification for Conductors and Cables:
      1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
      2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
   C. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.

D. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color coded boxes to identify systems other than normal power system.
   a. For exposed boxes in public areas, do not color code.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Materials:
   a. Indoor Clean, Dry Locations: Use plastic nameplates.
   b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
   a. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. Equipment Designation: 1/2 inch.
5. Color:

D. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
5. Color: Black text on clear background.

2.03 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch.

F. Color: Black text on white background unless otherwise indicated.
2.04 VOLTAGE MARKERS
   A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.
   B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
   C. Minimum Size:
      1. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
      2. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
   D. Legend:
      1. Markers for Voltage Identification: Highest voltage present.
      2. Markers for System Identification:
   E. Color: Black text on orange background unless otherwise indicated.

2.05 WARNING SIGNS AND LABELS
   A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
   B. Warning Signs:
      1. Materials:
      2. Minimum Size: 7 by 10 inches unless otherwise indicated.
   C. Warning Labels:
      1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
      3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION
3.01 PREPARATION
   A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION
   A. Install products in accordance with manufacturer's instructions.
   B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
      3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
      4. Elevated Equipment: Legible from the floor or working platform.
      5. Branch Devices: Adjacent to device.
      6. Interior Components: Legible from the point of access.
      7. Conduits: Legible from the floor.
      8. Boxes: Outside face of cover.
      9. Conductors and Cables: Legible from the point of access.
   C. Install identification products centered, level, and parallel with lines of item being identified.
   D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
   E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
F. Mark all handwritten text, where permitted, to be neat and legible.

END OF SECTION 26 05 53
SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

PART 1  GENERAL

1.01  SECTION INCLUDES
A. General purpose transformers.

1.02  REFERENCE STANDARDS
B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers; 2015.
D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2015.
F. NEMA ST 20 - Dry-Type Transformers for General Applications; 2014.
G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
J. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.

1.03  SUBMITTALS
A. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.

1.04  QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.

1.05  DELIVERY, STORAGE, AND HANDLING
A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 2  PRODUCTS

2.01  MANUFACTURERS
C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

2.02  TRANSFORMERS - GENERAL REQUIREMENTS
A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.
B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
   1. Altitude: Less than 3,300 feet.
   2. Ambient Temperature:
      a. Greater than 10 kVA: Not exceeding 104 degrees F.
b. Less than 10 kVA: Not exceeding 77 degrees F.

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.03 GENERAL PURPOSE TRANSFORMERS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.

B. Primary Voltage: 480 volts delta, 3 phase.

C. Secondary Voltage: 208Y/120 volts, 3 phase.

D. Insulation System and Allowable Average Winding Temperature Rise:
   1. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.

E. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.

F. Winding Taps:
   1. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.

G. Energy Efficiency: Comply with 10 CFR 431, Subpart K.

H. Sound Levels: Standard sound levels complying with NEMA ST 20.

I. Mounting Provisions:
   1. 15 kVA through 75 kVA: Suitable for floor or trapeze mounting.

J. Transformer Enclosure: Comply with NEMA ST 20.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor clean, dry locations: Type 2.
   2. Construction: Steel.
      a. 15 kVA and Larger: Ventilated.
   3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
   4. Provide lifting eyes or brackets.

K. Accessories:
   1. Mounting Brackets: Provide manufacturer's standard brackets.

2.04 SOURCE QUALITY CONTROL

A. Factory test transformers according to NEMA ST 20.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.
C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.
D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
A. Perform work in accordance with NECA 1 (general workmanship).
B. Install products in accordance with manufacturer's instructions.
C. Install transformers in accordance with NECA 409 and IEEE C57.94.
D. Use flexible conduit, under the provisions of Section 26 05 33.13, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.
F. Provide grounding and bonding in accordance with Section 26 05 26.
G. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.
H. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.

3.03 ADJUSTING
A. Measure primary and secondary voltages and make appropriate tap adjustments.
B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.04 CLEANING
A. Clean dirt and debris from transformer components according to manufacturer's instructions.
B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 22 00
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Power distribution panelboards.
   B. Overcurrent protective devices for panelboards.

1.02 REFERENCE STANDARDS
   A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e (Amended 2017).
   B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
   D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
   E. NEMA PB 1 - Panelboards; 2011.
   F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.
   H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
   I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
   K. UL 67 - Panelboards; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
      2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
      3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

1.04 SUBMITTALS
   A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
   D. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
1.05 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
   B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
   C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.07 FIELD CONDITIONS
   A. Maintain ambient temperature within the following limits during and after installation of panelboards:
      1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 PRODUCTS
2.01 MANUFACTURERS
   C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
   D. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS
   A. Provide products listed, classified, and labeled as suitable for the purpose intended.
   B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
      1. Altitude: Less than 6,600 feet.
      2. Ambient Temperature:
         a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
   C. Short Circuit Current Rating:
      1. Provide panelboards with listed short circuit current rating as indicated on the drawings.
   D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
   E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
   F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
   G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
      1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
      2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
   H. Conductor Terminations: Suitable for use with the conductors to be installed.
   I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
      1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
         a. Indoor Clean, Dry Locations: Type 1.
         b. Outdoor Locations: Type 3R.
      2. Boxes: Galvanized steel unless otherwise indicated.
         a. Provide wiring gutters sized to accommodate the conductors to be installed.
3. Fronts:
   a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.

J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

2.03 POWER DISTRIBUTION PANELBOARDS
A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase and Neutral Bus Material: Copper.
   2. Ground Bus Material: Copper.

D. Circuit Breakers:
   1. Provide bolt-on type.
   2. Provide thermal magnetic circuit breakers unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted enclosures unless otherwise indicated.

2.04 OVERCURRENT PROTECTIVE DEVICES
A. Molded Case Circuit Breakers:
   1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
   2. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
         1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
         2) 14,000 rms symmetrical amperes at 480 VAC.
   3. Conductor Terminations:
      a. Lug Material: Copper, suitable for terminating copper conductors only.
   4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

2.05 SOURCE QUALITY CONTROL
A. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field measurements are as indicated.
B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
C. Verify that mounting surfaces are ready to receive panelboards.
D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
A. Perform work in accordance with NECA 1 (general workmanship).
PANELBOARDS
Section: 26 24 16

B. Install products in accordance with manufacturer's instructions.
C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
E. Provide required supports in accordance with Section 26 05 29.
F. Install panelboards plumb.
G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
H. Provide grounding and bonding in accordance with Section 26 05 26.
I. Install all field-installed branch devices, components, and accessories.
J. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
K. Provide filler plates to cover unused spaces in panelboards.

3.03 FIELD QUALITY CONTROL
A. Inspect and test in accordance with NETA ATS, except Section 4.
B. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING
A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
B. Adjust alignment of panelboard fronts.

3.05 CLEANING
A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 24 16
SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Wall switches.
B. Receptacles.
C. Wall plates.
D. Floor box service fittings.
E. Poke-through assemblies.
F. Access floor boxes.

1.02 REFERENCE STANDARDS
A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2017h.
B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); 2017g.
C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2015).
F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2016.
G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
   4. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
   5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS
A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.05 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
D. Products: Listed, classified, and labeled as suitable for the purpose intended.
1.06 DELIVERY, STORAGE, AND PROTECTION
   A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS
2.01 WIRING DEVICE APPLICATIONS
   A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
   B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
   C. Provide GFCI protection for receptacles installed within 6 feet of sinks.
   D. Provide GFCI protection for receptacles installed in kitchens.
   E. Provide GFCI protection for receptacles serving electric drinking fountains.
   F. Unless noted otherwise, do not use combination switch/receptacle devices.

2.02 WIRING DEVICE FINISHES
   A. Provide wiring device finishes as described below unless otherwise indicated.
   B. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.

2.03 WALL SWITCHES
   A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
      1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

2.04 RECEPTACLES
   A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
      1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
      2. NEMA configurations specified are according to NEMA WD 6.
   B. Convenience Receptacles:
      1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   C. GFCI Receptacles:
      1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
         a. Provide test and reset buttons of same color as device.

2.05 WALL PLATES
   A. Wall Plates: Comply with UL 514D.
      1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
      3. Screws: Metal with slotted heads finished to match wall plate finish.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify that field measurements are as indicated.
B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION
A. Provide extension rings to bring outlet boxes flush with finished surface.
B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION
A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 48 inches above finished floor.
      b. Wall Dimmers: 48 inches above finished floor.
      c. Receptacles: 18 inches above finished floor or 6 inches above counter.
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   3. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
   4. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
C. Install wiring devices in accordance with manufacturer's instructions.
D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
H. Install wiring devices plumb and level with mounting yoke held rigidly in place.
I. Install wall switches with OFF position down.
J. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
K. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
L. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
M. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.
3.04 FIELD QUALITY CONTROL
   A. Inspect each wiring device for damage and defects.
   B. Operate each wall switch and wall dimmer with circuit energized to verify proper operation.
   C. Test each receptacle to verify operation and proper polarity.
   D. Test each GFCI receptacle for proper tripping operation according to manufacturer’s instructions.
   E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING
   A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING
   A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26 27 26
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. Lighting equipment and associated gear.
2. Lighting controls and associated gear.
3. Lighting system controls integration.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces, including recessed components, at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.4 SUBMITTALS

A. Provide full catalog number with all accessories, remote drivers/transformers and any associated gear. Provide manufacturer’s standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility.

B. In some case a working sample must be provided along with items above. See notes in descriptions below to determine if a larger or in-situ mock-up will be required.
C. To be considered an approved equal, alternate fixtures must be submitted to ELDS, for consideration no later than three weeks (15 working days) prior to requirement of approval/rejection status and/or bid date, whichever comes first, unless specifically noted otherwise in the specific fixture type description below.

D. Alternate fixtures submitted for approval must include full catalog number of proposed item along with fixture cut sheet and photometric report with luminance summaries. Please see individual fixture types below for additional items, submissions, or time frames that may be required. Some fixture types require samples if alternates are being submitted. For alternate control items or other non-lighted items, include manufacturer's full specification for such item, one-line diagrams, and cutsheets with full catalog numbers for all gear proposed.

E. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.

F. Provide all manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Provide project record documents. Record actual connections and locations of luminaires and any associated remote components.

1.5 SHOP DRAWINGS

A. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer. Indicate all details about LED chips or arrays including delivered lumen output, color properties (for static white luminaires include color temperature with +/- variation range as well as CRI and TM-30 data, include dimming protocol; for color-changing luminaires include nm values for each color provided as well as output and control protocol.)

B. Provide all manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C. Include estimated useful life, calculated based on IES LM-80 test data. Include IES LM-79 test report upon request.

D. Provide operation and maintenance data. Include instructions for each product including information on replacement parts.

E. Provide field quality control reports for all custom luminaires. Schedule of reports to be supplied by lighting designer. Confirm with design team once shop drawings are returned.
1.6 GENERAL NOTES

A. Lighting drawings and their scheduled data are intended as design drawings indicating fixture types and exact locations, and are not to be interpreted as engineering drawings. Refer to electrical drawings for coordination and all other electrical requirements.

B. Electrical code compliance and local governing regulations are the responsibility of the electrical engineer/installation contractor as are any required inspections.

1. Reference the following standards:
   d. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
   e. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.
   g. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2016.
   h. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
   k. UL 1598 - Luminaires; Current Edition, Including All Revisions.

C. This specification section specifically references the lighting drawings as submitted by ELDS. ELDS is not responsible for any unapproved lighting equipment, or improperly installed lighting equipment that results in non-compliance with the Energy Code, Electrical code, or any other code.

D. No substitution of material or equipment noted on the drawings and in this equipment schedule will be made without specific approval by the ELDS. All items must be approved by ELDS prior to being considered for bid pricing, purchase or installation.

E. All items in the following specifications (light fixtures & control/dimming equipment) shall be included in submittal review. NOTE: A specified item not included in the submittal package shall not be considered omitted from the project. An additional
fixture/item not included in the specification but submitted in the submittal package shall not be considered as an approved item unless specifically stamped as such. Alternates must be submitted to ELDS for approval per requirements given for each fixture type, and must be submitted within the time frame listed, along with any samples required.

F. Above-ceiling and in-wall/on-wall clearances required for specified fixtures has been coordinated with other disciplines as best as possible at time of construction document submission. For any conflicts that do arise in the field, notify General Contractor, Architect and/or Lighting Designer prior to installation. Any modifications of location or installation method must be approved.

G. All equipment listed is to be installed in accordance with the manufacturer’s printed instructions and in compliance with local and national electrical codes.

H. All linear lighting lengths must be field verified prior to order to achieve continuous coverage as shown on lighting drawings.

I. Recessed fixture housing “throat”, which projects through ceiling, must be flush with bottom of cutout at the ceiling line unless otherwise specifically noted. Recessed light fixture housings must be properly secured to structure so that when modules and/or trims are installed the fixture housing does not move upwards. Fixture must not merely rest on top of ceiling but must be affixed per code requirements. Any recessed housing with bottom of throat/housing not flush with ceiling will be required to be adjusted as such.

J. Light fixtures that are a part of this project may NOT be used as construction work lights. Contractor temporary lighting must be used for construction needs.

K. Recessed light fixture reflector trims must not be installed when ceiling is wet from plaster or paint (only install in dry ceilings to prevent trims from adhering to ceiling). Any damage to the trims or ceiling finish will be the responsibility of the Electrical Contractor. No silicone or other adhesive product foreign to the fixture shall be used to permanently affix the trims to the housing and/or ceiling. Any damage to ceiling caused by such product (either during or subsequent to installation) shall be the responsibility of the Electrical Contractor.

L. Coordinate final aiming and programming levels with ELDS during period of punch-list. A minimum of 3-weeks’ notice is required to schedule this procedure. Contractor shall provide ladders, lifts, scaffolds, or equipment as necessary, and coordinate presence of electricians or other trades as required. A minimum of two electricians very familiar with this project (preferably the installing contractors and foreman) will be required to be on site throughout the final aiming and tuning process. Check with ELDS for an estimated duration of this process. (Budget three nights at 8 hours each for the unphased project.) Project phasing may alter this time requirement.

M. The lighting equipment for this project has been specified in the month and year listed on this specification book as well as the associated drawings. Due to the rapid development in lighting technology, if the lighting for this project is not ordered within 12 months of this date, ELDS will require a technology current review (TCR.) A TCR ensures that the products previously specified are not obsolete, and advises if newer
generations of the product are now available and advisable. This process prevents outdated materials from being included on the job. If a TCR is not requested within 3 months of fixture order, and a fixture is not available, obsolete, or otherwise outdated, it will become the responsibility of the contractor to troubleshoot any issues associated with the fixture due to these reasons.

N. All fixtures indicated to be on the dimming system, must dim. Contractor to supply any emergency egress lighting power transfer relays necessary to integrate dimmed circuits into dimming system and allow dimming of fixtures during normal power condition. Consult MEP for more information. Provide UL924 emergency power transfer relays as required.

O. Contractor is to follow all manufacturers’ installation instructions. For any questions regarding fixture installation, contact manufacturer for directions. ELDS is not responsible for any damages associated with incorrectly installed product or accessories.

P. ELDS requests an invitation to the contractor bid meeting, construction kick-off meeting or any other meeting where installation particulars can be discussed early in the process. Failure to discuss such details early may result in incorrect installation. Contractor is responsible for any incorrect installation or for contractor not following all of manufacturer’s installation instructions. If written instructions are not found within the luminaire packing materials, contractor is to source instructions online, and/or request written instructions for every fixture/system type.

Q. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

R. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.

S. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

T. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer’s written instructions.

U. Keep products in original manufacturer’s packaging and protect from damage until ready for installation.

1.7 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.8 WARRANTY

A. Provide five-year manufacturer warranty for all LED luminaires, including drivers. The warranty shall include all luminaire components including but not limited to, LED arrays, LED drivers, luminaire body and hardware. LED arrays will be considered defective if a total of 8% or more of the individual light emitting diodes fail to illuminate.

B. Provide five-year warranty for batteries or inverters for emergency lighting units.

C. Provide ten-year warranty for batteries for self-powered exit signs.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Unless otherwise indicated provide complete luminaires including LED lamps, drivers, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute light.

B. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

C. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

2.2 LIGHTING EQUIPMENT SCHEDULE

A. Type A:

1. Luminaire: Luminaire is a system including a housing, internal tension system supplying mounting points for accessible tunable white (2700K – 6500K) LED light bars, LED ~24” light bars with ~2-1/2” pitch (10 LED pairs per board) with boards spaced ~3” on center, a stretched PVC fabric diffuser and remote drivers and Dynamix-style tunable white controllers. LED diodes are programmable per fixture to change color temperature over time. System includes channel addressing service. Protocol is DMX 512. Electrical service requires line voltage power to remote driver, data connection to remote driver, low voltage connection between drivers and LED tension supports (1 per 320W) and data connection from driver to LED tension supports. Remote location for gear is in accessible ceiling adjacent to luminaires. Maximum distance from luminaire to remoted power/control gear is 20’ using typical gauge wiring.
2. System is to provide seamless large-scale light fixtures with no individual diode imaging. Dimensions are 2’ wide x length shown on drawings with removeable top panels, accessible through adjacent ceiling tiles to access LED boards, drivers, and Dynamix-style controllers.

3. Daylight sensor with color temp/SPD readings to be provided with system to trigger color temp/spectral output and lumen output of these luminaires.

4. Minimum 5-year warranty to cover any material defects of luminaire housing, LED light engine and LED driver.

5. UL Listed (or equivalent) for damp locations, RoHS compliant.

6. To be considered equal: Submit one sample 2’ wide x 3’ long fixture consisting of housing with top removable access panel, LEDs, stretched PVC fabric diffuser, with associated drivers, power supplies and controllers either inside upper housing of fixture or in remote box, all on cord and plug. Sample must have pre-programmed shows of scrolling from 2700K to 6500K over 5 seconds, and five solid temperatures of white (2700K, 3000K, 4000K, 5000K & 6500K.) Sample must be provided with daylight sensor as specified above providing color temperature input and intensity input to controller and LEDs. One-line diagram of how this fixture receives input from photocell as well as DMX overrides, and all power/data inputs/output must be provided. Product approval or disapproval will be determined and reported within 14 working days of receipt of all required information and samples.

7. Color Temperature/Color Performance: 2700K – 6500K)

8. Fixture Watts: 3W/board, 7W/sq ft (premium), 60mm pitch btwn diodes on the LED boards

9. Field-cuttable LED Boards mounted in simple PCB holder for quick release, replacement and re-attachment

10. Output: 720 lumens/sq ft

11. Fixture Efficacy: 79-90 lumens/watt

12. Fixture Volts: 120 to 277

13. Dimming: DMX

14. Life: 80,000 hours to LM80

15. JA-8 Compliant

16. Housing to have extruded profile with double channel to hold diffuser and reflector with anchoring points for LED system

17. Diffuser to be stretched PVC to match Type C.
18. Acceptable Manufacturer: Tensioned Lighting Systems TLS-DYNAMIX-qty TBD-external dimension of 2’ x 16’ (or 2’ x 8’)-27-65-RE-W-SF-PR-I-with compatible drivers and Dynamix controllers (TMDC-XXX) mounted within housing to deliver power and data to system with no perceptible flicker. Consult JA-8 standard for flicker compliance. Contractor to supply all wiring and cabling (with appropriate pin-connectors.) Alternate Manufacturers must meet all construction and performance specifications as listed, see above for submittal criteria.

B. Type B:

1. Luminaire: 4” high, 2-1/4” width, 54” or 60” length (confirm based on size of ceiling tiles), produces 1100 lumens/foot or greater, 11 watts per foot or less, at 4000K color temperature (+/- 50K) with CRI greater than 90. Beamspread distribution to be ~35° and meet the performance criteria below. Recess mounted with louver flush with ceiling plane. All components must be serviceable from below. Driver and LED board must be replaceable. The following conditions shall be met: the fixture shall have a thermal management system to ensure 100% lumen output and consistent color temperature. White finish to be confirmed. Dimmable via 0-10V. Minimum 5-year warranty to cover any material defects of luminaire housing, LED light engine and LED driver. UL Listed (or equivalent) for damp locations, RoHS compliant.

2. To be considered equal reports must separately show the following components: IES LM-79 formatted file must be submitted and shown to have the equal or better efficacy and light output, all LEDs must have been tested in accordance with TM-21 and LM-80 reports, and show a lumen maintenance of 90% at 60,000 hours at 25°C, per reported L70 at a minimum of 50,000 hours. Color Temperature variance must be less than +/- 50K. To be considered an approved product, the following must be submitted to ELDS no less than 21 days before bids are due to General Contractor: full product catalog number with cut sheet (.pdf format), indication of LED chips/modules used and thermal management techniques used. Provide point by point calculation report using AGI32 as follows: Test room to be 90’ long, 18’ wide and 25’ tall. Reflectances 80/50/20. (5) Type B light fixtures to be centered in the width (9’ on either side to the wall.) Fixtures to run parallel to the long axis of the room. First fixture to be placed 15’ from end wall and then 15’ on center (leaving 15’ from opposite end wall.) Calculation points to be 2’ on center left to right (across 90’ length) and 1’ on center top to bottom (across 18’ width.) Calculation grid to measure vertical footcandles to be placed on one wall with 2’ spacing left to right and 1’ spacing top to bottom. All calculation points shall be set to measure to the one tenth of a footcandle. All luminaires shall use a light loss factor of 0.9. There shall be no manipulation of the lumen output other than this 0.9 light loss factor. Luminaire optics to be pointed straight down, A statistical area of 50’ wide centered on the long axis and 17’ wide centered on the short axis on the ground plane to show a performance of 10 (minimum) and 12 (maximum) average footcandles on the ground plane with a maximum of 14 footcandles and a minimum of 9 footcandles in this area. The uniformity for this area shall be no greater than 1.3:1 max:min. Importantly, the footcandle readings on the wall from 14’ a.f.f. to the ceiling shall in no case be greater than 2.0 vertical footcandles on the wall plane. Uniformity across the 14’ a.f.f. elevation line shall be no greater than 1.3:1 max:min in the
50' wide test area. Submit the point by point reports as noted above as well as the AGI32 file.

3. To be considered equal, also submit one sample 3' minimum fixture on cord and plug for review of glare and flicker properties. Product approval or disapproval will be determined and reported within 10 working days of receipt of all required information and samples.

4. Color Temperature/Color Performance: 4000K (+/-50K), CRI 90+

5. Fixture Watts: 11 watts/foot or less

6. Lumen Output: 1100 lumens/foot or greater

7. Fixture Efficacy: 100 lumens per watt or better

8. Fixture Volts: 120 to 277

9. Dimming: 0-10V

10. Acceptable Manufacturer: Selux PXL1-IB45-4000K-35deg-CL-PB-Grid Ceiling mount; contractor to confirm exact grid type of existing ceiling and coordinate fixture length and flanges with factory 4'-6" or 5' (TBD) length. MEP to confirm any Emergency circuiting requirements. Associated photocell to dim this circuit as required based on daylight availability.

11. Alternate Manufacturers must meet all construction and performance specifications as listed, see above for submittal criteria.

C. Type C:

1. Luminaire: Luminaire is a system including a housing, internal tension system supplying mounting points for accessible LED light bars, LED ~24” light bars, 40mm pitch, a stretched PVC fabric diffuser and remote drivers and pixel controllers. LED diodes are programmable per board for the general ribbon and jetway components, and one address per every two LEDs for the junction of the ribbon and jetway components to ensure smooth transition of light from one component to the other. System includes channel addressing service with remote addressing capabilities such that content programming can be done with Pharos/Mosaic or similar software and programmed shows can be stored. Protocol is DMX 512. Electrical service requires line voltage power to remote driver, data connection to remote driver, low voltage connection between drivers and LED tension supports (1 per 320W) and data connection from driver to LED tension supports. System MUST provide for smooth and continuous vertical chase of light to scroll from right to left at a slow speed without any pixilation, choppiness or flutter.

2. System is to provide (3) seamless large-scale light fixtures with no individual diode imaging. Dimensions are approximate – refer to electrical drawings and field measurements for accurate dimensions/ Ribbon: ~24” tall x ~240’ x 5” deep,
Jetways: ~24” wide x ~25’ x5” deep with an approx. 69-degree lit bend from ribbon to sloped ceiling, and an approx 21-degree bend about half-way along the fixture length to extend to the jetway. All dimensions to be field verified prior to quote and order. LEDs within ribbon system to be accessible via spatula-style removal of PVC material, and similar tool re-installation of material for portions of material removal – shall not require industrial heaters or specialty installers/de-installers to accomplish access to LED boards. If entire PVC material is removed, re-installation shall be per above but with assistance of heater to re-install and make fully smooth. All drivers, power supplies, pixel controllers to be remote mounted in accessible ceiling. Contractor is to field verify locations for mounting remote gear and confirm with ELDS and on shop drawings that the length is correct per field verification and to achieve compete coverage as shown on drawings from edge to edge, and also to confirm system limits for remote mounting of power/control gear. Maximum distance from luminaire to remoted power/control gear is 20 feet using typical gauge wiring.

3. Fascia and ceiling to which this system will be surface mounted shall be painted, exact color TBD.

4. Minimum 5-year warranty to cover any material defects of luminaire housing, LED light engine and LED driver.

5. UL Listed (or equivalent) for damp locations, RoHS compliant.

6. To be considered equal: submit one sample 2’ tall x 3’ long fixture (housing with bottom access panel, LEDs, stretched PVC fabric diffuser, with associated drivers, power supplies and controllers, on cord and plug. Sample must have pre-programmed shows of at least five saturated colors (including light orange and purple), and five temperatures of white (2400K, 3000K, 3500K, 4000K and 5200K.) Sample must be provided with controller and software to add shows. Sample must allow diffuser to be removed and reinstalled in exact method as proposed product. One-line diagram of how this fixture receives input from photocell as well as DMX overrides, and all power/data inputs/output must be provided. Product approval or disapproval will be determined and reported within 14 working days of receipt of all required information and samples.

7. Color Temperature/Color Performance: RGBW (W to be 4000K)

8. Field-cuttable LED Boards mounted in simple PCB holder for quick release, replacement and re-attachment

9. Fixture Watts: 0.4W/pixel

10. Output: 2.2 Nits per chip

11. Fixture Efficacy: 21.3 LM/watt (white mode)

12. Fixture Volts: 120 to 277

13. Dimming: DMX
14. Life: 80,000 hours to LM80

15. JA-8 Compliant

16. Housing to have extruded profile with double channel to hold diffuser and reflector with anchoring points for LED system

17. Diffuser to be stretched PVC with capacity to have over 200 feet installed without any seams. Diffuser to have silicon perimeter pre-shaped to be easily removed and reinstalled by hand with any wrinkles easily removed via simple heat application (blow-dryer method.)

18. Acceptable Manufacturer: Tensioned Lighting Systems TLS-RGBW-qty TBD-40mm Pitch-Ribbon (~24” x ~240’), Jetways (2) (~24” x 25’ with custom corner to have a continuous coverage of light from ribbon at fascia location bending to continue to sloped ceiling section, bending again to reach jetway door location) to -SM-RAL TBD-SF-I-with compatible remote drivers and pixel controllers (TCWC-XXX) to deliver power and data to system with no perceptible flicker. Consult JA-8 standard for flicker compliance. Contractor to supply all wiring and cabling (with appropriate pin-connectors.) Alternate Manufacturers must meet all construction and performance specifications as listed, see above for submittal criteria.

D. Type D:

1. Luminaire: 1.33” high, 2” wide, 4’ long produces 1,100 lumens/foot at 12 watts per foot, with an efficacy of 91.7 lumens per watt, 4000K color temperature (+/-50K) with CRI greater than 92. Asymmetric beamspread distribution to have peak candela at 112-113-degrees, and peak to zenith candlepower ratio to be 2.67:1 or greater. Surface mounted on cove ledge with 1.6” tall inside clear concealing lip. Line voltage with plug-and-play attachments. Dimmable via 0-10V. Minimum 5-year warranty to cover any material defects of luminaire housing, LED light engine and internal LED driver. UL Listed (or equivalent) for damp locations, RoHS compliant.

2. Contractor to use 4’ long segments as much as possible, filling in with 12” and 18” segments so that there is never more than 3” of unlit length at the end of each run. Contractor to field verify length of coverage to achieve end-to-end light as tightly as possible and order lengths accordingly.

3. To be considered equal reports must separately show the following components: IES LM-79 formatted file must be submitted and shown to have the equal or better efficacy and light output, all LEDs must have been tested in accordance with TM-21 and LM-80 reports, and show a lumen maintenance of 70% at 60,000 hours at 25oC, per reported L70 at a minimum of 50,000 hours. Color Temperature variance must be less than +/- 50K. To be considered an approved product, the following must be submitted to ELDS no less than 21 days before bids are due to General Contractor: full product catalog number with cut sheet (.pdf format), indication of type/manufacturer of LED chips used and thermal management techniques used. Provide point by point calculation report using
AGI32 as follows: Test room to be 30’ long, 30’ wide and 28’ tall. Reflectances 80/50/20. A cove shelf is to be inserted at 25.75’ height that is 30’ long and 1’ wide, at 50% reflectance. (30) Type B light fixtures at 1’ long to be centered on the short axis of the cove shelf and mounted at 25.85 feet above finished floor. Calculation on the ceiling plane points to be 1’ on center left to right and 1’ on center top to bottom. All calculation points shall be set to measure to the one tenth of a footcandle. All luminaires shall be calculated at initial, no light loss factor. Luminaire optics to be pointed straight up. Calculations to show a performance of no greater than 190 footcandles on the ceiling directly over the luminaires, no more than 138 footcandles on the ceiling at 2’ away from luminaires, no more than 79 footcandles on the ceiling at 4’ away from luminaires, at least 13 footcandles on the ceiling at 10’ away from luminaires, making the uniformity no greater than 15:1 from zenith to 10 away. Submit the point by point reports as noted above as well as the AGI32 file.

4. To be considered equal, also submit one sample 4’ minimum fixture on cord and plug for review of asymmetric distribution, glare and flicker properties. Product approval or disapproval will be determined and reported within 10 working days of receipt of all required information and samples.

5. Color Temperature/Color Performance: 4000K (+/-50K), CRI 92+

6. Fixture Watts: 12 watts/foot or less

7. Lumen Output: 1100 lumens/foot or greater

8. Fixture Efficacy: 91.7 lumens per watt or better

9. Fixture Volts: 120 to 277

10. Dimming: 0-10V

11. Life: 60,000 hours to L70


E. Type E:

1. Luminaire: Luminaire is a furniture-mounted system including housing, translucent diffuser, LED linear lighting, and associated drivers and DMX controllers. Fixture must curve to match the radius of the furniture system (factory bend only (no in-field bending) is acceptable.) Housing width shall be 6” per furniture manufacturer, and from 3” to 5” tall. At least 3” of the translucent lens to be fully visible over the furniture top on each side with no diode imaging whatsoever. LEDs within fixture must be accessible from above. Base of housing must securely fasten to the furniture system without gaps, overlaps or misalignments – work with furniture manufacturer to coordinate. Driver and associated controllers (power/data management) to be mounted in furniture base
behind locking access panel. LED diodes are programmable within 4" increments. System includes channel addressing service such that content programming can be done with Pharos/Mosaic or similar software and programmed shows can be stored. Protocol is DMX 512. System MUST provide for smooth and continuous vertical chase of light to scroll from right to left at a slow speed without any pixilation, choppiness or flutter. Electrical service requires line voltage power to remote driver, data connection to remote driver, low voltage connection between drivers and LED board, and data connection from driver to LED board. Maximum distance from light fixture to drivers shall be no greater than 20 feet. Top of fixture to be furniture-manufacturer-provided removable top cap with secure attachment to connect look-and-feel of furniture to the top of light fixture. Work closely with furniture manufacturer to achieve this.

2. Minimum 5 year warranty to cover any material defects of luminaire housing, LED light engine and LED driver.

3. UL Listed (or equivalent) for damp locations, RoHS compliant.

4. To be considered equal, submit one sample at 3’ long fixture, curved in plan to match radius of furniture system with associated translucent lens, and LED system to meet all performance criteria stated for this type. Access shall be through the top of the fixture using furniture-manufacturer-provided removable top cap with secure attachment to connect look-and-feel of furniture to the top of light fixture. Work closely with furniture manufacturer to achieve this. Provide sample with associated drivers, power supplies and controllers, on cord and plug, yet ensure all are sized to it within the 6” overall width of the furniture spine. (Fixture will be placed in the furniture system for review.) Sample must have pre-programmed shows of at least five saturated colors (including light orange and purple), and five temperatures of white (2400K, 3000K, 3500K, 4000K and 5200K.) Sample must be provided with controller and software to add shows. Sample must allow diffuser to be removed and reinstalled in exact method as proposed product. One-line diagram of how this fixture receives input from photocell as well as DMX overrides, and all power/data inputs/output must be provided. Product approval or disapproval will be determined and reported within 4 work weeks of receipt of all required information and samples (and pending DFW sample review and approval within the furniture system.)

5. Color Temperature/Color Performance: RGBW (W to be 4000K)

6. Field-cuttable LED Boards mounted in simple PCB holder for quick release, replacement and re-attachment

7. Fixture Watts: 0.4W/pixel

8. Output: 2.2 Nits per chip


10. Fixture Volts: 120 to 277

11. Life: 80,000 hours to LM80
12. JA-8 Compliant

13. Fixture Volts: 120V with cord and plug for connection to floor box, consult with A/V consultant for particular plug type.

14. Dimming: DMX with cables from driver suitable for connection to data jack in floor box.

15. Acceptable Manufacturer: Barbican: #062561-CC-AGTI curve-AGTI radius-AGTI diameter-FURN MT-REM driver in spine-RAL-TLS 2.2Nit-120V-RGBW-DMX-MA CUS, Custom Furniture System Manufacturer coordinated; and #062561-CC-AGTI straight-AGTI length-AGTI-FURN MT-REM driver in spine-RAL-TLS 2.2Nit-120V-RGBW-DMX-MA CUS, Custom Furniture System Manufacturer coordinated.

16. Please price as an alternate acceptable manufacturer (list as Light Alt #2): Innovative Lighting: DFWD 6” curved, spine-mounted, RGBW, DMX, Custom Furniture System Manufacturer coordinated; and DFWD 6” straight, spine-mounted, RGBW, DMX, Custom Furniture System Manufacturer coordinated.

F. Type F:

1. Luminaire: Recessed, tunable white, square aperture, beveled adjustable downlight with ~3-1/4” upper aperture, 4-1/2” lower aperture and 5-1/2” outside trim, with 1” regress and Solite full upper lens with flat horizontal trim lens (equal bevel all around, no angled cut trim), with ability to tilt up to 25-degrees with flat horizontal trim. Fixture must allow hot-aiming that is either tool-less and lockable or via a flat or Philips screwdriver (no Allen wrench adjustments.) Fixture must produce 1350 lumens delivered or greater (@3000K), 32 watts per fixture or less, with tunable white color temperature from 2200K to 6000K with 80 CRI or greater across the tunable spectrum. Beamspread distribution to be 40° with the ability to add filter to widen the beam in 5° increments. Accessory holder (preferably a snap-in holder) must be provided with the ability to hold up to one glass media and one filter media minimum. All components must be serviceable from below. Driver and LED engine must be replaceable. The following conditions shall be met: the fixture shall have a thermal management system to ensure 100% lumen output and consistent color temperature over time. RAL bevel and trim finishes to be confirmed. Recessed housing size no greater than 7” tall x 23” long x 13” wide (including mounting flanges.) Dimmable via DMX. Minimum 5-year warranty to cover any material defects of luminaire housing, LED light engine and LED driver. UL Listed (or equivalent) for damp locations, RoHS compliant.

2. To be considered equal reports must separately show the following components: IES LM-79 formatted file must be submitted and shown to have the equal or better efficacy and light output, all LEDs must have been tested in accordance with TM-21 and LM-80 reports, and show a minimum lumen maintenance of 70% at 50,000 hours at 40°C or less. To be considered an approved product, the
following must be submitted to ELDS no less than 21 days before bids are due to General Contractor: full product catalog number with cut sheet (.pdf format), indication of LED chips/modules used and thermal management techniques used.

3. To be considered equal, also submit one sample fixture on cord and plug for review of output, color temperature tunability, glare and flicker properties. Product approval or disapproval will be determined and reported within 10 working days of receipt of all required information and samples.

4. Color Temperature Range: 2200K to 6000K, CRI 80+ throughout the range

5. Fixture Watts: 32 watts or less

6. Lumen Output: 1350 delivered lumens or greater

7. Fixture Efficacy: 42 lumens per watt or better

8. Fixture Weight: 16lbs. or less

9. Fixture Volts: 120 to 277

10. UL Listed Damp location

11. Dimming: DMX


13. Alternate Manufacturers must meet all construction and performance specifications as listed, see above for submittal criteria.

G. Type G:

Luminaire: Luminaire is a single-sided (outward facing) table/furniture-mounted lighting system including housing, translucent diffuser, LED linear lighting, and associated drivers and DMX controllers. Fixture must curve to match the radius of the table/furniture (factory bend only (no in-field bending) is acceptable.) Housing width shall be 3-4” to match table/furniture system, and from 3” to 5” tall. At least 3” of the translucent lens to be fully visible over the table/furniture top with no diode imaging whatsoever. LEDs within fixture must be accessible from above or behind. Base of housing must securely fasten to the table/furniture system without gaps, overlaps or misalignments – work with table/furniture manufacturer to coordinate. Driver and associated controllers (power/data management) to be mounted in table/furniture base behind locking access panel. LED diodes are programmable within 4” increments. System includes channel addressing service such that content programming can be done with Pharos/Mosaic or similar software and programmed shows can be stored. Protocol is DMX 512. System MUST provide for smooth and continuous vertical
chase of light to scroll from right to left at a slow speed without any pixilation, choppiness or flutter. Electrical service requires line voltage power to remote driver, data connection to remote driver, low voltage connection between drivers and LED board, and data connection from driver to LED board. Maximum distance from light fixture to drivers shall be no greater than 20 feet.

1. Minimum 5 year warranty to cover any material defects of luminaire housing, LED light engine and LED driver.

2. UL Listed (or equivalent) for damp locations, RoHS compliant.

3. To be considered equal, submit one sample at 3’ long fixture, curved in plan to match radius of table/furniture system with associated translucent lens, and LED system to meet all performance criteria stated for this type. Provide sample with associated drivers, power supplies and controllers, on cord and plug, yet ensure all are sized to it within the overall width of the table/furniture mounting surface. Sample must have pre-programmed shows of at least five saturated colors (including light orange and purple), and five temperatures of white (2400K, 3000K, 3500K, 4000K and 5200K.) Sample must be provided with controller and software to add shows. Sample must allow diffuser to be removed and reinstalled in exact method as proposed product. One-line diagram of how this fixture receives input from DMX overrides, and all power/data inputs/output must be provided. Product approval or disapproval will be determined and reported within 4 work weeks of receipt of all required information and samples (and pending DFW sample review and approval within the furniture system.)

4. Color Temperature/Color Performance: RGBW (W to be 4000K)

5. Field-cuttable LED Boards mounted in simple PCB holder for quick release, replacement and re-attachment

6. Fixture Watts: 0.4W/pixel

7. Output: 2.2 Nits per chip

8. Fixture Efficacy: 21.3 LM/watt (white mode)

9. Fixture Volts: 120 to 277

10. Life: 80,000 hours to LM80

11. JA-8 Compliant

12. Fixture Volts: 120V with cord and plug for connection to floor box, consult with A/V consultant for particular plug type.

13. Dimming: DMX with cables from driver suitable for connection to data jack in floor box.

CUS, Custom Furniture System Manufacturer coordinated; and #062561-CC-TBL straight-TBL length-TBL-FURN MT-REM driver in spine-RAL-TLS 2.2Nit-120V-RGBW-DMX-MA CUS, Custom Furniture System Manufacturer coordinated.

15. Please price as an alternate acceptable manufacturer (list as Light Alt #2): or Innovative Lighting: DFWD 6” curved, spine-mounted, RGBW, DMX, TBLi, Custom Furniture System Manufacturer coordinated; and DFWD 6” straight, spine-mounted, RGBW, DMX, TBLi, Custom Furniture System Manufacturer coordinated.

2.3 CONTROL SYSTEM CONFIGURATION SOFTWARE

A. System Configuration

1. The Control System Configuration software shall be meet the following criteria:

2. Definitions
   a. A system is the configuration of one or more Show Controllers.
   b. A fixture is a controllable entity with one or more attributes.
   c. An attribute is a parameter of control such as intensity, pan or gobo select.
   d. A group is a selection of fixtures that can be stored and recalled.
   e. A trigger is a single point of control to the system (e.g. contact closure, serial command, timed event, etc.)
   f. Actions are items of functionality that can occur within a running control system in response to events (e.g. start timeline, pause timeline, set intensity, etc.)
   g. A timeline is a series of connected steps referencing control with timing information.
   h. A scene is a static look created for any fixture type.
   i. Effects are attribute settings that result in continually varying levels following a specified curve and using additional timing parameters (e.g. period, offset.)

3. System Configuration
   a. The application interface shall be based around (i) a tree-view; (ii) a workspace area; (iii) item selector.
   b. There shall allow multiple 2-dimensional layouts that display the organization or layout of the project.
   c. It shall be possible to represent data about the workspace area graphically (layout) or in tabular form.
   d. Items displayed on the layout may be arranged using drag-and-drop interaction.
   e. Layout views shall support zoom.
   f. Layout views shall support a management grid with user-defined spacing and color with associated snap-to-grid functionality.
   g. There shall be an auto-backup feature.
h. It shall be possible to add fixtures by selecting a fixture template from the provided library or download additional fixture templates from an internet hosted service.

i. It shall be possible to create a fixture layout based on data imported from a defined documentation format. (E.g. CSV).

j. There shall be provision for help functionality to be accessed from within the application.

k. It shall be possible to import images as a background image to the layout view.

4. Channel Configuration
   a. There shall be functionality to patch channels to DMX and/or Ethernet Protocols including sACN, Philips KiNet Pathway XDMX and ARTNET.
   b. There shall be support for Channels with split patches (e.g. VL5).
   c. It shall be possible to swap pan and tilt axes for a moving-light fixture.
   d. It shall be possible to invert pan and tilt axes for a moving-light fixture.
   e. It shall be possible to specify a minimum and maximum value for an attribute.
   f. It shall be possible to specify a default value for an attribute.

5. Design and Simulation
   a. There shall be control of LED arrays supporting pixel mapping of static or video media in any Apple® QuickTime® supported file format.
   b. There shall be control of moving lights (as a type of fixture).
   c. There shall be independent control of every attribute of a channel or fixture.
   d. Appropriate graphical controls shall be provided for non-intensity attributes (e.g. color picker).
   e. It shall be possible to create groups as a selection shortcut.
   f. The plan shall show simulation feedback for channels in a graphical form.
   g. It shall be possible to simulate control events.
   h. The simulation may be linked to the actual online system to synchronize playback and inject control events.

6. Timelines
   a. Timelines may be displayed and modified in linear form.
   b. Timelines may be set on an individual attribute basis.
   c. All timelines may include split timing.
   d. Timelines shall be applied based on priority.
   e. It shall be possible for all timelines to include effects.
   f. The end state of a timeline shall be user configurable.

7. Scenes
   a. Scenes may be displayed and modified in a graphical form.
   b. Multiple fixtures may be selected and modified at once.
   c. Scenes may be inserted into timelines.
   d. Scenes may be able to be recalled independent of timelines.

8. Triggers
   a. It shall be possible to trigger actions using external trigger or individual events.
   b. It shall be possible to set conditions for each trigger.
c. It shall be possible to specify timed events, including repeat intervals such as daily, weekly etc.
d. It shall be possible to specify astronomical timed event.
e. Serial input data shall be treated as a trigger and shall be handled as a standard or custom action.

9. Actions
a. There shall be a standard Actions for starting and stopping timelines, and scenes.
b. There shall be a standard action for pausing and resuming timelines.
c. There shall be standard actions to set timeline intensity.
d. There shall be standard actions to set timeline position.
e. There shall be standard actions for setting fixture color.
f. There shall be standard actions for working with external triggers connected to Expansion Modules.
g. It shall be possible to initiate custom scripts as actions.

10. Network:
a. Shall report online status of Show Controller and remote devices
b. Shall allow for configuration of network properties (IP) of Show Controllers
c. Shall allow for upload of configuration data to all or individual Show Controllers
d. Shall allow for download of configuration data from Show Controllers
e. Shall allow for download of logging data from Show Controllers
f. Shall provide for performing firmware upgrades to Show Controllers
g. Shall allow for discovery of connected Show Controllers
h. Shall supports an integrated web server for remote connectivity and control of programmed timelines

11. Reports:
a. It shall be possible to generate tabular reports and customize their layout and appearance.
b. It shall be possible to print reports.

12. Resources
a. Effect curves and fade profiles shall use a common format and allow custom variants to be generated by the user.
b. Additional fixture templates may be defined by the user (custom fixtures).

B. Minimum Computer Requirements, Computer and required accessories, cables, wiring, and components per LCSI to be provided by contractor:

1. Microsoft Windows
a. The software shall require the Windows 7,8 or 10 (32/64bit) operating system running on a Windows-compatible computer (1 GHz Intel processor or better) with a minimum of 100 MB of hard drive space and 1 GB RAM, OpenGL graphics acceleration, a monitor capable of displaying at least 1024 x 768 screen resolution, Ethernet or USB port keyboard and mouse.
2. Macintosh OS
   a. The software shall require Macintosh OS-X 10.7.x (Mountain Lion) or later operating system running on a compatible computer (1 GHz Intel processor or better) with a minimum of 100 MB of hard drive space and 1000GB RAM, OpenGL graphics acceleration, a monitor capable of displaying at least 1024 x 768 screen resolution, Ethernet or USB port keyboard and mouse.

2.4 Control Hardware

A. General
   1. The Show Controller shall be a microprocessor-based system specifically designed for control of lighting and other related systems in an architectural or entertainment application. A personal computer running emulation software shall not be acceptable. The show controller must supply the appropriate number of universes required to control each light fixture in 4" to 6" sections and each channel (RGBW and intensity channels).

   2. The Controller shall be provided with a 5-year manufacturer warranty.

B. Mechanical
   1. Enclosure and mounting shall comply with DIN43880 and EN60715 (35/7.5) respectively.
   2. The controller shall be an 8-unit DIN enclosure (143.5mm x 90.0mm x 58.0mm).
   3. The Controller shall have a recessed switch for resetting the unit without removal of power.
   4. There shall be visual indicators on the Controller showing status of the controller and its interfaces.
   5. The controller shall be entirely solid-state with no moving parts, fans or hard disc drives.
   6. The controller shall operate in a temperature range from 0°C to 50°C (32°F to 122°F).

   7. Control hardware to communicate with DMX controllable fixtures using DMX512 protocol. Conceptual wiring diagram is included below. Final one line diagram to be submitted to ELDS for approval along with equipment submittals.
Project NDA - Lighting Control Logic One-Line

any distances over 300 linear feet shall be fiber connection

POWER

Dedicated managed network switch for lighting system - located in IDF room

POWER FROM FLOOR BOX

0-10V Gateway 0-10V Zones

POE

ETC Paradigm - POCS Control Control Server located in IDF Room

to take and process the signal from DPW and translate to Mosaic

ETC Mosaic (48 universes) located in IDF room

for programming and storing the various light shows

POWERA FROM FLOOR BOX

Gateway for the ribbon/ribbon

DMX Power

Drivers for Ribbon LEDs

Power/Data

Ribbon LEDs

Power/Data

Drivers & T-Connectors for Furniture LEDs

Furniture LEDs

DFW Airport System

to signal a boarding condition, gate change condition, etc.

POE

network

network

ETC Paradigm - POCS Control Control Server located in IDF Room

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POE

network

network

ETC Paradigm - POCS Control Control Server located in IDF Room

to take and process the signal from DPW and translate to Mosaic

ETC Mosaic (48 universes) located in IDF room
C. Electrical
1. The Controller shall be designed to support the following wire terminations (Camden Electronics CTB9208 5.08mm plug-in rising clamp terminals):

2. The Controller shall support a multi-mode full-duplex RS232/half-duplex RS485 Serial Port
   a. RS232/RS485 serial input/output
   b. 3-pin rising clamp terminal Camden connector
   c. The Controller shall be capable of receiving DMX512 for triggering using the serial port.

3. The Controller shall support eight local inputs capable of digital, analog or contact closure operating mode
   a. 16-pin rising clamp terminal Camden connector
   b. Isolated digital/ analog inputs
   c. 8 tri-mode inputs: active high, active low or contact closure

4. The controller shall support a MIDI input and a MIDI output interface for use in triggers and for MIDI time code
   a. 5-pin DIN socket for MIDI In
   b. 5-pin DIN socket for IDI Out
      1) 3-pin 9V to 48V DC Power

5. In addition there shall be the following standard connectors:
   a. RJ45 socket for 10/100Base-TX Ethernet
   b. USB-B Socket for USB 1.1

6. The Controller shall be able to receive power over Ethernet as an alternative to direct DC power (IEEE 802.3af PoE powered device).

7. The Controller shall be ETL/ cETL listed and CE compliant

D. Functional

1. The Controller shall store show data in non-volatile solid-state memory. This memory shall be removable for purposes of backup or disaster-recovery.
2. Show data may be downloaded from a remote personal computer over an Ethernet or USB connection.
3. The Operating Software of the Controller shall be stored in a dedicated non-removable non-volatile solid-state memory. It shall be possible to update the Operating Software by download from a remote personal computer over an Ethernet or USB connection.
4. The Controller shall commence show playback automatically on receiving power without additional external inputs.
5. The Controller shall have an internal real-time clock that continues to operate when external power is absent. It shall be capable of adjusting for Daylight Saving Time automatically and can be updated over the Internet using the Network Time Protocol (NTP).
6. The Controller shall be able to calculate sunrise and sunset times based on longitude and latitude information, and use these as triggers for events.

7. The Controller shall have a capacity of 2048 channels of network DMX protocols including streaming ACN (ANSI E 1.31), ETCNet2, Philips KiNet, Pathway XDMX and Art-Net II protocols with one protocol active per 512 channels.

8. The Controller shall support DMX512 output with RDM for up to 1024 channels.

9. The Controller shall operate a web server on its Ethernet interface. This shall allow status information, control and configuration options to be accessed remotely.

10. The appearance and content of the web interface may be customized by the user.

11. The Controller shall allow lighting to be programmed as separate zones, with independent triggering and manual intensity control.

12. The Controller shall support multiple timelines, crossfades and effects running concurrently.

13. The Controller shall support playback of video media with individual pixels mapped to lighting fixtures in an array.

14. The Controller shall support multiple remote modules connected via Ethernet for support of additional show control interfaces, such as contact closures, analog inputs, relay outputs, serial audio input, linear time code, MIDI and DALI.

15. The Controller shall support multiple remote button stations connected via Ethernet for use as triggers and user feedback.

16. The Controller shall support multiple streams of linear timecode and audio data within a single networked system.

17. The Controller shall have an internal security feature that will restart the unit in the event of program failure.

18. Multiple Controllers shall automatically synchronize and share triggers when programmed as part of a single show and linked via Ethernet during playback.

19. The Controller shall support conditional logic and execute user-defined Lua scripts to support advanced show control operations.

20. The Controller shall be supported by programming software running on either a PC or Mac platform. Programming features shall include:
   a. Comprehensive architectural and automated fixture library
   b. Drag and drop placement of fixtures on plan
   c. Drag and drop patching of fixtures to output addresses
   d. Import of any media for mapping to fixture arrays
a. Timeline-based programming and playback
b. Extensive range of editable effect presets
c. Drag and drop placement of effect presets and media on timeline
d. Variety of triggering options for firing system-wide events
e. Each trigger event may be configured to initiate one or more lighting or show control action
f. Each trigger event may be configured to test one or more conditions before executing its actions
g. Simulation of individual timelines, and entire project with triggers
h. Live output from software for programming verification purposes
i. Controller and network management tools
j. Export CSV reports for all aspects of programming
k. Tools for remote management of content and show programming

B. Protection and Patents

1. The Mosaic Controller is protected under license by the following patents:
   a. U.S. Patents: 6,016,038; 6,150,774; 6,166,496; 6,211,626; 6,292,901; 6,340,868; 6,459,919; 6,528,954; 6,548,967; 6,577,080; 6,608,453; 6,624,597; 6,636,003; 6,717,376; 6,720,745; 6,774,584; 6,777,891; 6,781,329; 6,788,011; 6,801,003; 6,806,659; 6,869,204; 6,883,929; 6,888,322; 6,897,624; 6,936,978; 6,965,205; 6,967,448; 6,969,954; 6,975,079; 7,014,336; 7,031,920; 7,038,398; 7,038,399; 7,042,172; 7,064,498; 7,113,541; 7,132,635; 7,132,785; 7,132,804; 7,135,824; 7,139,617; 7,288,190; 7,231,060
   b. Canadian Patent: CA 2,302,227
   c. Hong Kong Patent: HK 1025416
   d. Australian Patent: AU 757000; AU 2003203584
   e. European Patents: EP 1 016 062 B1; EP 1 224 845 B1; EP 1 234 140 B1; DE 698 07 092 C0; DE 600 21 911 C0; DE 600 23 730 C0

PART 3 - LIGHTING CONTROLS INTEGRATOR:

3.1 WORK INCLUDES

A. Control integration for architectural lighting LED luminaires
1. Provide integration of LED luminaires and controls to comply with the Contract Documents performance criteria.

B. If at any time during the project LED luminaires are substituted for non-LED luminaires, those LED luminaires shall be included in this specification and shall be subject to the criteria in this specification and the Contract Documents.

3.2 RELATED DOCUMENTS

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

3.3 PROJECT CONDITIONS

A. Alternates:

1. Refer to Section 26 55 19 Part 2.1

3.4 SUMMARY

A. Lighting & Control System Integrator (LCSI) is required to integrate lighting and controls provided under the following sections:

1. 26 55 19 – Specialty Lighting and Controls
2. 26 09 23 – Lighting Control Devices
3. 27 41 16 – Audio Visual Systems
4. 27 42 16 – Transportation Information Display System

B. Lighting and lighting control system integration in the following areas:

1. Hold Room, Hold Room Furniture, Ribbon and Jetway lighting systems.

3.5 REFERENCES

A. Reference Standards:

1. National Fire Protection Association (NFPA) Publication: National Electrical Code, NFPA70
2. Underwriters Laboratories Standards:
   a. UL498, Electrical Attachment Plugs and Receptacles
   b. UL508, Electrical Industrial Control Equipment
   c. UL891, Dead-front Electrical Switchboards
d. UL1573, Stage and Studio Lighting Units


4. ANSI Standards


b. E1.17-2006 Entertainment Technology - Architecture for Control Networks

c. E1.20-2006 Entertainment technology – Remote Device Management

d. E1.20-2-2009 Entertainment Technology – Recommended Practice for Installing Control Cables

e. E1.30-7-2009, EP129 - Allocation of Internet Protocol Version 4 Addresses to ACN Hosts

f. E1.31-2009 Entertainment Technology - Lightweight streaming protocol for transport of DMX512 using CAN


6. American National Standards Institute


3.6 LIGHTING & CONTROL SYSTEM INTEGRATOR (LCSI) REQUIREMENTS:

A. The System Integrator shall be acknowledged in business as a Lighting Control Systems Integration Company, hereafter referred to as LCSI.

B. The LSCI Company shall employ full time technicians and project managers with experience in completing work of similar or greater size and scope.

C. The LSCI shall be a lighting system contractor who regularly engages in the furnishing, installation and servicing of systems of similar nature, size, scope and complexity.

D. The LCSI shall have maintained for the five (5) years preceding the bid date, a suitably staffed and equipped service organization which has continuously offered maintenance and repair services for the systems being provided.
E. The LCSI shall have on staff at least two (2) full-time manufacturer-certified field service technicians and have technical support and assistance accessible twenty-four (24) hours a day, seven (7) days a week. LCSI shall provide phone-based field service with a thirty minute guaranteed response time.

F. The LCSI shall maintain for the duration of this contract all required business and professional licenses and insurance.

G. The LCSI shall demonstrate to the satisfaction of the Owner, through Submittals presented in accordance with the project timetable, that the LCSI meets all the above qualifications.

H. Requirements for Approval: LCSI who are not pre-approved and are seeking acceptance must submit the following information no later than ten (10) days prior to bid date. Failure to submit any of the required information will automatically disqualify the contractor from consideration of approval.

1. Listing of five (5) equivalent installations including:
   a. Name, address, and current telephone number of Owner.
   b. Name, address, and current telephone number of Architect or AV consultant associated with the installation.
   c. Scope of work of the installation including all sub-contractors and manufacturers.

2. Brief written description of the LCSI’s operation, including facilities, departments and key personnel.

3. Biographical information of the project manager and integration team members who will be assigned to this project should the contractor be successful.

4. A full and complete financial statement sufficient to determine financial viability.

5. A list of all sub-contractors who the LCSI proposes to use including their qualifications to perform the work.

3.7 SUBMITTALS

A. LCSI qualifications including the Project Manager’s qualifications.

B. Review the Contract Documents and identify each LED System and its components including but not limited to the following:

1. LED Luminaire

2. Power Supply
C. Provide wiring diagrams for each LED system
   1. Include fixture, power supply, control source and interface
   2. Include emergency control for fixtures specified as emergency lighting
   3. Call out wire types
   4. Call out control addressing scheme
   5. Coordinate control addressing scheme with the Lighting Control System Manufacturer and the Owner’s Representative.

D. Provide coordinated wiring diagrams
   1. Locate power supplies on plan, RCP and elevation drawings
   2. Confirm required power is provided by the Electrical Contractor
   3. Coordinate access to power supplies with the General Contractor
   4. Estimate wire and cable lengths
   5. Review the wiring diagram with the Electrical Contractor and provide recommendations for wiring path and signal amplification if required

E. Samples and mockups for approval
   1. Provide Shop Drawings for approval of the mock ups
   2. Coordinate with finishes and mounting conditions
   3. Electrical Contractor shall provide full size mockups of a portion of each LED system with actual wire lengths
   4. Alternate components shall be on hand during the mock up demonstration at the discretion of the LCSI
   5. Demonstrate LED system performance matching the design criteria specified in the Contract Documents
6. Coordinate finishes and mounting conditions with the General Contractor and Design Team

7. Document approved mockups and coordinate installation with the Electrical Contractor

3.8 WARRANTY

A. Special Warranty: The LCSI shall provide a one (1) year system warranty for the complete system, not including expendable supplies, effective from the date of system acceptance. Within this warranty period, the LCSI shall be responsible as the Owner’s sole contact for the remedy, repair, or replacement of system deficiencies (through the manufacturer’s warranty where applicable).

3.9 LCSI SERVICES

A. Review the Contract Documents for performance criteria of the LED lighting systems.

B. Provide integration of LED luminaires and controls to comply with the Contract Documents

C. Project Management

1. The LCSI shall designate a Project Manager.

2. The LCSI’s Project Manager shall be the main contact between the Systems Integrator, Manufacturers, Design Team and Contractors from contract award until final sign off. The LCSI’s Project Manager shall be the same person throughout the entire course of the project.

3. The LCSI’s Project Manager shall attend a Kick-Off Meeting at the project site office or a place to be designated. The objectives of the Kick-Off Meeting are:

   a. Introduce the Project Team Members

   b. Review the Project Schedule

   c. Review the Scope of Work and any additional materials and documents not in the Scope of Work

   d. Layout the intent of the Project

   e. Further define required mockups and work them into the schedule

D. Provide lighting system mock-ups as follows:
1. The Electrical Contractor shall provide fixture samples with drivers and dimming modules for mock-ups demonstrating the performance of the LED luminaries and controls in situ or similar.

2. Fixtures are not released for purchase until the fixtures, accessories and performance have been reviewed and approved in a demonstration. Fixtures listed in the submittals referenced herein may be rejected based on non-conformance to design criteria listed in the Contract Documents.

3. Mock up session shall take place during the course of one (1) business day. The meeting shall take place within thirty (30) miles of the job site.

4. The mock up facility shall ideally have daylight contribution to the space simulating the gate area windows, but with the ability to block the daylight to simulate a night-time appearance. Design Team will require that the facility’s general lighting system be turned off throughout the review.

5. The demonstration shall include coordination with the LCSI. The Electrical Contractor shall notify the Owner’s Representative and the Design team two (2) weeks prior to the demonstration day. LCSI’s Project Manager shall attend the mock up.

6. LCSI shall review the information herein and make recommendations for execution of the controls for the mock up. Power supplies and dimmers shall be on hand, or to provide substitute components for accurate mock-up of controls system.

7. Each fixture and system shall be clearly labeled with the contract document fixture codes.

8. If the demonstration is incomplete, the contractor shall cover the expenses for the Design Team to return to the site for additional reviews.

9. It is essential all parts of the mock up are the actual models to be provided on the project. Fixtures and power supplies shall be held by the GC or Owner’s Representative as control samples for comparison to the installed products. Mock up components can be utilized in other demonstrations or the final installation. Mock-up materials not installed in the final project installation shall be returned to the supplier of the materials (manufacturer, GC or purchaser of mock-up materials) once the mock-up is complete.

E. Coordination

1. Provide field coordination of the LED system installation
   a. Review the drawings and site throughout the construction process. Notify the Electrical Contractor and General Contractor for any conditions which may be detrimental to the installation and performance of the LED systems
b. Review the LED system installation

c. Provide guidance and offer recommendations to the Electrical Contractor

d. Notify the General Contractor of any installation conditions which may be detrimental performance of the LED systems.

e. Provide proper notification to factory authorized start up personnel as required for startup, testing and training services.

f. Coordinate LED system start up with the Electrical Contractor and Lighting Control System Manufacturer

g. Set control addresses to the approved settings based on the mockups and control addressing schedules

h. Coordinate addressing with Lighting Control System Manufacturer for power supply power relay configurations

i. Run tests and tune the LED systems to match the performance requirements as stated in the Contract Documents

2. Notify the General Contractor when the systems are ready for review

a. Demonstrate the performance of the LED lighting systems for approval by the Design Team and Owner’s representative

b. Coordinate with the electrical contractor and manufactures to correct deficiencies

c. Coordinate, adjust, and set light levels for scene control with lighting designer and the Owner's representatives

d. Coordinate with Owner to receive final control sequences and scene requirements. Program panels and recorders to Owner’s final requirements

3. Provide Owner’s manual including, but not limited to, the following:

a. As-built drawings

b. The LCSI shall submit two (2) sets of full sized Record Drawings to the owner for final acceptance. These drawings shall be fully revised and reflect the actual finished installation. The drawing set shall be 100 percent complete and shall include all schematics, details and Bill of Materials for future maintenance and repair of all systems supplied by the LCSI.

1. Each drawing shall be dated and stamped as a Record Drawing.

2. Prints shall be full sized, stapled into sets. They shall be fully legible.
3. Any future revisions or modifications during the warranty period shall require that the Owner’s Record Drawings be updated.

4. The LCSI shall provide two sets of Instructions and Maintenance manuals to the Owner. The manuals shall consist of, but not be limited to:
   a. System Description
   b. User Operating Instructions
   c. User Maintenance Instructions
   d. Catalogue Cut Sheets from all equipment purchased
   e. Spare Parts Listing
   f. 11 inch by 17 inch reduced drawings of all system assemble drawings needed to perform system maintenance.
   g. Manuals shall be bound by the LCSI in loose-leaf binders and labeled with tabbed dividers for easy reference.

5. Training
   a. Provide two (2), four-hour sessions of training for the Owner’s Representative.

6. Acceptable Lighting Controls System Integrator:
   Mainstage, Pensacola, FL – 800-851-3618, contact Tripp Oliver 850-723-8467 or Nic Trapani 414-514-1669

PART 4 - EXECUTION

4.1 EXAMINATION
   A. Verify that field measurements are as indicated.
   B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
   C. Verify that suitable support frames are installed where required.
   D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
E. Verify that conditions are satisfactory for installation prior to starting work.

4.2 PREPARATION
A. Provide extension rings to bring outlet boxes flush with finished surface.
B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes

4.3 INSTALLATION
A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Install products in accordance with manufacturer's instructions.
D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
F. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Support surface-mounted luminaires from the building structure with a minimum of two 1/4 inch threaded rods per fixture. Use 1 1/2 inch x 1 1/2 inch steel framing channel where required to span joists and otherwise facilitate structural support.
   4. Secure recessed luminaires to building structure. Provide support to recessed luminaires by means of bar hangers extended across the main ceiling support members and also supported from the building structure.
   5. Secure pendant-mounted luminaires to building structure.
   6. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   7. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
G. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
H. Suspended Luminaires:
1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet (1.2 m) between supports.

I. Install accessories furnished with each luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

4.4 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

4.5 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting) and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

4.6 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires and controls to Architect and Lighting Designer, and correct deficiencies or make adjustments as directed.

B. Just prior to Substantial Completion, replace all luminaires that have failed.

4.7 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION
SECTION 27 05 00 – COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 – GENERAL

1.1 SUMMARY

A. Structured cabling for voice and data
B. Grounding and Bonding
C. Cable Pathways
D. Cable Management
E. Outfitting of Communication Equipment Rooms

1.2 RELATED WORK SPECIFIED UNDER OTHER DIVISIONS

A. Foundations and pads required for equipment furnished under this Division
B. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting.
C. Flashing of conduits into roofing and outside walls.
D. Heating, ventilating, and air conditioning equipment.
E. Electrical service to equipment rooms.
F. Cutting and patching for low voltage systems work, except for errors and omissions under this Division.

1.3 RELATED WORK - OWNER FURNISHED EQUIPMENT AND SYSTEMS

A. Telephone system electronics
B. Data network electronics
C. Computer workstations, servers, printers and other peripherals

1.4 QUALITY ASSURANCE

A. Contractor shall identify all types of quality control mechanisms they employ. Please list.
B. Perform work in accordance with contract documents.

C. All personnel performing the work of this Section shall be thoroughly familiar with the cabling methods set forth in the latest release of the BICSI TDMM (Building Industry Consulting Services International Telecommunications Distribution Methods Manuals).

D. Contractor’s RCDD shall review all required work prior to commencing. The Contractor’s RCDD shall oversee the installation and will have the end responsibility for the quality of the installation work performed. All submitted designs and or changes to the design shall be approved and signed off by the Contractor’s RCDD.

E. The installed cabling systems shall not generate nor be susceptible to any harmful electromagnetic emission, radiation, or induction that degrades cabling systems.

F. Expansion Capability: Unless otherwise indicated, provide spare positions in wall fields, cross connects, and terminal strips, and space in cable pathways to accommodate twenty (20) percent future growth in campus distribution and riser.

G. Backward Compatibility: The provided solution shall be backward compatible with lower category ratings such that if higher category components are used with lower category components, the permanent link and channel measures shall meet or exceed the lower channel’s specified parameters.

H. Component Compliance: The provided solution’s components shall each meet the minimum transmission specifications listed herein such that no individual component will be less than specifications for permanent and channel, regardless of the fact that tests for permanent and channel ultimately meet required specifications.

I. Pre-installation inspection: Visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport.

J. Test optical fiber cable while on reels. Use an optical time domain reflectometer (OTDR) to verify the cable length and locate cable defects, splices, and connector, including the loss value of each.

K. Test each pair of UTP cable for open and short circuits. Test results to be submitted to Owner.

L. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the Owner.

1.5 STANDARDS

A. The Contractor’s performance of the Work shall comply with applicable federal, state and local laws, rules and regulations. The Contractor shall give required notices, shall procure necessary governmental licenses, permits, and inspections and shall pay without burden to The Owner, all fees and charges in connection therewith unless specifically provided otherwise. In the event of violation, the Contractor shall pay all
fines and penalties, including attorney’s fees and other defense costs and expenses in connection therewith.

B. Federal Communications Commission

1. Equipment requiring FCC registration or approval shall have received such approval and shall be appropriately identified.

C. Codes, Standards and Ordinances

1. Design, manufacture, test, and install telecommunications cabling networks per manufacturer’s requirements and in accordance with NFPA-70 (National Electrical Code®), state codes, local codes, requirements of authorities having jurisdiction, and particularly the following standards:

   c. ANSI/TIA Standards

      2) ANSI/TIA-568.0-D-1 – Generic Telecommunications Cabling for Customer Premises – Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling, 2017
      3) ANSI/TIA-568.1-D – Commercial Building Telecommunications Infrastructure Standard, 2015
      4) ANSI/TIA-568.1-D-1 – Commercial Building Telecommunications Infrastructure Standard – Addendum 1: Updated References, Accommodation of New Media Types, 2018
      5) ANSI/TIA-568.2-D – Balanced Twisted Pair Telecommunications Cabling and Components Standard, 2018
      6) ANSI/TIA-568.3-D – Optical Fiber Cabling and Components Standard, 2016
      7) ANSI/TIA-568.3-D-1 – Optical Fiber Cabling and Components Standard - Addendum 1: General Updates, 2019
      8) ANSI/TIA-568.4-D - Broadband Coaxial Cabling and Components Standard, 2017
      9) ANSI/TIA-569-D – Telecommunications Pathways and Spaces, 2015
      10) ANSI/TIA-569-D-1 - Telecommunications Pathways and Spaces, Addendum 1: Revised Temperature and Humidity Requirements for Telecommunications Spaces, 2016
      11) ANSI/TIA-569-D-2 - Telecommunications Pathways and Spaces, Addendum 2: Additional Pathway and Space Considerations for Supporting Remote Powering Over Balanced Twisted-Pair Cabling, 2018
      12) ANSI/TIA-606-C – Administration Standard for Telecommunications Infrastructure, 2017
14) ANSI/TIA-607-C-1 – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises – Addendum 1, 2017
18) ANSI/TIA-942-B – Telecommunications Infrastructure Standard for Data Centers, 2017

d. NEMA-VE-1 – Metal Cable Tray Systems, 2009
e. NEMA-VE-2 – Metal Cable Tray Installation Guidelines, 2006
f. NFPA-70 – National Electrical Code, 2017
g. Install cabling in accordance with the most recent edition of BICSI® publications:


h. Federal, state, and local codes, rules, regulations, and ordinances governing the Work, are as fully part of the specifications as if herein repeated or hereto attached. If the Contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the Owner’s Representative in writing. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.
j. Underwriters Laboratories, Inc. (UL): UL 1479 – Tests of Through-Penetration Firestop Systems
k. Americans with Disabilities Accessibility Guidelines.
m. Uniform Building Code (UBC).
o. Texas Department of State Health Services (TDSHS).
p. DFW Airport Design Criteria Manual
q. US Customs and Border protection Airport Technical Design Standard, 2017
r. Applicable codes and directives of authorities having jurisdiction

1.6 COMPLETENESS OF WORK
A. The Contract Documents depict low voltage systems which are intended to be complete and functioning systems. All products, materials, labor, and programming necessary to render a fully functional system to fulfill the design intent shown on the documents shall be provided by the Contractor.

B. Catalog numbers referenced throughout this Division’s drawings and specifications are intended to convey a general understanding of the type of quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra charge shall be allowed because a catalog number is found to be incomplete or obsolete.

1.7 PRE-INSTALLATION CONFERENCE

A. Arrange and schedule pre-installation conference prior to beginning any work of this section Communications.

B. Agenda: Clarify questions in writing related to work to be performed, scheduling, coordination, etc. with consultant and/or project manager/Owner representative.

C. All individuals, who will be in an on-site supervisory capacity, shall be required to attend the pre-installation conference. This includes project managers, site supervisor and lead installers. Individuals who do not attend the conference will not be permitted to supervise the personnel that install, terminate, or test communications cables on the project. The Contractor’s RCDD that will oversee the installation is required to attend the pre-installation conference.

D. The manufacturer that will be providing the extended warranty is required to have a representative attend the pre-installation conference.

1.8 SEQUENCE AND SCHEDULING

A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and if accepted will be used to track work status.

B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.

C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

D. Submit schedule for installation of equipment and cabling. Indicate delivery, installation, and testing for conformance to specific job completion dates. As a minimum, dates are to be provided for bid award, installation start date, completion of station cabling, completion of riser cabling, completion of testing and labeling, cutover,
completion of the final punch list, start of demolition, Owner acceptance, and demolition completion.

1.9 SUBMITTALS

A. Comply with provisions of Division 01.

B. Produce Shop Drawings for section 27 05 28, 27 11 00, 27 15 00, 27 41 16, 27 42 16, and 27 51 16.

1.10 ALTERNATES, SUBSTITUTIONS AND CHANGE ORDERS

A. If a proposed alternate material is equal to or exceeds specified requirements, Contractor shall provide manufacturer’s specifications in writing for written approval prior to purchase and installation of proposed materials. The proposed material substitution shall not void or change manufacturer’s warranty.

B. Contractor shall provide a complete cabling infrastructure according to these written specifications and drawings. If the Owner changes the scope of work to be performed by the Contractor, it shall be in writing. Contractor shall respond to these changes with a complete material list, labor, and taxes in writing presented to the Owner for approval. Contractor shall not proceed with additional scope of work without a signed approval by the Owner.

C. Additional work performed by the Contractor will not be paid by Owner without signed approval of these changes prior to implementing changes. Submit a copy of signed change order upon billing.

1.11 USE OF THE SITE

A. Use of the site shall be at the Owner’s direction in matters in which the owner deems it necessary to place restriction.

B. Access to building wherein the Work is performed shall be as directed by the Owner.

C. The Owner will occupy the premises during the entire period of construction for conducting his or her normal business operations. Cooperate with the owner to minimize conflict and to facilitate the owner’s operations.

D. Schedule necessary shutdowns of plant services with the Owner and obtain written permission from the owner. Refer to article - CONTINUITY OF SERVICES herein.

E. Proceed with the Work without interfering with ordinary use of streets, aisles, passages, exits, and operations of the owner.

F. All Contractor personnel must check in with the facilities engineering department and/or the General Contractor upon arrival and upon departure.
1.12 DELIVERY AND STORAGE

A. Insofar as possible, deliver items in manufacturers’ original unopened packaging. Where this is not practical, cover items with protective materials, to keep them from being damaged. Use care in loading, transporting, unloading, and storage to keep items from being damaged.

B. Store items in a clean dry place and protect from damage.

C. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.

D. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.

E. Provide protective covering during construction to prevent damage or entrance of foreign matter.

F. Contractor is responsible for on-site security of tools, test equipment and materials.

G. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.13 CONTRACTOR CLOSE OUT SUBMITTALS

A. Submit Closeout documentation in accordance with Division 1 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 1 of the Project Manual, or a minimum of four (4) sets.

1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
2. Test reports on all copper and optical fiber cables (electronic file format and hard copy).
3. As-built cable schedules with recorded cable routing and lengths of each designated run.
4. As built documentation of all cabling systems.
5. As built documentation of CR/IDF modifications and associated cabinet elevations.

B. Warranty and Maintenance:

1. Test Report Binder(s)
2. Record Drawings

1.14 RECORD DRAWINGS
A. Keep a hard copy set of project drawings at the job site exclusively for recording deviations from the Construction Drawings.

B. Record locations and depths of buried and concealed conduits from fixed, easily identifiable objects, such as building walls. Where conduits are concealed in walls, indicate distances off of building corners or other building features not likely to be disturbed by future alterations.

C. Mark deviations in a different color so that work of various systems can be easily identified.

D. When Work is completed, record all deviations in an electronic format using AutoCAD 2007 in a format usable to the Owner. Coordinate this format with the Owner.

E. Submit two copies of completed "record drawings" on electronic media such as CD or DVD to Owner's Representative for distribution.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. All materials and equipment used in carrying out these specifications are to be new and have UL listing, or listing by other recognized testing laboratory when such listings are available.

B. Model numbers and manufacturers included in this specification are listed to establish as standard of product quality.

C. Other qualified manufacturers may be substituted only with The Owner's written consent. To request a substitution, the Contractor shall submit complete technical data, samples, and if requested, results of independent testing laboratory tests of proposed equipment.

1. If proposed System includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review.

2. Material not specifically identified within this document, but which is required for the successful implementation of the intended system(s), shall be of the same class and quality as the specified material and equipment.

3. Include a list of previously installed projects using proposed equipment that are similar in nature to specified system.

PART 3 – EXECUTION

3.1 COORDINATION
A. Insofar as it is possible to determine in advance, advise the General Contractor to leave proper chases and openings. Place all outlets, anchors, sleeves, and supports prior to pouring concrete or installation of masonry work. Should the Contractor neglect doing this, any cutting and/or patching required is to be done at this Contractor’s expense. Visit site and be informed of conditions under which work must be performed. No subsequent allowance will be made because of error or failure to obtain necessary information to completely estimate and perform work involved.

B. Carefully coordinate with other divisions to ensure proper power requirements, grounding, fireproofing and interlocking controls between the fire alarm system, security system, and other owner furnished systems.

C. Notify other tradesmen of any deviations or special conditions necessary for the installation of work. Interferences between work of various Contractors to be resolved prior to installation. Work installed not in compliance with specifications and drawings and without properly checking and coordinating as specified above shall, if necessary, be removed and properly reinstalled without additional cost to Owner.

D. The Owner or the Owner’s Representative shall be the mediating authority in all deviation and disputes arising on project.

E. Coordinate with local telephone and cable service providers to assure that proper points of service, demarcation location and grounding requirements are in accordance with contract drawings. Duct bank is to be provided by Division 26. This Contractor shall be involved regarding discussions about services to the building.

1. Coordinate with other trades to provide wall and ceiling access panels wherever required for access to communication equipment.

F. Intent:

1. These sections of specifications and drawings form a complete set of documents for communications systems for this project. Neither is complete without the other. Any item mentioned in one shall be as binding as though mentioned in both.

2. The intent of these specifications and drawings is to form a guide for a complete systems installation. Where an item is reasonably necessary for a complete system but not specifically mentioned, such as pull boxes, fittings, expansion fittings, support hangers, etc. provide same without additional cost to Owner.

3. Communication equipment room layouts indicated on drawings are diagrammatical only. Exact location of outlets and equipment to be coordinated and governed by project conditions. The Designer reserves the right to make any reasonable changes (approximately 6 feet) in location of junction boxes, or equipment prior to roughing in of such without additional cost to Owner.

G. Deviations:

1. No deviations from specifications and drawings to be made without full knowledge and consent of Designer.
2. Should the Contractor find during progress of work that existing conditions make desirable a modification of the requirements of any particular item, report such item promptly to Designer for his decision and instructions.

H. Main Horizontal Pathway/Raceway

1. Unless otherwise noted on the drawings, all communications/low voltage systems cabling shall be routed above accessible corridor ceilings parallel to room walls and corridors via cable tray or J-hook supports. Cabling shall be segregated by function as follows:
   2. Voice/data cabling.
   3. All other systems.

3.2 CONTINUITY OF SERVICES

A. The Contractor shall not take any action that will interfere with, or interrupt, existing building services unless previous arrangements have been made with the owner’s representative. Arrange the Work to minimize shutdown time.

B. Owner’s personnel will perform shutdown of operating systems. The Contractor shall give three (3) days’ advance notice for systems shutdown.

C. Should services be inadvertently interrupted, immediately furnish labor, including overtime, material, and equipment necessary for prompt restoration of interrupted service.

3.3 TRENCHING, EXCAVATION, BACKFILLING, AND REPAIRS

A. Trenching, Excavation, and Backfilling is the responsibility of the General Contractor. This Contractor is to coordinate all requirements with the GC. Failure to properly coordinate this effort resulting in additional trenching, excavation, backfilling, or repairs shall be performed without additional cost to Owner.

3.4 PLYWOOD BACKBOARD AND WALL BACKING

A. Contractor shall provide 4' W x 8' H x 3/4" D fire retardant plywood backboard as indicated in all Communication Rooms. Plywood is to be painted with two coats of flat white fire-retardant paint on all six sides and installed 6" above finished floor. The fire rating on the plywood shall be masked prior to painting and the mask removed after installation such that the fire rating is always visible.

B. General Contractor is to provide appropriate backing in walls as required for mounting brackets and other wall mounted equipment per manufacturer requirements.

C. Where work is to be done in an existing Telecommunication Room (TR), the Contractor shall ensure plywood in the TR is flame retardant. If the existing plywood does not comply the Contractor shall replace it with plywood compliant with 3.4.A.
3.5  FIRESTOPPING

A. Select appropriate type or types of through penetration firestop devices or systems appropriate for each type of communications penetration and base each selection on criteria specified herein.

B. Selected systems shall not be less than the hourly time delay ratings indicated in the Contract Documents for each respective fire-rated floor, wall, or other partition of building construction. Firestop for each type of communications penetration shall conform to requirements of an independent testing laboratory design drawing or manufacturer's approved modification when used in conjunction with details shown on the Drawings.

C. Perform all necessary coordination with trades constructing floors, walls, or other partitions of building construction with respect to size and shape of each opening to be constructed and device or system approved for use in each instance.

D. Coordinate each firestop selection with adjacent Work for dimensional or other interference and for feasibility. In areas accessible to public and other "finished" areas, firestop systems Work shall be selected, installed, and finished to the quality of adjacent surfaces of building construction being penetrated.

E. Use materials that have no irritating or objectionable odors when firestopping is required in existing buildings and areas that are occupied.

F. Provide damming materials, plates, wires, restricting collars, and devices necessary for proper installation of Firestopping. Remove combustible installation aids after firestopping material has cured.

G. All firestops shall be installed in accordance with the manufacturer’s instructions in order to maintain the specific rating assigned by the independent testing laboratory.

H. Existing raceways, cable trays, and cabling that penetrate existing building construction shall be firestopped to the extent necessary to fill cavities that may exist between existing building construction and existing communications penetrations or existing conduit sleeve, and between existing conduits and existing conduit sleeve.

I. If required by inspecting authorities:

   1. Expose and remove Firestopping to the extent directed by inspecting authority to permit his or her inspection.

   2. Reinstall new firestopping and restore Work where removed for inspection.

3.6  TESTS

A. On completion of Work, installation shall be entirely free of damaged conductors, software errors, incomplete jack termination including labeling and faceplates and dust. Perform a thorough operation test in the presence of the Owner or their representative.
Provide documentation of all test results as outlined in each system’s specifications. Include labor, materials and instruments for above tests.

B. Furnish owner, as a part of closing documents, a copy of such tests including identification of each cable, also the dedicated communication service ground test as required by each systems individual manufacturer indicating compliance with their requirements.

C. Prior to final observation and acceptance, test and leave in satisfactory operating condition, all systems and equipment including but not limited to the following:

1. Grounding.
2. Firestopping of all sleeves and conduits.
3. Telephone and LAN systems.
4. Turn in test results on cabling.

3.7 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, dust, and construction debris and repair damaged finish, including chips, scratches, and abrasions. This includes touching up paint removed for grounding.

B. Contractor shall provide a clean work environment, free from trash/rubbish accumulated during and after cabling installation.

C. Maintain construction materials and refuse within the area of work. Clean the work area at the end of each day.

D. Contractor shall keep all liquids (drinks, Sodas, etc.) off finished floors, carpets, tiles, racks and equipment. If any liquid damage to above finishes or equipment, Contractor shall provide professional services to clean or repair scratched/soiled finishes or damaged equipment at own expense

3.8 PERMITS

A. The Contractor shall secure all necessary permits required for the execution of this Work. Work will not start until all permit applications are approved.

3.9 OBSERVATIONS

A. When field observation services are a part of the project scope, the Designer’s office will provide periodic observation of the progress of Work specified herein. The purpose of the observation service is to ensure compliance of Contractor’s Work with specifications and drawings. The Designer’s office may also observe tests required of this Contractor as called for in other sections of the specifications.
B. Specifications and drawings represent Work to be done in view of total project requirements. To eliminate possible conflict with other trades, final location of conduits, jacks, outlets, components, etc., is responsibility of this Contractor. Contractor to provide all supervision required for his personnel to ensure that installation is made in accordance with specifications and drawings and all safety rules and regulations are observed. In event of conflicts of Work on project with other trades, Contractor is to make every reasonable effort to resolve conflict through meetings and discussions with other parties involved, by preparation of drawings, or other appropriate action. Only after this has been done shall the Designer's assistance be requested through the RFI process.

C. When the Designer is requested to visit the project to aid in resolution of conflicts, or for witnessing tests, they shall be given a minimum of 48 hours' notice prior to time their presence is requested at job site.

3.10 WARRANTY-GUARANTEE

A. The Designer reserves right to accept or reject any part of the installation which does not successfully meet requirements as set out in these specifications.

B. This Contractor shall, and hereby does, guarantee all Work installed under this division shall be free from defects in workmanship and materials for a period of one year from date of final acceptance. This Contractor further agrees to repair or replace any defective material or workmanship which is or becomes defective within the terms of this warranty-guarantee.

C. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

END OF SECTION
SECTION 27 05 28 – PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.1 SUMMARY

A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.

B. This section includes the minimum requirements for the installation of communications cable pathways outside of Telecommunications Rooms.

C. Included in this section are the minimum composition requirements and installation methods for the following:

1. Metallic Ladder Cable Tray
2. Non-Continuous Cable Support Systems
3. Fire-Rated Pathway Devices
4. Multi-Service Poke-Through Devices
5. Conduit Systems
6. Junction Boxes/ Pull Boxes

1.2 DEFINITIONS AND TERMS

A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:

1. AFF Above Finished Floor
2. ANSI American National Standards Institute
3. ASTM American Society for Testing and Materials International
4. BICSI Building Industry Consulting Service International
5. BOCA Building Officials and Code Administrators International,
6. CAN Canada/Canadian
7. CBP US Customs and Border Protection
8. DFW Dallas/Fort Worth International Airport
9. EMT Electrical Metallic Tubing
10. HVAC Heating, Ventilating and Air Conditioning
11. NEC National Electric Code
12. NECA National Electrical Contractors Association
13. NEMA National Electric Manufacturers Association
14. NFPA National Fire Protection Association
15. OAR Owner’s Authorized Representative
16. OD Outer Diameter
17. RCDD Registered Communications Distribution Designer
18. RFP Request for Proposal
19. RMC Rigid Metallic Conduit
20. STD Standard
1.3 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.

C. Strictly adhere to all TIA and BICSI recommended installation practices when installing cable pathways.

D. Contractor’s Qualifications:

1. Firms regularly engaged in the installation of Electrical Systems or Data Communications cabling and that have five (5) years of installation experience with systems similar to that required for this project.

2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked, and the clients will be asked questions relative to the performance of your company.

3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.

4. Provide a BICSI RCDD certified professional, or a master electrician, for oversight on this project. This person does not have to be working on-site but must be accessible to answer questions and provide weekly status reports. The RCDD or master electrician shall be a full-time employee of the contractor.

5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the OAR.

E. Manufacturer’s Qualifications:

1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.

F. Material and Work specified herein shall comply with the applicable requirements of:

1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
5. ANSI/TIA-569-D – Telecommunications Pathways and Spaces, 2015
6. ANSI/TIA-606-C – Administration Standard for Telecommunications Infrastructure, 2017
8. ANSI/TIA-942-B – Telecommunications Infrastructure Standard for Data Centers, 2017
11. NEMA – VE 1 – Metal Cable Tray Systems, 2009
12. NEMA – VE 2 – Metal Cable Tray Installation Guidelines, 2006
13. DFW Airport Design Criteria Manual
14. Applicable codes and directives of authorities having jurisdiction

G. Work:

1. The Work shall be performed in compliance with the applicable manufacturer’s installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.4 CONFLICTS

A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.

1.5 PERMITS

A. The Contractor shall secure all necessary permits required for the execution of this Work. Work will not start until all permit applications are approved.

1.6 SCHEDULING
A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.

B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.

C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.7 REQUIREMENTS

A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.

B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.

C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.

D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.

E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

A. Comply with provisions of Division 01.

B. Comply with provisions of Section 27 05 00.

C. Produce Shop Drawings for ALL horizontal and vertical pathways, to include but not limited to, dimensions/size of pathway, routing placement and its location relative to building structure (columns, floor or ceiling) and its relationship to electrical, mechanical elements as well as vertical and horizontal offsets and transitions.

D. Provide all submittal requirements under this section as a single package.

E. Provide product data for the following:
1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.

2. Proposed format of as-built documentation.

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.

   1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
   2. Provide above closeout documentation as an electronic file in PDF format.
   3. As built documentation of all pathway systems to include cable tray, conduits (horizontal and vertical), and non-contiguous support.

B. Warranty and Maintenance:

   1. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer’s recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.

B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.

C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.

D. Provide protective covering during construction to prevent damage or entrance of foreign matter.

E. Contractor is responsible for on-site security of tools, test equipment and materials.

F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.
B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

1.12 WARRANTY

A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01. Repair or replace defects occurring in labor or product within the Warranty period without charge.

B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

PART 2 – PRODUCTS

2.1 GENERAL

A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.2 METALLIC LADDER CABLE TRAY

A. Aluminum Cable Tray

1. Provide aluminum ladder cable tray for the main cable pathways on the ramp level of the facility.

2. Cable tray shall consist of two longitudinal members (side rails) with transverse members (rungs), constructed of extruded aluminum alloy 6063-T6, and welded together.

3. Straight tray sections shall have side rails fabricated as I-Beams. All straight sections shall be supplied in standard 20-24-foot lengths, except where shorter lengths are permitted to facilitate tray assembly lengths as shown on drawings.

4. Rungs shall be spaced 12 inches on center. Spacing in radiused fittings shall be 9 inches and measured at the center of the tray's width. Rungs shall have a minimum cable-bearing surface of 7/8 inch with radiused edges. No portion of the rungs shall protrude below the bottom plane of the side rails. Each rung must be capable of supporting the maximum cable load, with a safety factor of 1.5 and a 200-pound concentrated load when tested in accordance with NEMA VE-1, section 5.4.

5. The tray shall be classified as an equipment grounding conductor per NEC 392.7 with a maximum 1200 ampere rating.
6. Except as otherwise noted, provide metal cable tray as indicated: with splice plates, bolts, nuts, and washers for connecting units.

7. The tray width shall be as depicted on drawings with 6" high and 4" high rails, allowing for a loading depth of up to 5" and 3", respectively.

8. Special accessories shall be furnished as required to protect, support, and install a cable tray system. Accessories shall consist of, but are not limited to: section splice plates, expansion plates, blind-end plates, ladder drop outs, etc.

9. Cable tray supports shall be constructed from 12-gauge steel formed shape channel members 1-5/8" by 1-5/8" with necessary hardware such as trapeze support kits or wall mounted brackets.

10. Refer to the drawing set for the required widths.

11. Acceptable products: ("xx" denotes the width)
   a. Cablofil PW, Part Number 12-4F12-0020-xx, 6" Deep
   b. Cablofil PW, Part Number 12-4D11-0020-xx, 4" Deep
   c. Cooper B-Line, Part Number 26A12-xx-240, 6" Deep
   d. Cooper B-Line, Part Number 34A12-xx-240, 4" Deep
   e. Thomas & Betts, Part Number AH26-24-xx-L12-288, 6" Deep
   f. Thomas & Betts, Part Number AH44-24-xx-L12-288, 4" Deep
   g. Owner Approved Equivalent

B. Cable Tray Hangers

1. Provide threaded rod hangers, in lieu of conventional cable tray supports, in areas with horizontal space restrictions.

2. Hanger shall clamp to the side of the I-beam.

3. Hanger shall be designed for 1/2" threaded rod.

4. Acceptable products:
   a. Cablofil PW, Part Number 4F1-A837-ZN and 4D1-A837-ZN
   b. Cooper B-Line, Part Number 9ZN-5326 and 9Zn-5324
   c. Thomas & Betts, Part Numbers PGW26HRC and PGW44HRC
   d. Owner Approved Equivalent

C. Conduit Adapters

1. Provide conduit adapters for supporting conduits entering the cable tray.

2. Adapters shall come in sizes for supporting conduits from 1/2" to 4" in diameter.

3. Adapters shall clamp to the top of the tray I-beam.

4. Acceptable products: ("xx" denotes conduit diameter)
   a. Cooper B-Line, Part Number 9ZN-1155-xx
   b. Thomas & Betts, Part Numbers 6210 and 6212
   c. Owner Approved Equivalent

2.3 NON-CONTINUOUS CABLE SUPPORT SYSTEMS

A. Non-Continuous Cable Supports (J-Hooks)
1. Non-continuous cable supports shall provide a complete horizontal and vertical 1" bend radius control to help prevent degradation of cable performance.
2. Shall be UL 2043 and CAN/ULC S102.2 listed and are suitable for use in air handling spaces.
3. Cable tie channel allows user to easily install 3/4" Panduit Tak-Ty® Cable Ties to retain cable bundle.
4. Approved Products:
   a. Panduit J-PRO Cable Support System
   b. Owner Approved Equivalent

2.4 FIRE-RATED PATHWAY DEVICES

A. Provide through-wall fire-rated pathway devices, as required.

1. Cables penetrating through fire-rated floors or walls shall utilize fire-rated pathway devices capable of providing an F rating equal to the rating of the barrier in which the device is installed.
2. The device shall be tested for smoke leakage (L rating) and shall not require the use of any optional sealing materials to achieve the published rating.
3. The device shall utilize a fire and smoke sealing system that automatically adjusts to the addition or removal of cables.
4. Wiring devices shall be capable of allowing a 0 to 100-percent visual fill of cables.
5. Wire devices shall be of a sufficient size to accommodate the quantity and size of data cables required and shall be suitable for use with new or existing cable installations.
6. The installed device (in normal use) shall require no maintenance and shall accommodate future cable changes without mechanical adjustment and/or removal or replacement of protective materials.
7. Approved Products:
   a. STI EZ-PATH
   b. Hilti CP 653 Speed Sleeve
   c. Wiremold / Legrand FlameStopper
   d. Owner Approved Equivalent

2.5 POKE-THROUGH DEVICES

A. Gate Podium Poke-Through Devices

1. Provide floor poke-through devices for terminating power and communications as shown in the drawing set.
2. Devices shall be rated and engineered to be installed on the flooring type (terrazzo, carpet, etc).
3. The device shall provide up to 4 ports of communications connectivity and power receptacles wired for 2 circuits.
4. Unit shall be equipped with covers to protect device and power openings.
5. Device shall be UL Listed and UL Fire Classified under UL514A, UL514C and meet ADA Accessibility guidelines.
6. Coordinate the flange colors and options with the architect.
7. Acceptable products:
   a. Wiremold / Legrand
      1) 6ATC2P Multi-Service Poke-Through Device
      2) 1100CHA Communications Conduit Adapter
      3) Communications Bezel accepting jacks specified within section 271500
      4) Abandonment Plate (at future locations as shown on Architectural and Technology drawings)
   b. Owner Approved Equivalent

B. Furniture Poke-Through Devices
   1. Provide floor poke-through devices for extending power and communications into furniture as shown in the drawing set.
   2. Devices shall be rated and engineered to be installed on the flooring type (terrazzo, carpet).
   3. The device shall provide a ¾” conduit for connection of an electrical whip, and a 1.25” conduit for connection of a communications whip.
   4. Device shall be UL Listed and UL Fire Classified under UL514A, UL514C and meet ADA Accessibility guidelines.
   5. Coordinate the flange colors and options with the architect.
   6. Acceptable products:
      a. Wiremold / Legrand
         1) 6ATCFF Furniture Poke-Through Device
         2) Flexible Conduit, Connectors, and Outlet Boxes as Required
      b. Owner Approved Equivalent

2.6 CONDUIT SYSTEMS

A. General
   1. All conduit system components shall be UL rated.
   2. All conduit system components shall comply with the NEC.
   3. All conduit fittings, junction and pull boxes shall provide minimum cable bend radius in accordance with the latest release of ANSI/TIA-569 document.
   4. All conduit fittings shall have plastic bushings on all exposed conduit ends.

B. Rigid Metal Conduit (RMC) and Fittings Before Coating:
   1. RMC shall be UL6 listed and conform to ANSI C80.4 and NEC Article 344.
   2. RMC coating shall comply with WW-C-581d.
C. Electrical Metallic Tubing (EMT):
   1. EMT shall be UL listed and conform to NEC Article 358.
   2. EMT fittings shall be formed steel compression ring type. Die cast fittings are not allowed.
   3. Only manufacturer’s fittings, adapters, and terminators shall be used.
   4. All transition junction and pull boxes, fittings terminators and adapters shall be a metallic material.
   5. Shall be used inside buildings only.

D. Flexible conduit is not permitted.

E. Conduit Bodies are not permitted.

F. Non-metallic conduits are not permitted in above ground installations.

G. Conduit Fittings
   1. All above ground fittings shall be of metallic material.
   2. Conversion fittings are required for non-metallic (below ground) to metallic (above ground) transitions.
   3. All fittings shall be compression or threaded.
   4. Fittings shall provide a secure connection for pulling communications cables.
   5. Setscrew fittings are not permitted.

2.7 JUNCTION BOXES / PULL BOXES

A. All pull boxes shall be constructed with a minimum of 14-gauge Galvanized Steel with an ANSI 61 grey polyester powder finish inside and out over Phosphatized surfaces or Galvanizes Steel unless otherwise specified.

B. All pull boxes shall be minimum NEMA Type 1 rated on concourse level indoor spaces. Pull boxes shall be minimum NEMA Type 3R rated in ramp spaces and outdoor locations. Boxes are to be sized according to the table below unless otherwise specified.
C. All pull boxes shall have flat, removable covers fastened with plated steel screws within unique keyhole screw slots in the cover to permit removal of the cover without extracting screws unless otherwise specified.

<table>
<thead>
<tr>
<th>Maximum Trade Size of Conduit (inches)</th>
<th>Minimum Box Size (inches)</th>
<th>For Each Additional Conduit Increase Width (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Width</td>
<td>Length</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>1.25</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>1.5</td>
<td>8</td>
<td>27</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>36</td>
</tr>
<tr>
<td>2.5</td>
<td>10</td>
<td>42</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>48</td>
</tr>
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<td>12</td>
<td>54</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>60</td>
</tr>
</tbody>
</table>

D. All removable box covers shall be connected to box with a safety strap or chain.

E. All pull boxes shall provide the appropriate provisioning for grounding.

PART 3 – EXECUTION

3.1 GENERAL

A. Raceways shall be mechanically and electrically connected to all boxes and fittings and shall be properly grounded per NEC.

B. The routing and location of all conduits, cable tray, cable hooks and other raceways shall be coordinated with other trades prior to and during building construction to avoid delays and conflicts.

C. Where raceways pass through walls, partitions and floors, seal penetrations to provide a neat installation that will maintain the integrity of the waterproofing or fireproofing, as applicable, of the structure. Coordinate installation requirements with roofing installer where conduits pass through the roof.

D. All Raceways shall be run at least 6-inches from hot flues, steam pipes, hot water pipes and other hot surfaces.
E. All raceways entering a building from underground shall be sealed to prevent water, moisture, gas, or other foreign matter from entering the building. Service conduits shall be sealed in accordance with NEC 230-8.

F. Contractor’s on-site RCDD supervisor shall review, approve and stamp all shop drawings, coordination drawings and records drawings.

G. DO NOT route communication pathways under HVAC condensing units.

H. Expansion Fittings:
1. Raceways shall be provided with expansion fitting where necessary to compensate for thermal expansion and contraction.
2. Use expansion-deflection fittings on conduit crossing structural expansion joints and on exposed conduit runs where necessary. Provide bonding jumpers across fittings in metal raceway systems.

3.2 INSTALLATION

A. Aluminum Ladder Cable Tray
1. Installation and configuration shall conform to the requirements of the latest revision levels of ANSI/TIA Standards 568 & 569, NEMA VE2 (Cable Tray Installation Guidelines), NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer’s installation instructions.
2. Coordinate cable tray with other electrical work as necessary to properly integrate installation of cable tray work with other work.
3. Maintain a minimum of 12 inches of clearance above cable tray for cable installation. Maintain a minimum of 3 inches between ceiling tile and cable tray support.
4. Cable tray fitting supports shall be located such that they meet the strength requirements of straight sections. Install fitting supports per NEMA VE-2 guidelines, or in accordance with manufacturer’s instructions.
5. Cable tray should be free of burrs and sharp edges.
6. Cable tray shall be grounded according to manufacturers specifications.
7. Splice plates shall be made of 6063-T6 aluminum, using four square neck carriage bolts and serrated flange locknuts. Hardware shall be zinc plated in accordance with ASTM B633, SC1. If aluminum cable tray is to be used outdoors, then hardware shall be Type 316 stainless.
8. The resistance of fixed splice connections between adjacent sections of tray shall not exceed .00033 ohms. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing rated loading capacity of the cable tray.
9. Cable tray supports shall be placed so that the support spans do not exceed maximum span indicated on drawings. Supports shall be constructed from 12-gauge steel formed shape channel members 1-5/8 inch by 1-5/8 inch with necessary hardware.
10. Trapeze hangers shall be supported by 1/2-inch (minimum) diameter rods.
11. Cable tray shall be labeled at every fifty (50) feet with UV rated, chemical resistant 3” vinyl labels that are orange in color and are affixed with permanent adhesive. Cable tray should be marked in 2” black lettering with a cable tray number and month/year directly underneath.
   a. DFW owned cable tray shall be marked “DFW – COMM – ITS”.
   b. All other cable tray shall be marked “COMMUNICATIONS”.

B. Non-Continuous Cable Support Systems (J-hooks)
   1. Installation and configuration shall conform to the requirements of the current revision levels of ANSI/TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer’s installation instructions.
   2. Cable hooks shall be capable of supporting a minimum of 30 pounds with a safety factor of 3.
   3. Install cables without damaging conductors, shield, or jacket.
   4. Do not exceed load ratings specified by manufacturer.
   5. Adjustable non-continuous support sling shall have a static load limit of 100 lbs.
   6. Cable Hook spacing maximum 5 feet on center.
   7. Maintain maximum cable sag between cable hooks of 12 inches.
   8. Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.

C. Firestopping
   1. Comply with manufacturer’s product data, including product technical bulletins, product catalog installation instruction, and product carton instruction for installation.
   2. Verify substrate conditions are acceptable for product installation in accordance with manufacturer’s instructions.
   3. Install firestopping to comply with performance requirements specified herein.
      a. Install firestopping to comply with listed fire rated assemblies in accordance with ASTM and UL requirements.
      b. Installer shall be trained and approved by the manufacturer.
   4. Protect installed products from damage during construction operations until final completions.
   5. Inspection: Code official or building inspectors to review proper installation using manufacturer’s guidelines.

3.3 RACEWAY INSTALLATION

A. Raceways shall be mechanically and electrically connected to all boxes and fittings and shall be properly grounded per NEC.

B. The routing and location of all conduits, cable tray, cable hooks and other raceways shall be coordinated with other trades prior to and during building construction to avoid delays and conflicts.
C. Where raceways pass through walls, partitions and floors, seal penetrations to provide a neat installation that will maintain the integrity of the waterproofing or fireproofing, as applicable, of the structure. Coordinate installation requirements with roofing installer where conduits pass through the roof.

D. All Raceways shall be run at least 6-inches from hot flues, steam pipes, hot water pipes and other hot surfaces.

E. All raceways entering a building from underground shall be sealed to prevent water, moisture, gas, or other foreign matter from entering the building. Service conduits shall be sealed in accordance with NEC 230-8.

F. Contractor’s on-site RCDD supervisor shall review, approve and stamp all shop drawings, coordination drawings and records drawings.

G. DO NOT route communication pathways under HVAC condensing units.

H. Expansion Fittings:
   1. Shall be utilized in all cases where conduits pass through building expansion joints. Fittings shall be of an approved weatherproof telescopic type bonding jumper around or through the fitting.
   2. Raceways shall be provided with expansion fitting where necessary to compensate for thermal expansion and contraction.
   3. Use expansion-deflection fittings on conduit crossing structural expansion joints and on exposed conduit runs where necessary. Provide bonding jumpers across fittings in metal raceway systems.

3.4 CONDUIT INSTALLATION

A. Conduit shall be installed with threaded fittings and couplings.

B. All metallic couplings, connectors and fittings shall be malleable iron or Steel and finished with Zinc plating or by Galvanizing.

C. All conduits shall be plugged immediately upon installation to prevent the entrance of construction dirt and debris. All conduits shall be swabbed and cleaned before wires are pulled.

D. Expansion fittings shall be utilized in all cases where conduits pass through building expansion joints. Fittings shall be of an approved weatherproof telescopic type bonding jumper around or through the fitting.

E. Connection of Conduit to Pull / Junction Boxes and Enclosures:
   1. Connection to NEMA 1 type boxes and enclosures:
      a. Rigid conduit: Install insulated bushings and double locknuts.
      b. EMT: Install compression box connectors with insulated throats.
2. Connection to NEMA 3R, 4, 4X, and 12 type boxes: Install insulated bushings and sealing locknuts or hubs.

3. When conduits enter floor mounted enclosures from below and there is no sheet metal to which to attach; install grounding bushings on the conduit. Bond bushings to ground bus using a conductor the same size as required for an equipment grounding conductor sized for the given circuit.

4. Install sealing bushing within all conduits which have entered a building from outside, whether from above or below grade.

F. Each Conduit route shall be installed with the least amount of bends as possible. No section of conduit shall be longer than 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend) between pull points, pull boxes or reverse bends.

G. The inside radius of bends in conduit shall be.
   1. 6 times the internal diameter for 2-inches or less.
   2. 10 times the internal diameter for greater than 2-inches.

H. A measured pull tape shall be placed in all installed conduit.

I. Any single conduit run extending from a MCR/CR/IDF shall not serve more than one outlet.

J. All communication conduits shall be indentified with color coded orange tape marked “Communications” every 50 feet. Tag conduit termination points (to include J-Box locations) with the origination and destination location.

K. Conduit shall be reamed to eliminate sharp edges and terminated with an insulated bushing.

L. Conduit protruding through the floor shall be terminated at a minimum of 3 inches above the floor surface.

M. All stubbed conduit ends shall be provided with a ground bushing.

N. All conduit penetrations shall be provided with the proper conduit sleeves.
   1. Sleeves shall extend three inches AFF or four inches below finished ceiling, with a bushing.
   2. Sleeves shall be installed in the communications room floor or ceiling a minimum of two to four inches on center from the wall.
   3. Conduit floor sleeves shall be spaced to allow space for ground bushing and insulated bushing for cable protection.
   4. Shall be installed in a single tier or row from left to right horizontally. If two tiers or rows are required, the conduits shall be staggered minimum of 2 inches between tiers.
   5. Cable support anchors shall be installed 18 to 24 inches above the sleeves.
O. All cable (horizontal, riser or backbone) wall or ceiling penetrations shall be provided with the proper conduit sleeves.
   1. Sleeves shall extend three inches AFF or four inches below finished ceiling, with a bushing.
   2. Sleeves shall be installed in the floor or ceiling a minimum of two to four inches on center from the wall.
   3. Sleeves shall be installed in the walls at a minimum of two inches extended on each side of the wall.
   4. Cable floor, ceiling and wall sleeves shall be spaced to allow space for ground bushing and insulated bushing for cable protection.
   5. Shall be installed in a single tier or row from left to right horizontally.
   6. If two tiers or rows are required, the conduits shall be staggered minimum of 2 inches between tiers.
   7. Cable support anchors shall be installed 18 to 24 inches above the sleeves.

P. All conduit and cabinet entrances shall be sealed with an approved, re-enterable sealant material to prevent ingress of water, dust or other foreign materials.

Q. Conduit shall not be embedded in the required fire protective covering of a structural member that is to be individually encased in accordance with BOCA.

R. Install all exposed conduit parallel or perpendicular to lines of existing construction and grouped together where possible, without interfering with use of premises or working areas. Prevent safety hazards and interference with operating and maintenance procedures.

S. Conduit Sizing and supports:
   1. Horizontal (station) conduit is defined as the conduit run between the communications outlet and the cable tray or communications room as indicated on Drawings.
   2. Each horizontal conduit run shall be a one-inch metallic conduit and shall be home run from each communications outlet box to the equipment room, termination equipment or cable tray, as indicated in Drawings.
   3. Each route shall be installed with the least amount of conduit bends. Each single horizontal conduit run shall be provided with a junction or pull box every 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend).
   4. Each dual horizontal conduit run shall be provided with a Junction or Pull Box every 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend). The quantity of conduits entering the Junction or Pull Box shall equal the number of conduits exiting the Junction or Pull Box.
   5. Each terminating (outlet end) conduit connection shall be provided with the proper connecting insulated bushing or fitting.
   6. Each originating end (communications room end) shall be provided with the proper connecting insulated ground bushing and properly bonded to ground.

T. Horizontal Conduit Routes:
1. Horizontal (station) conduit is defined as the conduit run between the communications outlet and the cable tray or communications room as indicated on Drawings.

2. Each horizontal conduit run shall be a one-inch metallic conduit and shall be home run from each communications outlet box to the equipment room, termination equipment or cable tray, as indicated in Drawings.

3. Each route shall be installed with the least amount of conduit bends. Each single horizontal conduit run shall be provided with a junction or pull box every 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend).

4. Each dual horizontal conduit run shall be provided with a Junction or Pull Box every 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend). The quantity of conduits entering the Junction or Pull Box shall equal the number of conduits exiting the Junction or Pull Box.

5. Each terminating (outlet end) conduit connection shall be provided with the proper connecting insulated bushing or fitting.

6. Each originating end (communications room end) shall be provided with the proper connecting insulated ground bushing and properly bonded to ground.

U. Horizontal conduit entrance in communications rooms – wall entry

1. Horizontal conduits shall enter the communications room wall 12 to 18 inches above the top of the cable tray. Maintain cable bend radius with supporting device as required.

2. Conduit wall stubs shall be spaced in increments equal to the conduit outside diameter (OD) from each other.

3. All conduit wall stubs shall be extended to the terminating equipment, electronics, or cable tray, as noted in Drawings.

4. Conduit crossovers are not permitted.

V. Horizontal conduit entrance in communications rooms – ceiling entry

1. Horizontal conduits shall enter or be extended from the equipment room ceiling 12 to 18 inches above the top of the cable tray.

2. Ceiling conduit stubs shall be spaced in increments equal to the conduit outside diameter (OD) from each other.

3. All ceiling conduit stubs shall be extended to the terminating equipment, electronics, or cable tray, as noted in Drawings.

4. Conduit crossovers are not permitted.

W. Horizontal conduit entrance in communications rooms – floor entry

1. Horizontal conduits shall enter the communications room floor 2 to 4 inches on center from the wall and shall be stubbed 3 inches AFF.

2. Conduit floor stubs shall be spaced in increments equal to the conduit OD from each other.

3. Conduit crossovers are not permitted.

4. Provide vertical ladder rack or d-hooks properly secured to wall to transverse cable to cable tray over-head.
X. Horizontal conduit to cable tray

1. Non-communications conduit shall NOT be attached to the cable tray in any fashion.
2. Conduit terminating end shall be attached to cable tray side rail with “conduit-to-cable tray” clamps. No other form of attachment shall be permitted.
3. Top or bottom cable tray conduit feeds and attachments are not permitted.

Y. Horizontal Junction/Outlet Boxes

1. Each horizontal conduit shall be terminated into an outlet box.
2. Each outlet box shall be a deep 4 11/16-inch square junction box with a minimum of two 1-inch knockouts on each of the sides.
3. Each conduit home run shall be provided with a deep 4 11/16-inch square junction box (w/cover) at 100-foot intervals and 6 inches above each ceiling and wall intersection.

Z. Riser conduit entrance in communications rooms – wall entry

1. Riser conduits shall enter the communications room wall a minimum of 24 inches above the top of the cable tray.
2. Conduit wall stubs shall be spaced in increments to equal the conduit OD from each other.
3. Riser conduits shall be installed in a single tier or row from left to right horizontally.
   a. If two tiers or rows are required, the conduits shall be staggered between tiers.
   b. No more than two tiers or rows are permitted.
4. All conduit wall stubs shall be extended to and over the cable tray to access cable tray pathway.
5. All rise conduit stubs shall be provided with the proper universal drop-out/waterfall cable exit runway, which shall be supported by and mounted to channel strut.
6. Conduit crossovers are not permitted.

AA. Riser conduit entrance in communications rooms – floor entry

1. Riser conduits shall enter the communications room floor 2 to 4 inches on center from the wall and shall stub up 6 inches AFF.
2. Conduit floor stubs shall be spaced in increments to equal the conduit OD from each other.
3. Riser conduits shall be installed in a single tier or row from left to right horizontally.
   a. If two tiers or rows are required, the conduits shall be staggered between tiers.
   b. No more than two tiers or rows are permitted.
4. Exiting cable shall be extended to the bottom of the cable tray and be provided with cable support anchors and secured with supporting hardware every six inches above the conduit bushings.
5. Conduit floor stubs shall be extended 2 to 4 inches from wall on center and 3 inches above AFF.
6. The riser cable shall be extended in the cable tray to the terminating equipment, as noted in the Drawings.
7. Conduit crossovers are not permitted.

3.5 MISCELLANEOUS PATHWAY DEVICES

A. Coordinate 4” core drill final locations with structural engineer.
B. Install poke-thru devices in accordance with manufacturer’s instructions where indicated on floor plans.

3.6 TESTING

A. Test cable trays to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance. See NFPA 70B, Chapter 18, for testing and test methods.

B. Manufacturer shall provide test reports witnessed by an independent testing laboratory of the "worst case" loading conditions outlined in this specification and performed in accordance with the latest revision of NEMA VE-1; including test reports verifying rung load capacity in accordance with NEMA VE-1 Section 5.4.

END OF SECTION
PART 1 – GENERAL

1.1 SUMMARY

A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.

B. This section includes the minimum requirements for the labeling of communications infrastructure.

C. Included in this section are the minimum composition requirements and installation methods for the following:

1. Equipment Rack Labels
2. 110-Block Labels
3. Patch Panel Labels
4. Cable Labels
5. Faceplate Labels
6. Conduit System Labels
7. Ground Tags
8. Innerduct Tags

1.2 DEFINITIONS AND TERMS

A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:

1. ANSI American National Standards Institute
2. AWG American Wire Gauge
3. BICSI Building Industry Consulting Service International
4. CBP US Customs and Border protection
5. DFW Dallas/Fort Worth International Airport
6. NECA National Electrical Contractors Association
7. NEMA National Electric Manufacturers Association
8. NFPA National Fire Protection Association
9. OAR Owner’s Authorized Representative
10. RCDD Registered Communications Distribution Designer
11. RFP Request for Proposal
12. STD Standard
13. TGB Telecommunications Grounding Busbar
14. TIA Telecommunications Industry Association
15. TMGB Telecommunications Main Ground Bus Bar
16. UL Underwriters Laboratories
1.3 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.

C. Strictly adhere to all TIA and BICSI recommended installation practices when installing communications labeling systems.

D. Contractor's Qualifications:

1. Firms regularly engaged in the installation of Communications Cabling or Electrical Systems and that have five (5) years of installation experience with systems similar to that required for this project.

2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked and the clients will be asked questions relative to the performance of your company.

3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.

4. Provide a BICSI RCDD certified professional, or a master electrician, for oversight on this project. This person does not have to be working on-site, but must be accessible to answer questions and provide weekly status reports. The RCDD or master electrician shall be a full time employee of the contractor.

5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the OAR.

E. Manufacturer’s Qualifications:

1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.

F. Material and Work specified herein shall comply with the applicable requirements of:

1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010


5. DFW Airport Design Criteria Manual
7. Applicable codes and directives of authorities having jurisdiction

G. Work:

1. The Work shall be performed in compliance with the applicable manufacturer’s installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.4 CONFLICTS

A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.

1.5 PERMITS

A. The Contractor shall secure all necessary permits required for the execution of this Work. Work will not start until all permit applications are approved.

1.6 SCHEDULING

A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.

B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.

C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.7 REQUIREMENTS

Contract No. 9500700
Terminal D
Gate Area of the Future
Issued for Bid
27 05 53 - 3
Identification for Communications Systems
January 17, 2020
A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.

B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.

C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.

D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.

E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

A. Comply with provisions of Division 01.

B. Comply with provisions of Section 27 05 00.

C. Provide product data for the following:
   1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
   2. Proposed format of as-built documentation.

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.
   1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
   2. Provide above closeout documentation as an electronic file in PDF format.

B. Warranty and Maintenance:
   1. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING
A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer’s recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.

B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.

C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.

D. Provide protective covering during construction to prevent damage or entrance of foreign matter.

E. Contractor is responsible for on-site security of tools, test equipment and materials.

F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

1.12 WARRANTY

A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01. Repair or replace defects occurring in labor or product within the Warranty period without charge.

B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

PART 2 – PRODUCTS

2.1 GENERAL

A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in
the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

B. Labels and markings shall be physically and chemically resistant to damage that would render the label unreadable.

C. All labels shall be ANSI/TIA-606 compliant labeling products. All cables, faceplates, patch panels, 110 blocks, conduit, Innerduct and patch cords shall be labeled to ANSI/TIA-606 standards.

2.2 ADHESIVE COMPONENT LABELS

A. Outlet Label - 2-Port Identifier

1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyolefin.
2. Thermal transfer labels shall be constructed of die-cut, adhesive polyester.
3. Label shall be 1.25" (31.8 mm) W x 0.30" (7.6 mm) H.
4. The label shall be white in color, with black machine-printed characters.
5. Acceptable products:
   a. Panduit
      1) C125X030FJC Network Label, P1 Cassette
      2) C125X030FJJ Network Label, Laser/Ink Jet
      3) C125X030YPT Network Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

B. Copper Patch Panel and Work Area Outlet Label, 4-Port

1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyolefin.
2. Thermal transfer labels shall be constructed of die-cut, adhesive polyester.
3. Label shall be 2.52" (64.0 mm) W x 0.30" (7.6 mm) H.
4. The label shall be white in color, with black machine-printed characters.
5. Acceptable products:
   a. Panduit
      1) C252X030FJC Component Label, P1 Cassette
      2) C252X030FJJ Component Label, Laser/Ink Jet
      3) C252X030YPT Component Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

C. Copper Patch Panel Label, 6-Port
1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyolefin.
2. Thermal transfer labels shall be constructed of die-cut, adhesive polyester.
3. Label shall be 3.79" (96.3 mm) W x 0.30" (7.6 mm) H.
4. The label shall be white in color, with black machine-printed characters.
5. Acceptable products:
   a. Panduit
      1) C379X030FJC Component Label, P1 Cassette
      2) C379X030FJJ Component Label, Laser/Ink Jet
      3) C379X030YPT Component Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

D. Fiber Patch Panel Port Labels

1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyester, or black-on-white vinyl tape.
2. Label shall be 3.50" (88.9 mm) W x 1.00" (25.4 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
   a. Panduit
      1) T100X100VPC-BK Component Label, P1 Cassette
      2) C350X100YJJ Component Label, Laser/Ink Jet
      3) C350X100YJT Component Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

E. Rack and Cabinet Labels, and Cabinet Row End Labels

1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyolefin.
2. Thermal transfer labels shall be constructed of die-cut, adhesive polyester.
3. Label shall be 2.00" (50.8 mm) W x 1.00" (25.4 mm) H.
4. The label shall be white in color, with black machine-printed characters.
5. Acceptable products:
   a. Panduit
      1) C200X100YPC Component Label, P1 Cassette
      2) C200X100YJJ Component Label, Laser/Ink Jet
      3) C200X100YJT Component Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
d. Owner approved equal

F. Cabinet Row End Labels

1. Labels shall be constructed of die-cut, adhesive polyester.
2. Label shall be 4.00" (101.6 mm) W x 4.00" (101.6 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
   a. Panduit
      1) C400X400YJJ Component Label, Laser/Ink Jet
      2) C400X400YJT Component Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

G. Raised Panel Rack and Cabinet Labels

1. Label to have a raised thermal transfer printable surface, with high-tack adhesive.
2. Label shall be 2.00" (50.8 mm) W x 1.00" (25.4 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
   a. Panduit
      1) C200X100APT Component Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

H. Raised Cabinet Row End Labels

1. Label to have a raised thermal transfer printable surface, with high-tack adhesive.
2. Label shall be 3.00" (76.2 mm) W x 2.50" (63.5 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
   a. Panduit
      1) C300X250APT Component Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal
2.3 ADHESIVE WIRE MARKER LABELS

A. Category 6/6A UTP Cable and Patch Cord Labels

1. Label shall be constructed of self-laminating vinyl.
2. Label shall be 1.50" (38.1 mm) L x 1.00" (25.4 mm) W.
3. Label shall accommodate an outside diameter of 0.16" (4.0 mm) to 0.32" (8.1 mm).
4. The print-on area height shall be 0.50" (12.7 mm) and shall be white in color, with black machine-printed characters.
5. Acceptable products:
   a. Panduit
      1) S100X150VAC Self-Laminating Label, P1 Cassette
      2) S100X150YAJ Self-Laminating Label, Laser/Ink Jet
      3) S100X150VAT Self-Laminating Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

B. Fiber (2 mm & 3 mm) Cable Labels

1. Label shall be constructed of self-laminating vinyl.
2. Label shall be 1.60" (40.6 mm) L x 1.00" (25.4 mm) W.
3. Label shall accommodate an outside diameter of 0.25" (6.4 mm).
4. The print-on area height shall be 0.80" (20.3 mm) and shall be white in color, with black machine-printed characters.
5. Acceptable products:
   a. Panduit
      1) S100X160VAC Self-Laminating Label, P1 Cassette
      2) S100X160YAJ Self-Laminating Label, Laser/Ink Jet
      3) S100X160VAT Self-Laminating Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

C. Fiber Duplex and Ribbon Cable Labels

1. Label shall be constructed of self-laminating vinyl.
2. Label shall be 2.20" (55.9 mm) L x 1.00" (25.4 mm) W.
3. Label shall accommodate an outside diameter of 0.48" (12.2 mm).
4. The print-on area height shall be 1.10" (27.9 mm) and shall be white in color, with black machine-printed characters.
5. Acceptable products:
IDENTIFICATION FOR COMMUNICATIONS
SYSTEMS
Section: 27 05 53

a. Panduit
   1) S100X220VAC Self-Laminating Label, P1 Cassette
   2) S100X220YAJ Self-Laminating Label, Laser/Ink Jet
   3) S100X220VAT Self-Laminating Label, Thermal Transfer

b. Brady

c. HellermannTyton

d. Owner approved equal

D. Copper Riser Cable
   1. Label shall be constructed of self-laminating vinyl.
   2. Label shall be 2.25" (57.2 mm) L x 1.00" (25.4 mm) W.
   3. Label shall accommodate an outside diameter of 0.24" (6.1 mm) to 0.48" (12.2 mm).
   4. The print-on area height shall be 0.75" (19.1 mm) and shall be white in color, with black machine-printed characters.
   5. Acceptable products:
      a. Panduit
         1) S100X225VAC Self-Laminating Label, P1 Cassette
         2) S100X225YAJ Self-Laminating Label, Laser/Ink Jet
         3) S100X225VAT Self-Laminating Label, Thermal Transfer
      b. Brady
      c. HellermannTyton
      d. Owner approved equal

2.4 WIRE MARKER LABEL CORES

A. Fiber Label Core
   1. Label identification sleeve for fiber jumpers.
   2. Sleeve locates on a straight section of cable of at least 2.00" from fiber boot.
   3. Sleeve made of flexible PVC material.
   4. Acceptable products:
      a. Panduit
         1) NWSLC-2Y for 2 mm Simplex Fiber, Yellow
         2) NWSLC-3Y for 3 mm Simplex Fiber, Orange
         3) NWSLC-7Y for 3 mm Duplex Fiber, White
      b. Owner approved equal

2.5 NON-ADHESIVE LABELS
A. Outlet Label, 2-Port

1. Label shall be constructed of die-cut, non-adhesive polyester.
2. Label shall be 1.25" (31.8 mm) W x 0.40" (10.2 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
   a. Panduit
      1) C195X040Y1C Component Label, P1 Cassette
      2) C195X040Y1J Component Label, Laser/Ink Jet
      3) C195X040Y1T Component Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

B. Copper Patch Panel and Work Area Outlet Label, 4-Port

1. Label shall be constructed of die-cut, non-adhesive polyester.
2. Label shall be 2.61" (66.3 mm) W x 0.35" (8.9 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
   a. Panduit
      1) C261X035Y1C Component Label, P1 Cassette
      2) C261X035Y1J Component Label, Laser/Ink Jet
      3) C261X035Y1T Component Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

C. Copper Patch Panel Label, 6-Port

1. Label shall be constructed of die-cut, non-adhesive polyester.
2. Label shall be 3.90" (99.1 mm) W x 0.30" (7.6 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
   a. Panduit
      1) C390X030Y1C Component Label, P1 Cassette
      2) C390X030Y1J Component Label, Laser/Ink Jet
      3) C390X030Y1T Component Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal
D. 110 Termination Block Label Insert

1. Label shall be constructed of die-cut, non-adhesive polyester.
2. Label shall be 7.50” (190.5 mm) W x 0.50” (12.7 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
   a. Panduit
      1) C750X050Y1C Component Label, P1 Cassette
      2) C750X050Y1J Component Label, Laser/Ink Jet
      3) C750X050Y1T Component Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

E. Giga-Punch Block Label Insert

1. Label shall be constructed of die-cut, non-adhesive polyester.
2. Label shall be 7.88” (200.2 mm) W x 0.50” (12.7 mm) H.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
   a. Panduit
      1) C788X050Y1C Component Label, P1 Cassette
      2) C788X050Y1J Component Label, Laser/Ink Jet
      3) C788X050Y1T Component Label, Thermal Transfer
   b. Brady
   c. HellermannTyton
   d. Owner approved equal

PART 3 – EXECUTION

3.1 GENERAL

A. Labeling shall be by mechanical means. Hand-lettered labels are not permitted unless otherwise noted.
   1. Utilize Panduit, or equivalent, labeler and software

B. Tags shall be non-removable.
   1. Exceptions:
      a. Faceplate labels that are placed in recessed label holders
b. Patch panel labels that are placed in recessed label holders
c. Telecommunications Ground tags secured with cable ties
d. Innerduct tags secured with cable ties

C. Labels shall match hardware layout and design.

D. Labels shall be as large as practicable while fitting properly.

E. No lettering shall be smaller than 10-point.

F. Labeling shall be in compliance with the DFW Airport Design Criteria Manual.

3.2 DFW AND CBP AIRPORT STANDARDS

A. Room Identification

1. Label Communications Backboard or Equipment Rack closest to entry door with unique identifying code.
2. Characters shall be 1-inch minimum.

B. Equipment Rack Identification

1. Label each Equipment rack with a unique alpha numeric character indicating a TR/TC and a rack number
   a. Example: RS9-01
2. Position labels at top of rack.
3. Characters shall be 1-inch minimum

C. Wall Field Identification

1. Each wall field chassis must be labeled with the TR/ER ID then an alphabetical code ‘AA’ to ‘ZZ’.
2. Each wall field row must be labeled numerically starting with ‘01’ at the top.
3. Each chassis port shall be labeled by Destination Faceplate ID – Chassis# - Row#
   a. Example: RS9-017-AF-04-02

D. Patch Panel and Port Labeling

1. Patch panel ports are numbered from left to right, top to bottom starting with ‘01’ to ‘24’, then for a 48 port patch panel ‘25’-‘48’.
2. The top line of the data port label shall indicate the Destination Faceplate
   a. Example: RS9-017
3. The second line (port label) shall be labeled by Cabinet/Rack# - Rack Unit – Port#
   a. Example: 03-24-15

E. Patch Panel to Patch Panel Labeling

1. The top line of the label shall indicate Destination Cabinet-Rack ID
   a. Example: RS9-09
2. The second line of the label shall indicate Destination Rack Unit – Port #
   a. Example: 24-15

F. Telecommunications Outlet Identification

1. Label each Telecommunications Outlet connector with a unique identifying code
   a. Position labels in recessed label holders on faceplate and cover with plastic covers.
2. Telecommunications Outlet Faceplate labeling code shall be as follows:
   a. TR/ER – Faceplate number where:
      1) “TR/ER” is identifier for room where cable terminates in horizontal cross-connect.
      2) Faceplate number starts with ‘001’ to ‘999’
      3) Example: RS9-117
   b. WAO Jack ID
      1) Destination Cabinet/Rack #-Rack unit-Port # (e.g. YY-YY-YY).
         a) Port number starts with ‘01’ to ‘24’ for 24-port patch panel or ‘48’ if connected to a 48-port patch panel.

G. Horizontal Cabling

1. All horizontal cables shall be labeled at Telecommunications outlet and horizontal cross-connect with self-laminating labels via Panduit labeler and software.
2. Cables shall be labeled at each end with information indicating termination point of both ends of cable as follows:
   a. TR/ER – Faceplate #, Rack #/Wall Field ID – Rack Unit/Row – Port #
      1) Example:
          a) Data Cable: RS9-017-03-21-03
b) Voice Cable: RS9-0122-AA-21-03

3. Cables shall be labeled on a visible part of the cable within three to six (3-6) inches of termination point for ease of identification after termination.
4. Labels at the telecommunications outlet shall be visible by removing the faceplate.
5. Rooms with multiple outlet locations shall be numbered sequentially beginning clockwise from the first outlet to the left of the main entrance to the room.

H. Backbone Cabling

1. All backbone cabling shall be labeled at each end with self-laminating labels via Panduit labeling system.
2. Cables shall be labeled at each end with information indicating termination point of both ends of the cable as follows:
   a. TR/ER - Cabinet Rack/Wall Field ID – Rack Unit-Row/Destination Cabinet Rack/Wall Field ID - Rack Unit-Row

   1) Example:
   a) Data: RS9-03-06/ MCRN-02-03
   b) Voice: RS9-AD-02/MCRN-AB-03

3. Cables shall be labeled on a visible part of the cable within twelve (12) inches of termination point for ease of identification after termination.
4. Fiber backbone cabling shall be labeled at each end with information indicating the building identifier, owner, room, cable number and “FO” indicating fiber.
   a. “S” shall be used after the FO to indicate the use of single-mode fiber.
   b. “M” shall be used after the FO to indicate the use of multi-mode fiber.
   c. Fiber shall be labeled on the front of the fiber enclosure.

   1) SMF for single-mode fiber.
   2) MMF for multi-mode fiber.

I. Outside Plant Cabling (Fiber and Copper)

1. All outside plant cabling shall be labeled at each end with self-laminating labels via Panduit labeling system.
2. Cables shall be labeled at each end with information indicating termination point of both ends of the cable as follows:
   a. Field Number – EF/TR – Cabinet/Rack #- Rack Unit / Destination Field number –EF/TR – Cabinet Rack # - Rack Unit
   b. Example: 2349-MCRS-02-14 / 2476 –RS9-01-16

J. Conduit Labeling
1. All conduits shall be labeled at each end with self-laminating labels via Panduit labeling system.
2. Conduits shall be identified in accordance with the identification legend in Appendix A.
3. Conduits shall be labeled at each end and at each junction box or pull box as follows:
   a. Origin / Destination –Conduit identification
      1) Example: MCRS / RS9-BR2435
4. Metallic conduit shall be labeled as follows:
   a. Metallic conduit that is 2” or larger shall be labeled every fifty (50) feet with UV rated, chemical resistant 3” vinyl labels that are ORANGE in color and are affixed with permanent adhesive. Conduit should be marked in 2” black lettering (MAIN lettering) or 1/4” black lettering (SECONDARY lettering).
      1) MAIN lettering shall identify the system.
         a) All conduit shall be marked “COMMUNICATIONS”
      2) SECONDARY lettering shall identify;
         a) Origination
         b) Destination
         c) Construction Contract Number
      3) DFW cable tray shall be marked “DFW-COMM – ITS”
      4) Labeling specifics are outlined in Appendix A in this section.
   b. Metallic conduit that is smaller than 2” shall be labeled with UV rated, chemical resistant 1” vinyl labels that are ORANGE in color and are affixed with permanent adhesive. Conduit should be marked in 3/4” black lettering (MAIN lettering) or 3/16” black lettering (SECONDARY lettering).
      1) MAIN lettering shall identify the system.
         a) All conduit shall be marked “COMMUNICATIONS”
      2) SECONDARY lettering shall identify;
         a) Origination
         b) Destination
         c) Construction Contract Number
c. Labeling specifics are outlined in PART 4 - Appendix A in this section.

K. Fiber Optic Patch Cable Labeling

1. All backbone cabling shall be labeled at each end with self-laminating labels via Panduit labeling system.
2. Cables shall be labeled at each end with the origin / destination by TR/ER # - Cabinet/Rack # - Rack Unit # - strand # or switch port
   a. Example: MCRS-03-40-17/18 /RS9-01-44-17/18

L. Telecommunications Grounds

1. Label Grounds on a visible part of the ground cable within twelve (12) inches of termination point for ease of identification after termination.
2. Tags shall be secured to ground cable using self-locking ties

M. Innerduct

1. Innerduct containing fiber optic cable shall be labeled where exposed.
   a. Includes areas where Innerduct is installed in trays and equipment rooms.
2. Label tags to include unique identifiers and pair counts of cable(s) contained therein.
   a. Use Backbone Cable labeling formats as described above.
   b. Hand lettering is acceptable.
      1) Use indelible type ink
3. Tag shall be secured to Innerduct using self-locking ties.

PART 4 – APPENDIX A

4.1 THE DOCUMENT FOLLOWING IS A PART OF THE SPECIFICATION.
A. Terminal D - Conduit Labeling / Marking:

<table>
<thead>
<tr>
<th>TYPE</th>
<th>LABEL COLOR</th>
<th>LEGEND</th>
<th>SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>480V SYSTEM - CONDUIT</td>
<td>YELLOW</td>
<td>BLACK LETTERS “277/480V”</td>
<td>50’ OC</td>
</tr>
<tr>
<td>480V SYSTEM</td>
<td>YELLOW w/black letters</td>
<td>Tag conduit with origination/destination location &amp; contract #</td>
<td></td>
</tr>
<tr>
<td>208V SYSTEM - CONDUIT</td>
<td>BLUE</td>
<td>WHITE LETTERS “120/208V”</td>
<td>50’ OC</td>
</tr>
<tr>
<td>208V SYSTEM</td>
<td>BLUE w/white letters</td>
<td>Tag conduit with origination/destination location &amp; contract #</td>
<td></td>
</tr>
<tr>
<td>FA SYSTEM - CONDUIT</td>
<td>NONE</td>
<td>RED CONDUIT / BOXES</td>
<td>N/A</td>
</tr>
<tr>
<td>LV CONDUIT - Pathways for Communication Systems</td>
<td>ORANGE w/black letters</td>
<td>Tag &quot;COMMUNICATIONS&quot; &amp; origination/destination location &amp; Contract Number</td>
<td>50’ OC</td>
</tr>
<tr>
<td>LV SYSTEM</td>
<td>ORANGE w/black letters</td>
<td>Tag &quot;COMMUNICATIONS&quot; &amp; origination/destination location &amp; Contract Number</td>
<td></td>
</tr>
<tr>
<td>DFW CABLE TRAY Pathway/Cable Tray Communication Systems</td>
<td>ORANGE w/black letters</td>
<td>&quot;DFW-COMM - ITS&quot; &amp; Contract Number</td>
<td>50’ OC</td>
</tr>
<tr>
<td>ALL OTHER CABLE TRAY Pathway/Cable Tray Communication Systems</td>
<td>ORANGE w/black letters</td>
<td>&quot;COMMUNICATIONS&quot; &amp; Contract Number</td>
<td>50’ OC</td>
</tr>
<tr>
<td>MATV - Conduit</td>
<td>ORANGE w/black letters</td>
<td>Follow LV Conduit Guidelines</td>
<td>50’ OC</td>
</tr>
<tr>
<td>MATV System</td>
<td>ORANGE w/black letters</td>
<td>Follow LV System Guidelines</td>
<td>50’ OC</td>
</tr>
</tbody>
</table>
## IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
### Section: 27 05 53

<table>
<thead>
<tr>
<th>TYPE</th>
<th>LABEL COLOR</th>
<th>LEGEND</th>
<th>SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA / VE System</td>
<td>WHITE w/red letters</td>
<td>Tag &quot;PA/VE&quot; &amp; Contract Number</td>
<td>Termination Points &amp; (junction boxes) - WHITE COUPLINGS AND JUNCTION BOX COVERS</td>
</tr>
<tr>
<td>PA / VE CONDUIT - PA/VE (Speaker Zones)</td>
<td>WHITE w/red letters</td>
<td>Tag &quot;PA/VE S Zone&quot; (Speaker Zone Number) &amp; Contract Number</td>
<td>25' OC</td>
</tr>
<tr>
<td>PA / VE CONDUIT - PA/VE (Ambient Microphones)</td>
<td>WHITE w/red letters</td>
<td>Tag &quot;PA/VE A Zone&quot; (Ambient Microphone Zone Number) &amp; Contract Number</td>
<td>25' OC</td>
</tr>
<tr>
<td>AACS Conduit - DFW Security Systems (AACS)</td>
<td>WHITE w/red letters</td>
<td>Tag &quot;AACS&quot; &amp; origination location only (Comm Room) &amp; Contract Number</td>
<td>25' OC</td>
</tr>
<tr>
<td>AACS System - DFW Security Systems (AACS)</td>
<td>WHITE w/red letters</td>
<td>Tag &quot;AACS&quot; &amp; origination location only (Comm Room) &amp; Contract Number</td>
<td>Termination Points &amp; (junction boxes) nonexistent</td>
</tr>
<tr>
<td>CCTV Conduit - DFW Security Systems (CCTV)</td>
<td>WHITE w/red letters</td>
<td>Tag &quot;CCTV&quot; &amp; origination location only (Comm Room or Quad Box) &amp; Contract Number</td>
<td>25' OC</td>
</tr>
<tr>
<td>CCTV System - DFW Security Systems (CCTV)</td>
<td>WHITE w/red letters</td>
<td>Tag &quot;CCTV&quot; &amp; origination location only (Comm Room or Quad Box) &amp; Contract Number</td>
<td>Termination Points &amp; (junction boxes) nonexistent</td>
</tr>
</tbody>
</table>

#### LABEL SIZES FOR VOLTAGE IDENTIFICATION

* Conduits 4” or larger – 3” labels with 2” lettering
* Conduits 2” & larger but smaller than 4” – 1” labels with ¾” lettering
* Electrical Conduits smaller than 2” – no labeling required
* Low-Voltage Conduits smaller than 2” (LV, MATV, PA/VE, AACS, CCTV) – 1” labels with ¾” lettering

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Contract No. 9500700  27 05 53 - 19  Issued for Bid
Terminal D  Identification for  January 17, 2020
Gate Area of the Future  Communications Systems
SUPPLEMENTARY INFORMATION (DEST/ORIG, CONTRACT #)

* Primary reasoning for labeling the voltage is for differentiation of different conduit systems (i.e. safety). Therefore, the label sizes for voltage must meet the above criteria. All other information on label is to aid maintenance personnel in ID'ing the systems in the field.
* Sizes for labels and lettering for the supplementary information can be smaller than the voltage ID sizes.
* Origination should be labeled with a distribution equipment label ID (i.e. Panel #, DP #, switch gear #) and Room Name.
* Destination should be labeled with the equipment label ID (switch gear #, panel board #, AHU #, etc.) and Room Name (if applicable)
* Contractors to submit label to design teams for approval prior to installation.

END OF SECTION
SECTION 27 15 00 - COMMUNICATIONS HORIZONTAL CABLEING

PART 1 – GENERAL

1.1 SUMMARY

A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.

B. This section includes the minimum requirements for the installation of horizontal cabling between Telecommunications Rooms and Work Area Outlets.

C. Included in this section are the minimum composition requirements and installation methods for the following:

1. Category 6A Cable
2. Miscellaneous Communications Cabling
3. Secondary Protection Devices
4. Faceplates, Jacks, and Modules
5. Tenant Distribution Panel
6. Jet-Bridge Interface Box
7. Patch Panels
8. Patch Cords
9. Cable Ties

1.2 DEFINITIONS AND TERMS

A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:

1. ANSI American National Standards Institute
2. AWG American Wire Gauge
3. BICSI Building Industry Consulting Service International
4. CBP Customs and Border Protection
5. CMR Communications Riser Cable
6. CMP Communications Plenum Cable
7. CR Communications Room
8. DCM Design Criteria Manual
9. DFW Dallas/Fort Worth International Airport
10. FEP Fluorinated Ethylene Propylene
11. F/UTP Foil Shielded Twisted pair
12. IDC Insulation Displacement Connector
13. IEC International Electrotechnical Commission
14. IEEE Institute of Electrical and Electronics Engineers
15. ISO International Standards Organization
16. MCR Main Communications Room
17. MDF  Main Distribution Frame
18. NEMA  National Electric Manufacturers Association
19. NEXT  Near End Crosstalk
20. NFPA  National Fire Protection Association
21. OAR  Owner’s Authorized Representative
22. PCI  Panduit Certified Installer
23. RCDD  Registered Communications Distribution Designer
24. RFP  Request for Proposal
25. RL  Return Loss
26. STD  Standard
27. STP  Shielded Twisted Pair
28. TIA  Telecommunications Industry Association
29. TSA  Transportation Security Administration
30. TSB  Technical Services Bulletin
31. UL  Underwriters Laboratories
32. UTP  Unshielded Twisted Pair

1.3 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.

C. Strictly adhere to all TIA and BICSI recommended installation practices when installing communications cabling.

D. Contractor’s Qualifications:

1. Firms regularly engaged in the installation of Data Communications cabling and that have five (5) years of installation experience with systems similar to that required for this project.
2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked, and the clients will be asked questions relative to the performance of your company.
3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.
4. Provide a BICSI RCDD certified professional for oversight on this project. This person does not have to be working on-site but must be accessible to answer questions and provide weekly status reports. The RCDD shall be a full-time employee of the contractor.
5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project
manager shall be assigned for the duration of the project and shall not be replaced without written consent from the OAR.

E. Manufacturer’s Qualifications:

1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.

F. Material and Work specified herein shall comply with the applicable requirements of:

1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2015
5. ANSI/TIA-568.2-D – Balanced Twisted-Pair Telecommunications Cabling and Components Standards, 2018
8. ANSI/TIA-606-C – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2017
10. ANSI/TIA-942-B – Telecommunications Infrastructure Standard for Data Centers, 2017
12. UL 13 – Standard for Safety for Power-Limited Circuit Cables
13. UL 444 – Standard for Safety for Communications Cables
15. IEEE 802 – Local Area Network Standard
16. DFW Airport Design Criteria Manual
17. US Customs and Border Protection Airport Technical Design Standard, 2017
18. Applicable codes and directives of authorities having jurisdiction

G. Work:

1. The Work shall be performed in compliance with the applicable manufacturer’s installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.4 CONFLICTS
A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.

1.5 PERMITS
A. The Contractor shall secure all necessary permits required for the execution of this Work. Work will not start until all permit applications are approved.

1.6 SCHEDULING
A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.

B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.

C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.7 REQUIREMENTS
A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.

B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.

C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.

D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.
E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

A. Comply with provisions of Division 01.

B. Comply with provisions of Section 27 05 00.

C. Produce Shop Drawings for ALL horizontal cabling, to include but not limited to, proposed routing and its location relative to building structure (columns, floor or ceiling) and its relationship to electrical, mechanical elements as well as any horizontal cables that may exceed 295’ in length (including service loops).

D. Provide all submittal requirements under this section as a single package.

E. Provide product data for the following:

1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
2. Manufacturer’s certificate of acceptance of the qualifications of the installing Contractor to install, test and maintain the manufacturer’s equipment.
3. Manufacturer’s installation specifications for UTP cabling and optical fiber, indicating minimum bend radius and maximum pull tension.
5. Proposed format of as-built documentation

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.

1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
2. Test reports on all copper and optical fiber cables (electronic file format and hard copy).
3. As-built cable schedules with recorded cable routing and lengths of each designated run.
4. As built documentation of all cabling systems.
5. As built documentation of MDF/CR/IDF modifications and associated cabinet elevations.
6. Laminated as-built drawing sheet of CR/IDF service area representing each level, with a scale of not less than 1/8”, mounted on the wall of each CR/IDF.
B. Warranty and Maintenance:
   1. Test Report Binder(s)
   2. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer’s recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.

B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.

C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.

D. Provide protective covering during construction to prevent damage or entrance of foreign matter.

E. Contractor is responsible for on-site security of tools, test equipment and materials.

F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

1.12 WARRANTY

A. WARRANT labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01. Repair or replace defects occurring in labor or product within the Warranty period without charge.

B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

C. In addition to the warranty outlined above, the Contractor shall facilitate a warranty between the Owner and the Manufacturer that provides coverage of the installed...
cabling system for a period of (25) twenty-five years (Panduit Certification Plus System Warranty). This warranty will cover the installed horizontal cabling system (Patch Panel to Workstation). Category 6A copper links originating from patch panels shall be warranted against the link performance minimum expected results defined in the current revision of the ANSI/TIA 568 standards document for Category 6A performance requirements. Category 6A copper links originating from wall mounted 110-style termination blocks shall be warranted against link performance minimum expected results for Category 6A performance requirements. Installation shall be performed by a Panduit Certified Installer.

PART 2 – PRODUCTS

2.1 GENERAL

A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.2 ACCEPTABLE DISTRIBUTORS

A. Subject to compliance with requirements set forth in DFW DCM, Contractor shall procure all horizontal cabling components thru an approved Panduit product distributor.

2.3 ACCEPTABLE VENDORS AND MATERIALS

A. Subject to compliance with requirements, install products from the following manufacturers, except where noted:

1. Cable, Copper
   a. Panduit Corp.
   b. Owner Approved Equivalent

2. Termination Components
   a. Panduit Corp.

B. Part numbers are provided for convenience purposes only; the contractor is responsible for complete material list and quantities. All materials listed are manufactured by Panduit Corporation unless otherwise noted. Colors shall be approved by Owner.

2.4 CATEGORY 6A PRODUCTS

A. UTP Cable
1. Provide Category 6A cabling where specified in the drawings
2. Cable shall exceed requirements of ANSI/TIA-568-C.2, ISO 11801 Class EA Edition 2.1, and IEEE 802.3an-2006 standard channel requirements for supporting 10GBASE-T and be third party tested to 650 MHz.
3. The conductors shall be 23 AWG construction with FEP (CMP) insulation.
4. All four pairs shall be surrounded by a metallic Vari-MaTrix tape cut into segments of varying length and a flame-retardant jacket. The tape shall minimize the cable diameter and suppress the effects of alien crosstalk while retaining UTP electromagnetic interface immunity.
5. The jacket color shall be blue for DFW outlet cabling.
6. Approved products:
   a. Panduit PUP6AV04xx-G (where xx indicates color) TX6™ 10Gig™ Category 6A UTP Copper Cable, Plenum
   b. Owner approved equivalent

B. F/UTP Outdoor Rated Cable

1. Provide outdoor rated Category 6A cabling where installed in outdoor conditions.
2. Cable shall exceed requirements of ANSI/TIA-568-C.2, ISO 11801 Class EA Edition 2.1, and IEEE 802.3an-2006 standard channel requirements for supporting 10GBASE-T and be third party tested to 650 MHz.
3. The conductors shall be 23 AWG construction with FEP (CMP) insulation.
4. The jacket color shall be black.
5. Approved products:
   a. Panduit TX6™ 10Gig™ Category 6A UTP Copper Cable
   b. Superior Essex
   c. Belden
   d. Owner approved equivalent

C. RS-422 Communications Cable

1. Provide control cabling as described in the drawing set.
2. Cable shall be 24 AWG stranded four conductors, wrapped in a 100% aluminum foil shield, with a 24 AWG drain, and wrapped with water-blocking tape.
3. Jacket shall be constructed of UV-stable polyvinylchloride.
4. Cable shall carry a CM NEC rating, for indoor/outdoor use and a minimum Class 2 rating for power-limited circuits.
5. Acceptable products:
   a. Belden
   b. West Penn
   c. Owner approved equivalent

D. UTP Jack Modules

1. Provide Category 6A jack modules to terminate both ends of each Category 6A horizontal cable.
3. Module shall meet requirements of IEEE 802.af and IEEE 802.3at for Power over Ethernet (PoE) applications.
4. Module shall be 100% tested to ensure NEXT and RL performance and be individually serialized for traceability.
5. Module color shall be blue for MCRN, gray for MCRS, and yellow for TSA.
6. Approved products:
   a. Panduit CJ6X88TGxx (where xx indicates color) Mini-Com® TX6™ 10Gig™ UTP Jack Module.
   b. Owner approved equivalent

E. Category 6A Copper Patch Cords within Communications Rooms

1. Provide Category 6A patch cords for patching within the MCR or data center.
2. Patch cord shall exceed requirements of ANSI/TIA-568-C.2 Category 6A, IEEE 802.3an-2006, and ISO 11801 Class EA channel standards.
3. Shall meet requirements of IEEE 802.af and IEEE 802.3at for PoE applications.
4. Each patch cord shall be 100% performance tested and wired T568B.
5. Patch cord shall be constructed of TX6A™ 10Gig™ 28 AWG stranded copper cable and TX6™ PLUS Modular Plugs for superior performance.
6. Patch cord plugs shall meet all applicable ANSI/TIA-968-A requirements and exceeds IEC 60603-7 specifications.
7. Plugs shall use an integral pair manager to optimize performance and consistency by reducing untwisting of conductors within the plug.
8. Patch cord shall perform in center of TIA component range, ensuring interoperability and 10GBASE-T Ethernet channel performance.
9. Patch cord shall be labeled with an identification of performance level, length, and a quality control number.
10. Provide a variety of 5’, 7’ and 10’ length patch cords. Include a quantity necessary to patch every available patch panel port:
   a. 25% of the patch cords are to be 5’ in length.
   b. 50% of the patch cords are to be 7’ in length.
   c. 25% of the patch cords are to be 10’ in length.

11. Approved products:
   a. Panduit UTP28X5BU Category 6A Copper Patch Cord, 5’, Blue
   b. Panduit UTP28X7BU Category 6A Copper Patch Cord, 7’, Blue
   c. Panduit UTP28X10BU Category 6A Copper Patch Cord, 10’, Blue
   d. Owner approved equivalent.

F. Category 6A Copper Patch Cords for Work Area Outlets (WAO)

1. Provide Category 6A patch cords for patching within the MCR or data center.
2. Patch cord shall exceed requirements of ANSI/TIA-568-C.2 Category 6A, IEEE 802.3an-2006, and ISO 11801 Class EA channel standards.
3. Shall meet requirements of IEEE 802.af and IEEE 802.3at for PoE applications.
4. Each patch cord shall be 100% performance tested and wired T568B.
5. Patch cord shall be constructed of TX6A™ 10Gig™ 24 AWG stranded copper cable and TX6™ PLUS Modular Plugs for superior performance.
6. Patch cord plugs shall meet all applicable ANSI/TIA-968-A requirements and exceeds IEC 60603-7 specifications.
7. Plugs shall use an integral pair manager to optimize performance and consistency by reducing untwisting of conductors within the plug.
8. Patch cord shall perform in center of TIA component range, ensuring interoperability and 10GBASE-T Ethernet channel performance.
9. Patch cord shall be labeled with an identification of performance level, length, and a quality control number.
10. Provide a variety of 5', 7' and 10' length patch cords. Include a quantity necessary to patch every available patch panel port:
   a. 25% of the patch cords are to be 5' in length.
   b. 50% of the patch cords are to be 7' in length.
   c. 25% of the patch cords are to be 10' in length.

11. Approved products:
   a. Panduit UTP6A5BU Category 6A Copper Patch Cord, 5', Blue
   b. Panduit UTP6A7BU Category 6A Copper Patch Cord, 7', Blue
   c. Panduit UTP6A10BU Category 6A Copper Patch Cord, 10', Blue
   d. Owner approved equivalent

G. RJ-45 to 110 Patch Cords
1. Provide RJ-45 to 110 patch cords for patching voice circuits in TR locations.
2. Patch cord shall be constructed of 1- and 2-pair, 24 AWG UTP stranded cable.
3. Patch cord to be factory assembled with 1-, or 2-pair 110 connector on one end and an RJ-45 plug on the other.
4. 75% of the cords shall be 1-pair; the other 25% shall be 2-pair.
5. Provide a variety of 5’, 7’ and 10’ length patch cords for TR locations. Include a quantity necessary to patch two ports for each work area outlet:
   a. 25% of the patch cords are to be 5’ in length.
   b. 50% of the patch cords are to be 7’ in length.
   c. 25% of the patch cords are to be 10’ in length.

6. Approved products:
   a. Panduit
   b. Owner approved equivalent

2.5 WORK AREA OUTLET PRODUCTS

A. Wall Mount Faceplates
1. Provide wall mount faceplates for voice and data work area outlets.
2. Faceplate shall accept four (4) or six (6) Mini-Com® Modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
3. Include label/label covers for easy port identification.
4. Raised rail design for aesthetic appeal.
5. Faceplate shall be white in color.
6. Approved products:
   a. Panduit CFPE4WHY Mini-Com® Executive Series Faceplate, 4Port, White.
   b. Panduit CFPE6WHY Mini-Com® Executive Series Faceplate, 6Port, White.
   c. Owner approved equivalent.

B. Stainless Steel Faceplates

1. Provide stainless steel faceplates in mechanical, electrical or unfinished spaces.
2. Faceplate shall be of stainless-steel construction.
3. Faceplate shall accept four (4) or six (6) Mini-Com® Modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
4. Include label/label covers for easy port identification.
5. Approved products:
   a. Panduit CFPL4SY Mini-Com® Stainless Steel Faceplate, 4-Port, White.
   b. Panduit CFPL6SY Mini-Com® Stainless Steel Faceplate, 6-Port, White.
   c. Owner approved equivalent.

C. Surface Mount Outlet Box

1. Provide surface mount outlet boxes for work area outlet locations where outlets cannot be recessed.
2. Shall accept Mini-Com® Modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
3. Mount easily with supplied mounting screws, adhesive tape or optional magnet.
4. Cable entry from side and rear knockouts and from opening in center of base.
5. Outlet box shall be white in color.
6. Approved products:
   a. Panduit CBX1WH-A Surface Mount Box, 1 Port
   b. Panduit CBX2WH-AY Surface Mount Box, 2 Port
   c. Panduit CBX4WH-AY Surface Mount Box, 4 Port
   d. Panduit CBXSD6AW-AY Surface Mount Box, 6 Port
   e. Owner approved equivalent.

D. Furniture Faceplate

1. Provide faceplates for work area outlet locations inside of modular furniture.
2. Shall accept Mini-Com® Modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
3. Coordinate the exact faceplate assembly with the furniture manufacturer.
4. Faceplate shall be black in color.
5. Approved products:
   a. Panduit CFFP*4BL Furniture Faceplate, 4 Port
   b. Owner approved equivalent.

E. Tamper Resistant Faceplate
1. Provide wall mount faceplates for voice and data work area outlets.
2. Accept Mini-Com® Modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
3. Include two tamper resistant screws to prevent unauthorized access to the connections (combo head screws also included).
4. Two-piece hinged design.
5. Sloped design improves bend radius control.
6. Faceplate shall be off white in color.
7. Approved products:
   a. Panduit CFPR4IW Mini-Com® Tamper Resistant Faceplates, 4Port, Off White.
   b. Owner approved equivalent.

F. Blank Modules
1. Populate any unused faceplate module openings with blank modules.
2. Populate any unused patch panel module openings with blank modules.
3. Blank module color shall match the faceplate and patch panel color.
4. Approved products:
   a. Panduit CMBWH-X Mini-Com® Blank Module, White
   b. Panduit CMBBL-X Mini-Com® Blank Module, Black
   c. Owner approved equivalent.

G. Patch Panels
1. Provide modular patch panels in MCR and equipment cabinet locations for all horizontal cabling.
2. Patch panel shall accept Mini-Com® Modules for UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
3. Use of two label pocket faceplates allowing both port and panel identification.
4. Can be clearly identified with the PanTher™ LS8E or Cougar™ LS9 Hand-Held Thermal Transfer Printers.
5. Use either 24-port or 48-port angled patch panels. Approved products:
   a. Panduit CPPLA24WBLY Angled Patch Panel, 24 Port, with labels, Black
   b. Panduit CPPLA48WBLY Angled Patch Panel, 48 Port, with labels, Black
   c. Owner approved equivalent

2.6 MISCELLANEOUS PRODUCTS
A. Cable Ties
   1. Provide “hook & loop” cable ties for bundling cables.
   2. The material shall consist of nylon loops with polypropylene hooks.
   3. Use plenum-rated ties in plenum spaces.
   4. Approved products:
      a. Panduit TTS-20R0 Hook & Loop Roll, Low Profile, 20'L, .75"W, Black
      b. Panduit HLSP*S-X0 Hook & Loop Cable Tie, Plenum
      c. Owner approved equivalent.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify conduit, raceways, boxes, fittings and bodies are properly installed as described in Division 26.

B. Verify grounding and bonding following Section 270526.

C. Verify supporting devices are properly installed following Section 270528.

D. Verify conduit has a minimum 1-inch diameter for UTP or F/UTP home runs.

E. All protected telecommunication terminations require bonding, grounding and a busbar.

3.2 INSTALLATION

A. General
   1. Cables shall be pulled in accordance with the manufacturers recommended practices and in compliance with the NEC and the BICSI Telecommunications Distribution Methods Manual. Planning and care shall be taken to prevent abuse and damage during the handling or installation phase. Specified minimum cable bend radius shall be met without deviation.
   2. Pull cables simultaneously where more than one is being installed in same raceway. Use pulling compound or lubricant where necessary. Compound used must not deteriorate conductor or insulation. Use pulling means including fish tape, cable, rope, and basket weave wire/cable grips that will not damage media or raceway.
   3. Protect cable from tension, compression, torsion, bending, squeezing and vibration. Do not pull cables improperly or exceed the Manufacturer's tensile rating. This value shall be not more than thirty-two (32) lbf. force (provide breakable link for all cable pulling). There shall be no coils of excess cable left in the ceilings, cable trays, or raised floor areas unless specified otherwise. A trailer pull string shall be left in all conduits before and after cables have been installed. The cabling within the wiring closets/cabinets shall be routed and dressed neatly to their termination points such that no excess cable is present. As cables are
pulled into the cabinet, bundle them in groups with Velcro type straps according to their terminating row position. Strap exposed cables for strain relief at the termination in the communications rooms.

4. All strapping and lashing of cable within the CR(s) and IDF(s) shall be made with "Velcro" type straps for easy access to cable bundles to facilitate future "adds and changes". No plastic tie-wraps will be allowed for support of cable.

5. All cabling will be rated for a minimum operation range of -20°C to 75°C

6. All floor and wall penetrations shall be fire-stopped in accordance with local codes and restrictions.

7. New cabling will be installed in cable tray, conduit, and/or J-hooks throughout entirety of cable path.

B. Horizontal Cable

1. Install voice and data cable locations and configurations as depicted on drawings.

2. Test all cable prior to installation. Upon failure to perform testing, the installer shall accept the cable as good and assume all liability for the replacement of the cable should it be found defective at a later date.

3. All conformance standards must be certified for multipair and individual cable runs.

4. Jacketing and insulation must satisfy the Underwriter’s Laboratories (UL) listed fire rated cable insulation requirements in plenum areas.

5. Any pulling compound or lubricant used in cable installation must not deteriorate the conductor or the insulation. Provide 3M type WLC or an approved equal.

6. Copper cable runs shall not exceed 295 feet. All runs shall be continuous. No splicing is allowed.

7. The Contractor shall install copper cable with a minimum bend radius of six times the diameter of the cable.

8. Provide a 10-foot, patch cable with RJ-45 connectors for 50% of each work area outlet insert installed. Provide a combination of 5, 7 and 10-foot patch cords for each termination in the CR/IDF rooms, as required on the contract drawings. The patch cable rating and connector shall match the horizontal cable/connector rating.

9. Install 10-feet of spare copper cable (service loop) in each closet prior to termination. Provide Velcro type tie wrap for cable support and organization.

10. Install minimum 12-inches of spare copper cable in ceiling plenum prior to dropping down wall to outlet. Support slack to structure with J-Hook and Velcro ties. If there is no plenum, loop shall be located in box prior to termination. Provide box of sufficient size to accommodate spare cable, termination equipment if applicable and maintain bending radius.

11. Install 10-feet of spare copper cable (service loop) at each above ceiling outlet prior to termination. Provide Velcro type tie wrap for cable support and organization.

12. All horizontal cable shall be rated for plenum use.

13. The maximum pulling tension for 4-pair 23 AWG horizontal UTP and F/UTP cables shall not exceed 32 lbf. The Contractor shall provide a tension meter during the pulling of all cables. If the meter shows that the tension has exceeded 32 lbf, the Contractor shall discard the cable and pull new cable.
3.3 WORKSTATION TERMINATION

A. At the workstation termination point, cables shall be routed and dressed to provide a service loop in case re-termination is necessary. Leave 12 inches of slack at the junction box. Provide strapping of voice and data cable to provide strain relief of cable in relation to outlet termination.

B. Each horizontal workstation cable shall terminate on a "Mini-Com" modular jack connector and attached to the outlet faceplate. All unused faceplate ports will have a blank insert.

C. The Contractor shall adhere to the latest termination procedures as specified by manufacturer's instructions.

D. Follow TIA-568A termination procedures.

3.4 PATCH SYSTEM

A. Each horizontal data cable will terminate on a "Mini-Com" modular jack, inserted into the patch panel module. Horizontal termination of individual data cables within the communications room shall be the same as aforementioned termination procedures for the workstation cables.

B. Mount the distribution panels starting at the upper most position of the racks/rails beginning with contractor provided fiber patch panels. Allow for sufficient space between the distribution panels to allow for horizontal wire managers and cross connect component installation. Provide a detail of your elevation plan to the OWNER or Owner’s Representative before proceeding.

C. Provide and install Category 6A patch cables (as described in parts list) for channel testing. Patch cables will be provided and installed for 50% of each data link. Ten-foot cables used for WAO and five/seven/ten foot cables for cabinet patching.

D. Small diameter patch cords, which are installed in the IT spaces (Communications Room/Telecommunications Rooms/IT Rooms) shall installed in a manner as to limit the bundling of patch cords to no more than 24 patch cords.

3.5 110- BLOCK SYSTEM

A. Mount 110-block panel kits starting that the upper most position of the rack/rails below the contractor provided patch panels. Provide a detail of your elevation plan to the OWNER or Owner’s Representative before proceeding.

B. Each horizontal data cable shall be routed through slots in the base. Each pair of each cable shall be inserted into position in the wire strip slots while maintaining the proper color sequence and punched-down. Secure the connecting block over the wired base.

C. Terminate cross-connect wires to the top of the connecting blocks, maintaining the proper color sequence.
3.6 LABELING

A. Comply with Section 270553 - Identification for Communications Systems.

3.7 TESTING

A. Copper Media Testing:

1. Contractor shall utilize personnel trained in the operation of the following Level II rated test equipment:
   a. Fluke DSX Series
   b. Ideal LanTEK III
   c. Or approved equal

2. All cables and termination hardware shall be 100% tested for defects in installation and to verify cable channel performance under installed conditions. The Contractor prior to system acceptance shall verify all conductors of each cable useable. Any defect in the cable system installation including but not limited to cable, connectors, patch panels and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

3. Perform end to end link testing of all cabling and connections with specified equipment and certify as meeting the criteria as defined in Category 6A UTP cabling systems within the most current publication of ANSI/TIA-568 standards document.

4. Provide equipment calibration reports with test results.

5. Provide 72 hours’ notice to the OAR prior to testing.

3.8 CLEANING

A. Upon completion of the installation, make all components free of any oil, grease, dust and debris.

B. Work areas will be cleaned at the end of each work day and a final cleanup will occur at project completion.

3.9 DOCUMENTATION

A. Electronic submittal, via CD ROM, of required cable test results, As-Built drawings, and warranty information will be submitted to the Owner or Owner’s representative at least ten (10) working days before Certificate of Occupancy is awarded. CAD files will be submitted in Micro Station (.dgn) or Autocad (.dwg) format. When proprietary software is needed to view cable test results, the contractor will provide a licensed copy for DFW ITS Department. DFW ITS Department maintains the cable management software database. The Contractor is responsible for providing the installed wiring infrastructure data on a CD in Microsoft Excel (.xls) format. The Contractor shall coordinate the specific document requirements with DFW ITS Department.
3.10 ACCEPTANCE

A. Review test results and conduct a final inspection and punch list walk-thru with Owner and/or OAR, to inspect installation and obtain concurrence. Concurrence does not waive the responsibility of the Contractor to correct deficiencies.

END OF SECTION
SECTION 27 21 00 – DATA COMMUNICATIONS NETWORK EQUIPMENT

PART 1 – GENERAL

1.1 SUMMARY

A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.

B. Included in this section are the minimum composition requirements and installation methods for the following:

1. Intelligent Lighting (LTG) Control Network Switches
2. Network Switch Accessories

1.2 DEFINITIONS AND TERMS

A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:

1. ANSI American National Standards Institute
2. BICSI Building Industry Consulting Service International
3. CR Communications Room
4. DFW Dallas/Fort Worth International Airport
5. IEEE Institute of Electrical and Electronics Engineers
6. GbE Gigabit Ethernet
7. GBIC Gigabit Interface Converter
8. Gbps Gigabit per second
9. LAN Local Area Network
10. LTG Lighting
11. NECA National Electrical Contractors Association
12. NEMA National Electric Manufacturers Association
13. NFPA National Fire Protection Association
14. OAR Owner’s Authorized Representative
15. PoE Power over Ethernet
16. RCDD Registered Communications Distribution Designer
17. RFP Request for Proposal
18. SFP Small Form-Factor Pluggable
19. STD Standard
20. TIA Telecommunications Industry Association
21. UL Underwriters Laboratories
22. UTP Unshielded Twisted Pair

1.3 QUALITY ASSURANCE
A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.

C. Strictly adhere to all TIA and BICSI recommended installation practices when installing the products specified in this section.

D. Contractor’s Qualifications:

1. Firms regularly engaged in the installation of Data Communications systems and that have five (5) years of installation experience with systems similar to that required for this project.
2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked, and the clients will be asked questions relative to the performance of your company.
3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.
4. Provide a Cisco certified professional for oversight on this project. This person does not have to be working on-site, but must be accessible to answer questions and provide weekly status reports. The professional shall be a full-time employee of the contractor.
5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the OAR.

E. Manufacturer’s Qualifications:

1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.

F. Material and Work specified herein shall comply with the applicable requirements of:

1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2015
5. ANSI/TIA-606-C – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2017
7. ANSI/TIA-942-B – Telecommunications Infrastructure Standard for Data Centers, 2017
8. IEEE 802 – Local Area Network Standard
11. DFW Airport Design Criteria Manual
12. Applicable codes and directives of authorities having jurisdiction

G. Work:

1. The Work shall be performed in compliance with the applicable manufacturer’s installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.4 CONFLICTS

A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.

1.5 PERMITS

A. The Contractor shall secure all necessary permits required for the execution of this Work. Work will not start until all permit applications are approved.

1.6 SCHEDULING

A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.

B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.7 REQUIREMENTS

A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.

B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.

C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.

D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.

E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

A. Comply with provisions of Division 01.

B. Comply with provisions of Section 27 05 00.

C. Produce Shop Drawings showing the installation locations of all network equipment, including rack elevations, one-line diagrams showing network connectivity and the fiber assigned to network equipment.

D. Provide product data for the following:
   1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
   2. Manufacturer’s certificate of acceptance of the qualifications of the installing Contractor to install, test and maintain the manufacturer’s equipment.
   3. Proposed format of as-built documentation.

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater
of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.

1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
2. As-built equipment schedules with makes, models, serial numbers, MAC addresses and asset tags.
3. As built documentation of all fiber assignments.
4. As built documentation of MDF/IDF modifications and associated cabinet elevations.

B. Warranty and Maintenance:

1. Documentation shipped with equipment.
2. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer’s recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.

B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.

C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.

D. Provide protective covering during construction to prevent damage or entrance of foreign matter.

E. Contractor is responsible for on-site security of tools, test equipment and materials.

F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.
1.12 WARRANTY

A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01. Repair or replace defects occurring in labor or product within the Warranty period without charge.

B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

C. Contractor is responsible for providing a minimum one (1) year of extended support for all network equipment, starting from the date of acceptance by the Owner.

PART 2 – PRODUCTS

2.1 GENERAL

A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.2 NETWORK SWITCHES

A. Lighting Control Network Switches –
   1. Cisco 9200
   2. 48-port 10/100/1000Base-T
   3. Stackable
   4. POE+ (up to 30W)
   5. Redundant power supplies, supporting POE+
   6. 1G uplink module
   7. IP Base software, with wireless controller functionality.
   8. Part numbers:
      a. C9200-48P Cisco 9200, IP Base, 48-Port, Modular Uplink Ports
      b. C9200-NM-4G 4-Port 1G Uplink Module
      c. 1000BASE-LX 1G SFP Module
      d. PWR-C5-1KWAC Redundant Power Supply
      e. C9200-STACK-KIT StackWise-Kit (where required)
      f. Provide all other parts for a complete installation (power cable, cabinet mount kit, etc.)
B. General:

1. Contractor shall confirm exact make, model, configuration and accessories with DFW ITS prior to placing order.

2. Contractor shall request and utilize DFW ITS approved reseller for procurement.

3. Contractor shall provide and install network switches for a complete operational system.

4. Contractor shall include a minimum one (1) year of extended support for all network equipment, starting from the date of acceptance by the Owner.

PART 3 – EXECUTION

3.1 PREPARATION

A. The Contractor will be responsible for providing, installing and configuring the network switches, and working with the other Contractors for switch configuration requirements. Refer to Section 26 55 19 (Speciality Lighting and Controls) for additional information.

B. The drawing set and entire specification set is integral to the installation and configuration of these network switches. Examine these documents before beginning work.

C. Obtain asset tags from the Owner for each device, and install on the devices, as instructed, before installation.

3.2 EXAMINATION

A. Verify rack grounding and bonding following Section 270526.

B. Verify the appropriate power circuit voltage, amperage and plug types are available.

3.3 CONFIGURATION

A. Turn over the network electronics to the Owner for configuration and asset tagging. The Owner will configure and install the network electronics.

B. Turn over half of the GBICs to the Owner for installation in the Owner’s distribution switches.

3.4 INSTALLATION
A. Install work following drawings, manufacturer’s instructions and approved submittal data. The number of cables per run, outlet configuration and other pertinent data will be included on the drawings.

B. The Contractor will adhere to the Project’s installation schedule and should attend all construction meetings scheduled by the General Contractor.

C. The Contractor’s installation shall include coordination, testing and problem resolution with the system vendors.

D. The Contractor will be responsible for making all necessary fiber optic and copper cross connects.
   1. Singlemode fiber optic patch cords shall be furnished by Contractor, in the required lengths.
   2. Copper patch cord requirements are provided under Section 271500.
   3. Redundant fiber optic backbone connections shall be made to each switch.
   4. The Owner requires a system inspection prior to the powering up of any hardware.

END OF SECTION
SECTION 27 41 16 - INTEGRATED AUDIO VIDEO SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the minimum requirements for the integrated audio-video systems near Gates D12 and D14 within Terminal D. The associated Drawing Set, including the General Notes, further specifies the system and is part of the technical specifications.

B. This section shall detail the following AV systems:
   1. Direct-View LED Displays and Mounts
   2. Direct-View LED Controllers
   3. Direct-View LED Anti-Moiré Film (included as an add-alternate cost)
   4. Cables and Miscellaneous Accessories

C. The Contractor shall integrate the AV System with the Media Server which provides content and control. Integration shall include software and hardware components as described below and in this section.

   1. Local Area Network (LAN) for AV Control: The Contractor shall connect and program AV control devices operating on the LAN. The Contractor shall coordinate all network requirements with the Owner or Owner’s Representative prior to installation.

   2. Mounting: The Contractor shall coordinate the mounting location of AV devices with other building trades. Coordination shall include the mounting location of the device, mounting hardware, back boxes, and other nearby equipment.
      a. Where display devices are mounted, coordinate the location of AV back boxes, voice/data outlets, and electrical receptacles with the exact mounting hardware to be installed for equipment support to provide clear access to cables and connectors.
      b. Where touch screens are surface mounted, coordinate location of cable routing with other AV devices, voice/data outlets, electrical receptacles, and furniture or millwork. Provide grommets as necessary for cable routing. Refer to device specifications for additional mounting requirements.

D. The Contractor shall integrate the AV System with other building systems including, but not limited to, lighting systems. Integration shall include software and hardware components as described below and in this section.

   1. Local Area Network (LAN) for AV Control: The Contractor shall connect and program AV control devices operating on the LAN. The Contractor shall coordinate all network requirements with the Owner’s Representative prior to implementation.
2. Mounting: The Contractor shall coordinate the mounting location of AV devices with other building trades. Coordination shall include the mounting location of the device, mounting hardware, back boxes, and other nearby equipment.

   a. Where display devices are mounted, coordinate the location of AV back boxes, voice/data outlets, and electrical receptacles, with the exact mounting hardware to be installed, and provide clear access to cables and connectors.
   b. Where touch screens are surface mounted, coordinate location of cable routing with other AV devices, voice/data outlets, electrical receptacles, and furniture or millwork. Provide grommets as necessary for cable routing. Refer to device specifications for additional mounting requirements.

1.2 PROFESSIONAL REFERENCES

A. Comply with provisions of Division 01.

1.3 RELATED SECTIONS

A. Refer to Section 27 05 00.

1.4 SCOPE OF WORK

A. The Contractor shall provide AV Systems at the Smart Gate Areas near Gates D12 and D14 located within Terminal D. The systems shall be inclusive of the input source devices (Media Server), signal transportation infrastructure, signaling and control devices, output display devices, cabling, Direct-View LED displays, mounting hardware, and LED Controller equipment, as well as all associated accessories, software, licensing and services required for a complete and working system.

B. The Contractor shall provide all equipment, material, labor and services required to construct and install the AV Systems based on these specifications and design drawings including, but not limited to:

1. Submittals, as specified herein
2. Equipment, materials, labor and services, not specifically mentioned or shown, which may be necessary for the installation and full operation of the AV system.
3. Hardware as specified for the system, including any required for a complete and working system which may not be listed
4. Installation and setup of the system hardware and software including all programming.
5. Software specified or required to make the system fully operational, including the provision of IP addresses.
6. Final connection of hardware to power, infrastructure termination, and patch cords connecting system equipment to the data outlets and other network communication equipment.
7. As-Built documentation for all AV hardware and software components as specified herein.
8. Test plans, system testing and commissioning as specified herein.
9. System warranty as specified herein.
10. Spare stock, as specified herein.
11. Training as specified herein.
12. Maintenance and support as specified herein.

1.5 DEFINITIONS AND TERMS

A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:

1. AFF Above Finished Floor
2. AHJ Authority Having Jurisdiction
3. ANSI American National Standards Institute
4. AVB Audio Video Bridging
5. AVIXA Audiovisual and Integrated Experience Association
6. AWG American Wire Gauge
7. BICSI Building Industry Consulting Service International
8. CMR Communications Riser Cable
9. CMP Communications Plenum Cable
10. CR Communications Room
11. DCM Design Criteria Manual
12. DFW Dallas/Fort Worth International Airport
13. DSP Digital Signal Processor
14. EDID Extended Display Identification Data
15. EMI Electromagnetic Interference
16. FCC Federal Communications Commission
17. HD High Definition
18. HDCP High-Bandwidth Digital Content Protection
19. HDMI High-Definition Multimedia Interface
20. IDF Intermediate Distribution Frame
21. IEEE Institute of Electrical and Electronics Engineers
22. LCD Liquid Crystal Display
23. LED Light Emitting Diode
24. MCR Main Communications Room
25. NECA National Electrical Contractors Association
26. NEMA National Electric Manufacturers Association
27. NFPA National Fire Protection Association
28. RFP Request for Proposal
29. STP Shielded Twisted Pair
30. TIA Telecommunications Industry Association
31. TR Telecommunications Room
32. UHD Ultra-High Definition
33. UL Underwriters Laboratories
34. USB Universal Serial Bus
35. UHD Ultra High Definition
1.6 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.

C. Strictly adhere to all AVIXA, TIA and BICSI recommended installation practices when installing communications cabling.

D. Contractor’s Qualifications:

1. The Contractor must have been in the business of selling and installing similar systems for a minimum of three (3) years.
2. The Contractor shall have been actively engaged in installing, maintaining and operating similar systems and services as outlined in the Specifications.
3. The Contractor shall have a minimum of three (3) sites that are actively using the same system with the same version of the software, and each of those sites must be currently in operation and have been in operation for at least the proceeding twelve (12) months.
4. The Contractor shall submit a minimum of three (3) reference sites, to include client names, phone numbers, and a summary of work, that are actively using the system proposed by Contractor. These references will be checked, and the clients will be asked questions relative to the performance of your company.
5. Provide an AVIXA CTS certified professional for oversight on this project. This person does not have to be working on-site but must be accessible to answer questions and provide weekly status reports. The CTS shall be a full-time employee of the contractor.
6. Provide full time project manager with a minimum of ten (10) years field experience in installation of audiovisual systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the Owner.

E. Installer’s Qualifications:

1. All lead technicians performing installation shall have a minimum of two (2) years of experience on the proposed system and be manufacturer certified on all hardware/software applications.
2. Contractor shall ensure that all technicians performing installation are badged by DFW to allow the technicians access to the areas of work.
F. Manufacturer's Qualifications:

1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.

2. Equipment and materials shall be a standard product of manufacturers regularly engaged in the manufacture and installation of that type of equipment and shall be the manufacturer's latest standard design. Items of the same classification shall be by the same manufacturer and shall be the same series and model. This requirement includes equipment, modules, assemblies, parts, and components.

G. Supplier's Qualifications:

1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.

2. Equipment and materials shall be a standard product of suppliers regularly engaged in the supply of that type of equipment and shall be the manufacturer's latest standard design. Items of the same classification shall be supplied by the same manufacturer. This requirement includes equipment, modules, assemblies, parts, and components.

H. Material and Work specified herein shall comply with the applicable requirements of:

2. ANSI/TIA Standards:
   b. ANSI/TIA-568.0-D-1 – Generic Telecommunications Cabling for Customer Premises – Addendum 1, Updated References, Accommodation of New Media Types, 2017
   g. ANSI/TIA-568.4-D - Broadband Coaxial Cabling and Components Standard, 2017
   h. ANSI/TIA-569-D – Telecommunications Pathways and Spaces, 2015
   i. ANSI/TIA-569-D-1 - Telecommunications Pathways and Spaces, Addendum 1: Revised Temperature and Humidity Requirements for Telecommunications Spaces, 2016
   j. ANSI/TIA-606-C – Administration Standard for Telecommunications Infrastructure, 2017

3. AVIXA Standards:
   a. ANSI/AVIXA-V202.01:2016 Display Image Size for 2D Content in AV Systems
   b. ANSI/AVIXA-F501.01:2015 Cable Labeling for AV Systems
   c. ANSI/AVIXA-A102.01:2017 Audio Coverage Uniformity in Listener Area
   e. ANSI/INFOCOMM-3M-2011 Projected Image System Contrast Ratio
   g. ANSI/INFOCOMM-10:2013 Audiovisual Systems Performance Verification

5. Install cabling in accordance with the most recent edition of BICSI® publications:

6. UL 13 – Standard for Safety for Power-Limited Circuit Cables
7. UL 444– Standard for Safety for Communications Cables
8. IEEE 802 – Local Area Network Standard
9. DFW Airport Design Criteria Manual
10. Applicable codes and directives of authorities having jurisdiction

I. Work:
   1. The Work shall be performed in compliance with the applicable manufacturer’s installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
   2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
   3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
   4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.7 CONFLICTS

A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts notify the Owner in writing prior to commencement of affected work.
1.8 PERMITS
A. The Contractor shall secure all necessary permits required for the execution of this Work. Work will not start until all permit applications are approved.

1.9 SCHEDULING
A. The Contractor shall comply with all scheduling requests established by Owner, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.
B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.10 REQUIREMENTS
A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The Owner must approve material submittal and substitutions in writing.
B. All materials proposed and provided by the Contractor must be new and unused. Materials refers to all hardware, software, equipment, cabling, accessories and incidentals.
C. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.
D. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.
E. The requirements as given in this document are to be adhered to unless revised by the Owner in writing.
F. The Owner reserves the right to waive these requirements at any time.

1.11 SUBMITTALS
A. Comply with provisions of Division 01.
B. Comply with provisions of Section 27 05 00.
C. In addition to the requirements of Section 27 05 00, the Contractor shall provide the following shop drawings.

1. Produce Shop Drawings for ALL audio-video systems. This shall include the following, such that any component, wire, or piece of equipment added to the system may be easily identified by going to the actual equipment and making reference to this information.

   a. Functional Block Diagram
      1) Provide overall block diagrams showing the major interconnections between components and subsystems. This should include cable type, connector type, and equipment locations, with components labeled as in the floorplans, wiring diagrams, elevation and arrangement drawings.

   b. Floor Plans
      1) Provide floor plans showing the location of all components in the system.
      2) Provide floor plan of any room housing AV cabinets, showing the location of each piece of related equipment in the room.

   c. Arrangement Drawings
      1) Provide Drawings showing the physical arrangement of all major system components. This includes, but not limited to, the proposed routing and its location relative to building structure (columns, floor or ceiling) and its relationship to electrical, mechanical elements.

   d. Elevation Drawings
      1) Provide elevation drawings of all rack mounted and wall mounted equipment, showing the location of each component in the rack and on the wall. Components shown shall be identified as in the functional block diagrams.

   e. Wiring Diagrams
      1) Provide wire-by-wire diagrams showing all field installed interconnections. The wire color and identification on the diagrams shall agree with the wire and wire markers installed on the equipment.

   f. Control System Interface
      1) Provide drawings indicating the proposed touchscreen control interfaces’ intended Graphical User Interface (GUI). The GUI shall be an intuitive custom interface that shall be designed in
collaboration with the Owner and Owner’s Representative. The Contractor shall conduct no less than two workshops (initial, finish/approval) with the Owner and submit shop drawings with operational narrative indicating the functionality for the Touchscreen GUI.

D. Provide product data for the following:

1. Product data consisting of manufacturers specifications for each type of product to be installed, and all applicable manufacturer certifications supporting compliance with stated Specifications.
2. Manufacturer’s certificate of acceptance of the qualifications of the installing Contractor to install, test and maintain the manufacturer’s equipment.
3. Proposed format of as-built documentation

E. Provide all submittal requirements under this section as a single package.

1.12 CONTRACTOR CLOSE OUT SUBMITTALS

A. The intent of this Section is to document the newly installed systems, for operation and maintenance during and after the Warranty period. It is intended that the operation and maintenance manuals be exhaustive in the coverage of the system to the extent that they may be used as the sole guide to the troubleshooting, identification, and repair of defective parts.

B. The Close Out documentation requirement of this Section is in addition to Shop Drawing requirements. The information and Drawing sets shall be compiled after system fabrication and testing, and shall incorporate any changes made after Shop Drawing submittal.

C. The Contractor shall provide the following documentation:

1. Maintenance Manuals
   a. Manuals including maintenance instructions and other descriptive material as received from the manufacturers shall be provided that will enable the Owner’s personnel to maintain equipment and test equipment. This documentation shall include descriptions, specifications, theory of operation (where applicable), layout drawings (showing component types and positions), and back-panel and assembly wiring diagrams. In addition to hardcopies, electronic copies, in a Design Consultant approved format, shall be provided.

2. Preventative Maintenance
   a. Instructions shall be provided for preventive maintenance procedures that include examinations, tests, adjustments, and periodic cleaning. The manuals shall provide guidelines for isolating the causes of hardware malfunctions and for localizing faults. The manuals shall provide thorough
instructions on the use of any specialized test equipment needed for hardware maintenance.

3. Maintenance Schedule
   a. A recommended schedule for preventative, routine, and emergency maintenance indicating frequency and response time.

D. Project Record Documents required include:

1. Marked-up copies of Contract Drawings
2. Marked-up copies of Shop Drawings
3. Newly prepared Drawings
4. Marked-up copies of Specifications, Addenda and Change Orders
5. Marked-up Project Data submittals
6. Record Samples
7. Field records for variable and concealed conditions
8. Record information on Work that is recorded only schematically
9. As-built drawings
10. Record drawings
11. Electronic as-built and Owner requirements
12. Completed Inventory Control (Asset Tag) Spreadsheets

E. In addition to the Project Record Drawing requirements set forth in Division 01, as-built drawings shall fully document and be fully developed and provided, and shall include, but not be limited to:

1. Floor Plans
2. Riser Diagrams
3. Block diagrams
4. Point-to-point wiring diagrams
5. Detail of connections to monitors, speakers, signal processors, amplifiers, etc.
6. Details of connections to power sources, including primary and secondary power supplies, uninterrupted power supplies, and grounding
7. Details of surge protection device installation
8. Equipment mounting details
9. Rack/Cabinet layout elevations and details, including heat and load calculations
10. Details of interconnection to data transmission media and data communication network including all hardwire and fiber optic systems

F. Post changes and modifications to the Documents as they occur. Do not wait until the end of the Project.

1. Upon completion of the as built drawings, the Design Consultant may review the as built work with the Contractor.
2. If the as built work is not complete, the Contractor will be so advised and shall complete the work as required.

G. Project Record Drawings shall also be submitted in electronic format, per the Division 01 requirements.
1.13 INTELLECTUAL PROPERTY

A. Patents: Should patented articles, methods, materials apparatus, etc., be used in this Work, the Contractor shall acquire the right to use same. The Contractor shall hold the Owner and their agents harmless for any delay, action, suit, or cost growing out of the patent rights for any device on this Project.

B. Copyrights: Should copyrighted software be used in this Work, the Contractor shall acquire the right to use same. The Contractor shall hold the Owner and their agents harmless for any delay, action, suit, or cost growing out of the copyrights for any software on this Project.

C. License to Use: All software required for the complete operation of the system as specified herein shall be delivered with either full Ownership transferred to the Owner or a non-time limited License to use on each machine it is installed on, including the right to make backup copies.

D. Software Master Source Code: The Owner shall be provided with the master source code for all software developed and installed on the systems provided under this project.

1.14 WARRANTY

A. Manufacturer Warranty: Provide the manufacturer’s standard maintenance and support services for all hardware and software associated with this system at no additional charge for a period of not less than three (3) years. Replacement of equipment shall be included in the Contractor’s System Warranty.

B. Contractor’s System Warranty: The Contractor shall guarantee all labor, workmanship, and materials for a period of one (1) year from the date of Final Completion unless noted otherwise for specific systems. Should a failure occur within the Warranty period to the system, the Contractor shall provide all labor and materials necessary to restore the system to the condition required for the final test and Final Completion for this Contract, at no cost to the Owner.

1. Emergency Warranty work shall include the repair or replacement of components which fail during the warranty period excluding equipment damaged or rendered unserviceable due to apparent and provable misuse, abuse, vandalism or negligence by the Owner’s employees or the public. Apparent and provable as used herein shall mean that the physical evidence indicates what and who caused the damage, e.g., lightning strike, liquid damage, someone other than the Contractor’s technician, etc.

2. Tie ins: During the Warranty period, additional components may be connected to the systems. New devices will be connected in the same manner as shown on the Drawings for this Contract and the existence of the new connections shall not void this Warranty guarantee.

C. Extended Correction Period: Contractor shall provide a price for an extended Warranty and Operations Maintenance Services Agreement for all the Systems as a whole, as detailed within Add Alternate Pricing, located herein.
1.15 DELIVERY, STORAGE, AND HANDLING

A. Handle equipment and components carefully to avoid breakage, impact, denting and scoring finishes. Do not install damaged equipment. Replace and return damaged units to equipment manufacturer.

B. Equipment delivered to the job site shall be opened and inspected immediately upon arriving and compared to the approved Shop Drawing submittal and checked for defects. If the equipment is not correct, the equipment shall be returned to the manufacturer immediately and a new order for the approved equipment shall be placed at no cost to the Owner.

C. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other contaminants. Equipment damaged prior to Final Completion shall be replaced at no cost to the Owner.

D. The required spare stock, as specified herein, shall be stored by the Contractor and provided to the Owner as part of the Owner’s Final Acceptance. The Owner will NOT provide Final Acceptance without the required spare stock. Reference “SPARE PARTS” located within Part 2 for the spare stock required.

1.16 EQUIPMENT PURCHASES

A. Latest Technology

1. Products and materials shall be purchased by the Contractor in a timely manner to meet construction schedules but shall not be purchased so far advanced of the date(s) of installation that they become technologically obsolete or replaced with newer technologies.

2. In the event the manufacturer(s) of submitted products and materials have upgraded or replaced their products and materials with newer or improved technologies at the time of purchase, the newer or improved products or materials shall be provided unless they are incompatible with other components of the Audio-Video system, or so directed by the Design Consultant.

3. Latest technology products and materials shall be operationally and functionally equivalent or superior to the submitted products and materials. These products shall be submitted to the Design Consultant for approval, before ordering.

B. Procurement

1. Contractor shall confirm exact make, model, configuration and accessories through the Product Submittal process prior to placing order.

1.17 ADD ALTERNATE PRICING

A. Provide an additional cost for the following add-alternates:
1. Provide an additional cost for extended Warranty and Operations Maintenance Services Agreement for the Videowall Display System, as a whole, for the following lengths of time. Include a description of the daily, weekly, monthly, and/or annual preventative maintenance schedule, response times, and other pertinent information.
   a. One (1) Year
   b. Two (2) Years
   c. Three (3) Years
   d. Four (4) Years
   e. Five (5) Years

2. Provide a “unit” cost to furnish and install an Anti-Moiré film on one (1) column direct-view LED display (covering 3-sides).

3. Provide a “unit” cost to furnish and install an Anti-Moiré film on the Proscenium direct-view LED display (covering 2 columns with horizontal spanning member).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers for Audio Visual System Equipment and Cabling: Subject to compliance with requirements, manufacturers offering products are subject to approval by the Design Consultant.

B. Acceptable Manufacturers:
   1. Crestron
   2. LG Electronics
   3. Owner Approved Equivalent

C. Refer to Approved Products for individual product examples to understand the Standard of Quality required.

2.2 GENERAL HARDWARE REQUIREMENTS

A. All hardware requirements given are the minimum requirements. Contractor’s product shall meet or exceed these requirements. All devices shall be the manufacturer’s latest model at the time of the equipment submittal. Additionally, the hardware selected shall meet the operational, functional, performance and dimensional requirements specified herein.

B. Approved Equal Substitution: The Contractor may propose an Owner Approved Equal device that meets or exceeds the specifications. Requests for hardware substitution shall be submitted in writing to the Design Consultant and Owner’s Authorized Representative, and include the hardware cut sheet and the exact configuration being proposed, including any related input, output, control, and mounting equipment.
C. Environmental Rating: Equipment shall be rated for continuous operation under the ambient environmental temperature, humidity, and vibration conditions encountered at the installed location. For devices located in harsh environments such as interior uncontrolled or exterior environments, the Contractor shall provide the necessary housings or enclosures to ensure proper equipment operation and performance. The equipment shall meet the following requirements based location:

1. Interior controlled environment: 15 to 45 degrees Celsius dry bulb and 20 to 80 percent relative humidity, non-condensing. Interior office areas shall be considered this type of environment.

D. Exterior environments: 20 degrees to 70 degrees Celsius dry bulb and 5 to 100 percent relative humidity, condensing.

E. Enclosure Accessories: Contractor is responsible for providing fans, shelves, drawers, special power wiring, ground connections, cables, connectors, appurtenances, and adapters of any kind necessary to accommodate the system installation, operation, testing, or maintenance. This includes those accessories required for a clean and organized installation.

2.3 AV SYSTEM ARCHITECTURE

A. The Audio Video Systems shall be integrated systems comprised of video, audio, and control equipment. The input, routing, processing, distribution, output and control of the Audio Video Systems shall be seamless from the user’s perspective.

1. AV equipment shall be compliant with the transport of combined digital audio and video signals in the High-Definition Multimedia Interface (HDMI) format. HDMI components shall support minimum of 6.75 Gbps data rates, Deep Color up to 12-bit, 3D, and HD lossless audio formats.
   a. HDMI interfaces shall support the seamless application of the most current HDCP protocol.
   b. HDMI components shall manage VESA standard EDID communications to provide seamless routing and switching between sources and output devices.

2. Video: The input, routing, distribution, and output shall be at a minimum digital High Definition 1080p (1920x1080 pixels). Digital system sources may include input panels, computer workstations, and video conferencing. Outputs may include LCDs or projectors. Where noted on the block diagram, additional video transport methods shall be utilized including:
   a. HDMI transmission over twisted pair
   b. HDMI transmission over ethernet

3. Audio: Digital or analog input sources shall be processed using a digital signal processor with full software-based sound editing and mixing capabilities, routed to an amplifier, and distributed to speaker zones. Sound sources include audio
from input panels, computer workstations, and DVD or media players. Outputs shall include zoned speakers. Where noted on the block diagram, additional audio transport methods shall be utilized including:

a. HDMI transmission over twisted pair,
b. Microphone level balanced mono audio
c. 70.7 Volt distributed audio

4. Control System: The control component of the AV Systems shall control the selection of video/audio routing. The user interface for the controls shall be a touch screen. The AV Systems shall allow the user to select a source for display on the monitor. Network communications shall utilize TCP/IP network protocol. Where noted on the block diagram, additional control methods shall be utilized including:

a. Voltage relay contact closure
b. Serial interface
c. Infrared communications shall not be used without prior approval in writing by the Design Consultant

2.4 DISPLAYS AND MOUNTING BRACKETS

A. Videowall Displays

1. Provide direct-view LED videowalls as shown on the drawing set.
2. The videowall shall provide the following features:

a. Front accessible for future maintenance
b. Modular cabinet construction with a seamless, edge to edge image
c. Minimum 5,000:1 contrast ratio
d. Minimum 800-nit brightness (after calibration)
e. 16-bit color depth
f. 3,200-9,300K color temperature
g. LED HDR technology
h. 100,000 hours LED lifetime
i. Front accessibility for future service and maintenance
j. 1.5mm pixel pitch or smaller

3. Displays shall be sized as dimensioned within the drawing set.
4. Perform all calibration services necessary for the video wall to ensure that:

a. Each panel has uniform brightness and color chromaticity with other panels in the same videowall
b. Each videowall has uniform brightness and color chromaticity with neighboring videowalls in the same room

5. Test all panels upon unboxing to document any pixels which are inoperable upon receipt.
6. Prior to installation, Contractor shall ensure a dust free environment for installation of the displays. Once installed, Contractor shall protect displays from construction dust and debris until Final Acceptance.

7. Contractor shall protect equipment from metal shavings throughout the installation, until Final Acceptance. All metal fabrication, metal grinding, and metal drilling shall be completed and thoroughly cleaned prior to equipment installation.

8. Include all necessary cabling, send boxes, system controllers, on-board power supplies, mounting hardware, and other hardware for a complete and working system.

9. Include spare parts stock from the same production lot number, refer to “SPARE PARTS” section below for requirements.

10. Approved products:
   a. LG LAPE 2.0mm Series Displays
   b. LG LED Videowall Controllers
   c. Custom Pre-Manufactured LG Mounting Hardware
   d. Approved equivalent

B. Control System

1. Provide a touchpanel control interface and associated AV control processor, as shown in the drawing set.

2. Control system shall provide the following features:
   a. Ethernet or bi-directional serial control of each component requiring control
   b. Each touchpanel shall be minimum 10" screen with custom, unique ‘pages’ and menu systems coordinated with and approved by the Owner
   c. Touchpanels shall provide two-way operation to allow visual control feedback of the system status
   d. The control functions shall include, but are not limited to, the following:
      1) Preset scene selections
      2) System power on/off
      3) Videowall Display on/off, brightness adjustment
      4) Recall of pre-set automated voice announcements over the Public Address system
      5) Coordinate touchpanel color with the architect prior to ordering

3. Password or PIN shall be coordinated with the Owner’s Representative to prevent unauthorized tampering of the systems. Additional protection may be required for advanced control menus.

4. All controls shall be intuitive, and graphical in nature where possible using a room layout

5. Firmware of all devices should be updated to the most recent version, and SIP Intercom functionality should be disabled.

6. Coordinate all needs for IP addresses, firewall access, and other IT related needs with the Owner’s IT department prior to installation.

7. Approved products:
a. Crestron TSW-1060-NC Control Panels, Crestron PRO3 Processor
b. Approved equivalent

2.5 CABLES AND MISCELLANEOUS ACCESSORIES

A. Shielded Cat6A Video Extension Cable
   1. Refer to Category 6A cable requirements within Section 27 15 00.

B. AV Control Cable: RS-232 Serial Data Cable
   1. Serial data cable shall contain two complete sets of foil shielded twisted pair
      signal conductors with a ground conductor and comply with TIA 232.
   2. Connector types shall be as required by the equipment.
   3. Serial data cable shall support transmission of RS-232 signals up to 1,000 feet.
   4. Cable jacket shall be riser rated PVC or plenum rated as required.
   5. Cable characteristics:
      a. Conductor Gauge: 24 AWG (7x32 AWG stranded).
      b. Characteristic Impedance: 100 ohms
      c. Capacitance between paired conductors: 12 pF/ft +/- 2 pF/ft.

C. AV Control Cable: Voltage Relay/Contact Closure
   1. Provide manufacturer approved cable for AV voltage relays and/or contact
      closures.
   2. Coordinate cable and voltage type for relays provided by other Contractors,
      including the Fire Alarm interface and Paging interface.

D. AV Low Voltage Power Supplies
   1. Provide only manufacturer approved low voltage power supplies, where separate
      power supplies are required.
   2. Input: 120 VAC
   3. Output: 12 or 24 VDC
   4. Mounting: Rack mounted

E. Network Patch Cables
   1. Provide Category 6A patch cables as needed.
   2. Comply with Section 27 15 00.

F. Miscellaneous Hardware, Materials, and Associated Equipment:
   1. Furnish and install all hardware, materials, custom panels, wall boxes, floor
      boxes, rack panels and associated equipment for the complete installation of this
      system as designed.
2. Rack Accessories: Provide all rack/cabinet mounting kits and accessories including, but not limited to, fixed shelves, locking slide shelves, horizontal tray, vertical cabling ring section, vertical mounting rail and bracing kits.

3. Cable Accessories: Provide all adapters, connectors, interconnects, and accessories as required to complete the installation of all systems as designed and specified.
   a. Connectors, Adapters, Gender switchers, Patch panels, HDMI, HD-15, F-Type, XLR, 3.5mm mini type cables. Manufacturer: Crestron, Panduit or approved equal.

2.6 SPARE PARTS

A. Contractor shall provide the following spare equipment, to be retained by the Contractor until after successful testing. Determination of quantities shall be provided based on the final design of the system through the approved shop drawing process.

1. LED Panels (Modules or Tiles) – minimum 5% spare stock for each installed display, from the manufacturer’s same production lot as the display, clearly labeled to indicate the associated display’s location
2. Individual LEDs – minimum 5% spare stock for each installed display, from the manufacturer’s same production lot as the display, clearly labeled to indicate the associated display’s location
3. Power Supplies – minimum 5%
4. LED Controllers / Processors – minimum 5%
5. All tools associated with maintenance of the LED panels – 2 sets
6. LED Panel Packaging – (3) sets for future RMA shipping

B. All spare parts shall be tested upon arrival. If any spare parts arrive non-operational or not fully functional, it shall immediately be returned to the manufacturer for repair or replacement.

C. All spare stock shall be neatly packaged and clearly labeled.

D. If the Contractor uses any of the LED panel spare stock during the installation process prior to Final Acceptance, the Contractor shall replace the LED panel spare stock with product from the manufacturer’s same production lot at no cost to the Owner. The Owner will NOT accept an installed display with less than the specified spare stock from the same production lot number.

2.7 PERFORMANCE REQUIREMENTS

A. System Availability: At any given time, the overall AV shall be considered unavailable if the system is not available, not fully or accurately functional, or does not meet performance criteria for the given connection. All AV components shall execute, without degradation, at the scheduled periods and response times for the systems to be considered available. The systems shall operate as specified twenty-four (24) hours per
day, seven 7 days per week. Availability of the overall AV shall be at least 99.99% (52 minutes maximum downtime per year).

2.8 EXTERNAL INTERFACES

A. The Contractor shall coordinate with the Owner or the Owner’s Representative for connectivity of the AV System(s) to the network(s), Public Address, and Emergency Messaging system.

B. Contractor shall include any interfaces to external systems (e.g. Fire Alarm) which may be required by NFPA Code.

2.9 EXPANSION AND SPARES

A. The Contractor shall clearly state limitations of the proposed system in terms of adding additional capacity including limitations for the number of devices per circuit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with requirements and other conditions affecting the performance of the Audio/Visual Systems. Advise Consultant immediately in writing of any discrepancies between field conditions and drawings that affect subject Work. Do not proceed until unsatisfactory conditions have been corrected.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

3.2 ASSET TAGGING

A. Prior to installation, all equipment of greater than $2,000 value, and otherwise as directed by Owner, shall be asset tagged in the DFW Inventory System by the Contractor. Asset tags and inventory control sheet are to be obtained from Owner. Signed, completed inventory control sheet detailing equipment description, location, serial number, label name, if any, and asset number assigned shall be included in as-built documents.

3.3 INSTALLATION

A. Installation shall include the delivery; unloading; setting in place; fastening to walls, floors, ceilings, counters, and other structures where required. Interconnecting wiring of the system components, equipment alignment and adjustments, and all other Work
whether or not expressly required herein which is necessary to result in a complete operational system. Install system in accordance with National and/or Local applicable codes. Install equipment in accordance with manufacturer’s written instructions.

B. During installation, and up to the date of final acceptance, the Contractor shall be under obligation to protect his finished and unfinished Work against damage and loss. In the event of any such loss or damage, the Contractor shall replace or repair such Work or equipment at no cost to Owner.

C. Each installed LED videowall display shall consist of LED panels from the manufacturer’s same lot number to ensure color consistency.

D. Install plumb and level and secured in accordance with manufacturer’s instructions. All LED panel edges shall be seamless.

E. Additional requirements for the installation of Audio Video Systems:

1. Prior to installation of large displays or screens, ensure the wall is constructed to properly support the display or screen. A minimum safety factor of 5:1 shall be used.

2. Program all capable audio video devices EDID so that the system will self-coordinate and lock audio and video signals from source to output device. Signals shall be coordinated to provide native formats from the source to the output where possible.

3. Form separate groups for the following:
   a. Power cables.
   b. Control cables.
   c. Video cables.
   d. Audio cables carrying signals less than -20 dBm.
   e. Audio cables carrying signals between -20 dBm and +20 dBm.
   f. Audio cables carrying signals above +20 dBm.

4. Route all cable and wiring within equipment racks, cabinets and millwork according to function, separating wires of different signal levels (microphone, line level, amplifier output, AC, control, etc.) by as much distance as possible. Neatly arrange, harness and bundle all cable with nylon ties.

5. Observe proper circuit polarity and loudspeaker wiring polarity. Clearly label connections and wires as to function and polarity. Wires patch panels and connectors as follows:

<table>
<thead>
<tr>
<th>WIRE</th>
<th>CONNECTOR</th>
<th>SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red or White</td>
<td>Pin #2</td>
<td>Hi or POS</td>
</tr>
<tr>
<td>Black</td>
<td>Pin #3</td>
<td>Lo or Neg</td>
</tr>
<tr>
<td>Shield</td>
<td>Pin #1</td>
<td>Ground/ Common</td>
</tr>
</tbody>
</table>

6. Cables shall not be wired with a polarity reversal between connectors at either end. Take special care when wiring microphone cables to ensure that constant polarity is maintained.
7. Provide all circuits, balanced and floating, except as noted in these specifications or directed by the Owner at the time of final equalization and testing.

8. Make all solder connections with rosin-core solder. Use temperature-controlled soldering irons rated at least 60 watts for all soldering work. No soldering guns, gas or butane, or temperature-unregulated irons will be allowed on the job site. (The presence of such soldering tools on the job site will constitute evidence of solder connections made with unauthorized tools and will be grounds for rejection of all solder connections in the system and the subsequent re-work of same.)

3.4 TESTING

A. System testing shall be comprised of two phases:

1. Performance Verification Testing
2. Endurance Testing

B. The Contractor shall provide a test plan and procedures for each of the two (2) testing phase. The test plan for each phase of testing shall detail the objectives of all tests. The tests shall clearly demonstrate that the LED displays, software and all components fully comply with the requirements specified herein. The test plan shall be provided at least thirty (30) days prior to the scheduled start of each test. Test plans shall contain at a minimum:

1. Functional procedures including use of any test equipment.
2. Test equipment is to be identified by manufacturer and model.
3. Interconnection of test equipment and steps of operation shall be defined.
4. Test records shall include test equipment serial number, calibration date and calibration certification of test equipment.
5. Expected results required to comply with specifications.
6. Traceability matrix referencing Specification requirements with specific test procedures.
7. Record of test results with witness initials or signature and date performed.
8. Pass or fail evaluation with comments.

C. The test procedures shall provide conformity to all Specification requirements. Satisfactory completion of the test procedure is necessary as a condition of system acceptance.

D. Display calibration shall be performed per manufacturer’s requirements and specifications using equipment defined by the manufacturer.

E. Documentation verification, both interconnects and operationally, shall be part of the test. Where documentation is not in accordance with the installed system interconnect and operating procedures, the system shall not be considered accepted until the system and documentation correlate.

F. The Contractor shall provide the Owner’s Representative a minimum of seven (7) days’ notice to participate in any or all of tests.
G. Test Reports: The Contractor shall prepare, for each test, a test report document that shall certify successful completion of that test. Two (2) copies of the test report shall be submitted to the Owner’s Representative for review and acceptance within seven (7) days following each test. The test report shall contain, at a minimum:

1. Commentary on test results.
2. A listing and discussion of all discrepancies between expected and actual results and of all failures encountered during the test and their resolution.
3. Complete copy of test procedures and test data sheets with annotations showing dates, times, initials, and any other annotations entered during execution of the test.
4. Signatures of persons who performed and witnessed the test.

H. Test Resolution: Any discrepancies or problems discovered during these tests shall be documented and corrected by the Contractor at no cost to Owner. The problems identified in each phase shall be corrected and re-tested. The amount of equipment and system to be re-tested shall be determined by the Owner before any subsequent testing phase is performed.

3.5 PERFORMANCE TESTING:

A. The Contractor shall provide a complete rehearsed demonstration of all system operations, and the Owner’s Representative shall determine that the system performs sufficiently and provides the specified functions. Testing may be witnessed by additional Owner personnel.

B. Performance of system shall equal or exceed criteria stated within the Specification sections.

C. If any part of the LED videowall system does not perform satisfactorily, as determined by the Owner, the Contractor shall make corrections and modifications and schedule new test with the Owner’s Representative.

D. Provide all test equipment required to complete the Performance test. Phase analyzers, extension cables, tools, oscilloscopes, oscillators, test generators, including, but not limited to, a video test generator that emulates the computer scan frequencies required in these specifications, and all other miscellaneous equipment, shall be supplied by the Contractor as necessary to complete testing.

E. Maintain and submit a check-off list of all required tests for reference by the Owner's Representative before the Performance Test begins.

F. The Performance test includes the Contractor and the Owner’s Representative examining all cable trays, equipment placement, and rack wiring to ensure installation was completed in compliance with the specifications.

G. Completion:
1. At successful completion of Performance Test, testing equipment shall be dismantled and removed so as to prevent any damage to displays and surrounding area of work.

2. Re-pack any testing equipment in original containers to be left on site for project use.

H. Termination:

1. Performance Test shall be terminated by the Owner's Representative when:
   a. Individual components, subsystems, or the displays fail to perform as specified.
   b. It is determined that the system is missing components or installation is not complete.

2. Upon termination, corrective work shall be performed, and the Performance Test rescheduled with the Owner's Representative.

3. Re-testing shall be performed by Contractor at no additional expense

I. Contractor shall continue to perform corrective actions and re-test until Performance Test is passed.

3.6 ENDURANCE TESTING:

A. Start Endurance test after:

1. Successful completion of Performance Testing.
2. Correction of deficiencies has been completed.
3. Receipt of written start notification from the Owner's Representative.

B. Monitor all displays during Endurance Testing. Coordinate monitoring with the Owner's Representative.

C. During Endurance Testing, all equipment and components shall be in 100% operating condition with any replacements, updates or maintenance performed prior to beginning testing.

D. Record Endurance Test data on approved forms so as to provide a continuous log of system performance which shall include the following:

1. Date and time for all entries
2. Name of individual making entry
3. Environmental conditions
4. Airport activities in progress
5. Description of all alarm annunciations, responses, corrective actions, and causes of alarms. Classify as to type of alarm
6. Description of all maintenance and adjustment operations performed on system
7. Daily and weekly tabulations
E. Entries of performance data shall be reviewed by Owner’s Representative.

F. Testing Stages:

1. Stage I - Initial Phase Testing:
   a. Testing shall be performed for 24 hours per day, for 10 consecutive calendar days.
   b. Make no repairs, adjustments, or corrections during this stage unless authorized in writing by the Owner’s Representative.
   c. Owner may terminate Stage I testing at any time when the system fails to perform as specified. Upon termination of testing the Contractor shall commence an assessment period as described in Stage II.
   d. If displays experience no emergency, critical failures, or recurring operational failures (defined as same operational failure 3 times in 24 hours or more than 5 times during the 5 days), proceed to Stage III - Final Testing.

2. Stage II - Initial Phase Assessment:
   a. After conclusion of Stage I or termination of testing, identify all failures, determine causes, and repair. Submit report explaining:
      1) Nature of each failure
      2) Corrective action taken
      3) Results of tests performed to verify corrective action as being successful
      4) Recommended point for resumption of testing.
   b. After submission of report, schedule review meeting at job site. Schedule date and time with the Owner’s Representative.
   c. At review meeting, demonstrate that all failures have been corrected by performing verification tests.
   d. Based on report and review meeting, the Owner’s Representative will direct Contractor to repeat Stage I, restart Stage I, or proceed to Stage III - Final Testing.

3. Stage III - Final Phase Testing:
   a. Testing shall be performed for 24 hours per day, for 10 consecutive calendar days.
   b. Make no repairs, adjustments, or corrections during this stage unless authorized in writing by the Owner’s Representative.
   c. Owner may terminate Stage III testing at any time when the system fails to perform as specified. Upon termination of testing the Contractor shall commence an assessment period as described in Stage IV.
   d. If system experiences no emergency, critical failures, or recurring operational failure (defined as same operational failure 3 times in 24 hours or more than 7 times during the 10 days), proceed to Stage IV – Final Phase Assessment.
G. Stage IV - Final Phase Assessment:

1. After conclusion of Stage III or termination of testing, identify all failures, determine causes, and repair. Submit explaining the nature of each failure, corrective action taken, results of tests performed, and recommended point for resumption of testing. Repeat Stage III for failure of final phase assessment.

2. After submission of report schedule review meeting at job site. Schedule date and time with the Owner's Representative.

3. At review meeting, demonstrate that all failures have been corrected by performing verification tests.

4. Based on report and review meeting, the Owner's Representative will approve Endurance Test or direct Contractor to repeat all or part of Stages III and IV.

H. Submit final report of Endurance Testing containing all recorded data.

3.7 DOCUMENTATION

A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.

1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.

2. Provide above closeout documentation as an electronic file in PDF format.

B. Warranty and Maintenance:

1. Record Drawings.

3.8 MAINTENANCE AND SUPPORT

A. Contractor shall provide a price for an extended Warranty and Operations Maintenance Services Agreement for the Systems as a whole.

B. Refer to Part 1 “WARRANTY” Section for additional details.

3.9 TRAINING

A. The following training guidelines shall be followed:

1. By means of training classes augmented by individual instruction as necessary, the Contractor shall fully instruct the Owner's designated staff in the operation, adjustment and maintenance of all products, equipment and subsystems. The Contractor shall be required to provide all training aids (e.g., notebooks, manuals, etc.).
2. All training shall be completed a minimum of one week prior to the system becoming operational and utilized by the Owner. Training schedule is subject to the Owner’s approval.

3. Training shall be conducted by experienced personnel and supported by training aids. An adequate amount of training material shall be provided by the Contractor. The following is considered a minimum:

   a. Operations and flow charts, overall block diagrams, and descriptive material with “screen shot” images for all software
   b. Schematic drawings for each of the hardware components
   c. All procedure manuals, specification manuals, and operating manuals
   d. As-built drawings

4. Participants shall receive individual copies of technical manuals and pertinent documentation 7-days in advance of the training course.

3.10 FINAL ACCEPTANCE

A. After successful completion of the Performance Testing and Endurance Testing, the Contractor shall provide the specified spare stock and closeout documentation to the Owner. Final Acceptance shall occur upon acceptance of all specified closeout documentation and specified spare stock.

END OF SECTION
SECTION 27 51 16 – PUBLIC ADDRESS AND VOICE EVACUATION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.

B. This section includes the minimum requirements for the Public Address/Voice Evacuation (PA/VE) System. The associated Drawing Set, including the General Notes, further specifies the system and is part of the technical specifications.

C. Scope of Work

1. PA/VE Systems Integrator and the Contractor shall furnish and install all work shown on the plans and described in the specifications. All work and costs shall be performed under this Contract.

2. The PA/VE Systems Integrator authorized by the DFW Airport Board is Ford Audio-Video Systems Inc.

3. Demolition work is required for this system and includes deprogramming and carefully removing system components and devices.

4. The Contractor shall maintain the existing PA/VE systems in all operational and occupied areas throughout construction.
   
   a. The Contractor shall understand the existing paging zones and maintain circuit connectivity to speaker zones outside of the construction area.
   
   b. The Contractor shall coordinate programming of speaker zones prior to and after construction such that announcements and evacuation messages are routed and intelligible in the correct zones.

1.2 DEFINITIONS AND TERMS

A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:

1. ANSI American National Standards Institute
2. BICSI Building Industry Consulting Service International
3. CR Communications Room
4. DFW Dallas Fort Worth International Airport
5. IEEE Institute of Electrical and Electronics Engineers
6. LAN Local Area Network
7. NECA National Electrical Contractors Association
8. NEMA National Electric Manufacturers Association
9. NFPA National Fire Protection Association
10. RCDD Registered Communications Distribution Designer
11. RFP Request for Proposal
12. STD Standard
13. TIA Telecommunications Industry Association
14. UL Underwriters Laboratories

1.3 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the Owner.

C. Strictly adhere to all NFPA, BICSI and TIA recommended installation practices when installing the products specified in this section.

D. Contractor’s Qualifications:

1. Firms regularly engaged in the installation of Life Safety systems and that have five (5) years of installation experience with systems similar to that required for this project.
2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked, and the clients will be asked questions relative to the performance of your company.
3. Provide verification that installation personnel responsible have been properly trained to install the products described in this section.
4. Provide a professional engineer, licensed in the State of Texas, for oversight on this project. This person does not have to be working on-site but must be accessible to answer questions and provide weekly status reports. The engineer shall be a full-time employee of the contractor.
5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the Owner.

E. Manufacturer’s Qualifications:

1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.
F. Material and Work specified herein shall comply with the applicable requirements of:

1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2015
5. ANSI/TIA-606-C – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2017
6. ANSI/TIA-607-D – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, 2019
7. ANSI/TIA-942-B – Telecommunications Infrastructure Standard for Data Centers, 2017
8. IEEE 802 – Local Area Network Standard
11. ADA - Americans with Disabilities Act
15. National Electrical Code (NEC), 2017
17. National Fire Protection Association (NFPA)
19. DFW Airport Design Criteria Manual
20. Applicable codes and directives of authorities having jurisdiction

G. Work:

1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.4 CONFLICTS

A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case
of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.

1.5 PERMITS

A. The Contractor shall secure all necessary permits required for the execution of this Work. Work will not start until all permit applications are approved.

1.6 SCHEDULING

A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.

B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.

C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.7 REQUIREMENTS

A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.

B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.

C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.

D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.

E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

A. Comply with provisions of Division 01.
B. Comply with provisions of Section 27 05 00.

C. Provide product data for the following:

1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.

2. Contractor Shop Drawings consisting of no less than arrangement drawings showing physical arrangement of all physical components, floor plans showing locations of components on plans, elevation drawings showing location of components on walls, functional block diagrams showing major interconnections between components and subsystems, and wiring diagrams showing all field installed interconnects. All components and interconnections shall be consistently identified and labeled for cross reference between the drawings.

3. Proposed format of as-built documentation.

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.

1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.

B. Warranty and Maintenance:

1. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer’s recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.

B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.

C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.

D. Provide protective covering during construction to prevent damage or entrance of foreign matter.
E. Contractor is responsible for on-site security of tools, test equipment and materials.

F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

1.12 MATERIAL PURCHASES

A. Latest Technology

1. Products and materials shall be purchased by the Contractor in a timely manner to meet construction schedules but shall not be purchased so far advanced of the date(s) of installation that they become technologically obsolete or replaced with newer technologies.

2. In the event the manufacturer(s) of submitted products and materials have upgraded or replaced their products and materials with newer or improved technologies at the time of purchase, the newer or improved products or materials shall be provided unless they are incompatible with the rest of the PA/VE System, or so directed by the Design Consultant.

3. Latest technology products and materials shall be operationally and functionally equivalent or superior to the submitted products and materials. These products shall be submitted to the Design Consultant for approval, before ordering.

1.13 WARRANTY

A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01. Should a failure occur within the Contractor’s warranty period, the Contractor shall provide all labor and materials necessary to restore the system to the condition required for the Final Test and Acceptance for this Contract, at no cost to the DFW Airport Board.

B. During the Warranty period, new devices may be connected in the same manner as shown on the Drawings for this Contract and the existence of the new connections shall not void this guarantee.
C. At completion of this project, Contractor shall provide to Owner a written quote for extending the existing System Maintenance Agreement to cover components installed or removed by this project. Quote shall itemize added and removed components, and pricing shall be provided as a monthly rate.

D. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Modify the existing Atlas IED PA/VE System as indicated on the plans. The PA/VE System is a fully network based digital system and is specifically designed to intelligibly reproducing live, prerecorded, or assembled voice messages.

B. Fire Alarm (FA) System: The Work shall not alter or compromise in any way the integration with the existing Fire Alarm System listed below.

1. The FA System will initiate any general evacuation alarms; it will initiate FA system strobes and signal the PA/VE system to distribute a prerecorded Voice Evacuation message.

2. Any general evacuation alarms will be initiated manually by DPS from the FA System.

3. The PA/VE System shall initiate any evacuation alarms; it shall signal the FA System to initiate strobes and distribute a recorded or live voice announcement through the PA/VE System. The PA/VE system shall also mute speakers in areas of the terminal where the FA will distribute all audible/visual notifications.

4. The PA/VE System shall mute normal automatic messages and announcements made from microphone stations during a fire alarm, except for those made when Emergency Responder’s ID is used to log into microphone station. Ambient analysis and control shall ensure audio quality is acceptable during evacuation alarms.

5. The PA/VE System provides voltage contact closure output interface for supervisory trouble signal to the Fire Alarm system.

C. Zoned System: The system is comprised of operational public announcement and voice evacuation zones. For system coverage, refer to Public Address zones shown on the drawings.

D. System Architecture: The system features distributed processing, with multiple Announcement Control System (ACS) software controllers. Failed or abnormal performance of any active system component generates a fault to the fault reporting system.
E. Ethernet Network: The entire system operates on a single Ethernet network. The network is designed using a hierarchical star configuration with a Gigabit backbone between all core, intermediate, and edge switches. The network is designed and installed using recognized industry practice and tested in accordance with ANSI/TIA-568.1-D, ANSI/TIA-568.2-D, ANSI/TIA-568.3-D.

F. Software: All system software for every system component is integrated into a single enterprise-class application utilizing a common database.

G. Ambient Noise Analysis and Control: The systems shall include the capability to automatically adjust the volume levels in each zone based on changes in the ambient noise levels in those zones.

1. Each zone that includes a sensor within its boundaries shall have automatic control.
2. The system shall automatically null announcement or program material for that zone to prevent “run-away” or inaccurate volume tracking and shall provide smooth unobtrusive control.
3. Software shall allow for setup of the following parameters:
   a. Automatic, slaved to an automatic channel, or fixed modes.
   b. Configuration of one to four sensors for control of a zone and control of multiple zones from one or more grouped sensors.
   c. Control of threshold, maximum gain allowed and scaling ratio.
   d. Software shall provide for real time monitoring of sensor levels, program levels, output levels, and gain changes.
   e. System shall provide for automatic setup of zones using the integrated system messaging.

H. System Equalization: The system provides for frequency response equalization for each speaker zone output.

1. Filter types shall allow notch, high pass, or low pass.
2. Filters shall have a Q range of 0.055 to 33.
3. Provide eight (8) filters for each zone output.

2.2 MANUFACTURERS
A. Atlas IED
B. Bose Professional Systems

2.3 EQUIPMENT, COMPONENTS, ACCESSORIES
A. Type A, loudspeaker shall be comprised of a 4.5-inch coaxial cone type driver. Enclosure shall be a steel enclosure design equipped with an access panel to facilitate connection in conduit systems. External wiring shall be accomplished via a removable lockable wiring connector with screw-down terminals. The
system shall include a support backing plate to reinforce the ceiling material and tile support rails for use on either 2 ft. by 4 ft. or 2 ft. by 2 ft. ceiling tiles. The assembly can be installed from beneath the ceiling tile. Loudspeaker grilles shall be press-fit, manufactured from 24-gauge perforated steel mesh and finished in white epoxy. The loudspeaker shall be listed to both UL1480 and UL2043.

1. Sensitivity: 90 dB at 1m with 1W input power.
2. Frequency Response: 90 Hz to 20 kHz (+/- 5 dB)
4. Horizontal Coverage: 110 degrees, 800 Hz – 4 kHz.
5. Rated Power: 50 watts continuous.
6. Transformer
   a. Primary Voltage: 70.7V
   b. Primary taps at: 32W, 16W, 8W, 4W.

7. Acceptable product:
   a. Atlas Sound FAP43T-W.
   b. Or approved equal.

B. Type B, compact two-way loudspeaker system. The system shall consist of two-way woofer and tweeter within environment-resistant housing. Each system shall include a stamped powder coated aluminum grille and removable C-shaped mounting bracket.

1. Sensitivity: 90 dB at 1m with 1W input power.
2. Frequency Response: 85 Hz to 16 kHz (+/- 5 dB)
3. Dispersion: 90 by 90 degrees.
4. Rated Power: 100 watts
5. Transformer
   a. Primary Voltage: 70.7V
   b. Primary taps at: 30W, 15W, 7.5W, 3.7W, 2W.

6. Acceptable product:
   a. Atlas Sound SM52T- (B or WH).
   b. Or approved equal.

C. Type C, pendant mounted loudspeaker. The loudspeaker shall be installed above the “baffle ceiling” of the FIS Corridor and FIS Connector as shown on the RCP drawings for Level 3. The loudspeaker shall be attached to the ceiling deck and aimed down towards the baffle ceiling. Typical mounting height will be 12 to 14 feet above the floor. The system shall consist of two-way woofer and tweeter within environment-resistant housing. Each system shall include a stamped powder coated aluminum grille and removable C-shaped mounting bracket.

1. Sensitivity: 90 dB at 1m with 1W input power.
2. Frequency Response: 85 Hz to 16 kHz (+/- 5 dB)
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3. Dispersion: 90 by 90 degrees.
4. Rated Power: 100 watts
5. Transformer
   a. Primary Voltage: 70.7 V
   b. Primary taps at: 30W, 15W, 7.5W, 3.7W, 2W.

6. Acceptable product:
   a. Atlas Sound SM52T-(B or WH).
   b. Or approved equal.

D. Type F, pendant mounted loudspeaker. The loudspeaker shall be installed above the ceiling located in the open space between ceiling panels as shown on sheets TI2.3A5 and TI2.3A6. The loudspeaker system shall consist of a two-way woofer and tweeter within an environment-resistant housing. Each loudspeaker system shall include a color matched “C” bracket.

1. Sensitivity: 88 dB at 1 m with 1W input power.
2. Frequency Response: 115 Hz to 16 kHz (+/- 5 dB).
3. Dispersion: 90 by 90 degrees.
5. Transformer:
   a. Primary Voltage: 70.7 V.
   b. Power taps at: 16W, 8W, 4W and 2W.

6. Acceptable product:
   a. Atlas Sound SM42T-(B or WH).
   b. Or approved equal.

E. Type L, steerable array loudspeaker. The loudspeaker shall be a self-powered digital beam-steering loudspeaker system. The system shall include onboard DSP and 600 watts of amplification. Loudspeaker enclosure shall be extruded aluminum sidewalls, steel end caps, all powder coated and powder-coated aluminum grille.

2. Frequency Response: 75 Hz to 17 kHz (+/- 3 dB)
3. Dispersion: 160 degrees horizontal, vertical software adjustable up to 30 degrees.
4. Rated Power: 600W.
5. Transformer: N/A.
6. Acceptable product:
   a. Bose Professional Panaray® MSA12X.
   b. Or approved equal.
F. Integrated Furniture Speaker. The loudspeaker shall be comprised of a 2.5-inch speaker integrated into the gate area furniture, where shown in the drawing set. Enclosure shall be a plastic enclosure design for recessed installation. External wiring shall be accomplished via a removable 2-position terminal block.

1. Sensitivity: 84 dB (1-watt @ 1-meter).
2. Maximum SPL 92 dB @ 1-meter.
3. Frequency Response: 210 Hz to 16 kHz (+/- 3 dB)
4. Dispersion: 170 degrees conical
6. Transformer: Include an Atlas HT series 70-volt transformer
7. Acceptable product:
   a. Bose Professional FreeSpace 3 Satellite Speaker
   b. Atlas HT series 70-volt transformer
   c. Or approved equal.

G. Loudspeaker Digital Processor: The open-architecture DSP sound processor shall include Dante™ audio networking, 8 x 8 analog audio input with 48 kHz/24-bit audio conversion. A processor shall be supplied for Comm Room RS-4 for a total of one (1) units.

1. Acceptable product:
   a. Bose Professional ControlSpace ESP-880AD Engineered Sound Processor
   b. Or approved equal.

H. Smart Mainframe Power Amplifier System: AtlasIED TitanONE T112 shall house, supply power to, and control up to seven (7) TitanONE Series amplifier cards and a DSP/CPU card. In addition, the Smart Mainframe Power Amplifier shall have a provision to provide digital audio utilizing CobraNet type network audio.

1. The integrated NIC (Network Interface Card) shall include dual ports for redundant network connections.
2. The Smart Mainframe Power Amplifier shall house six (6) active single or dual channel amplifier cards and a seventh (7th) active spare that is automatically engaged in a failure condition.
3. The integrated digital signal processor (DSP) shall provide up to 12 channels of processing to include level control of individual circuits, up to 8 bands of parametric equalization, high pass filter, signal delay, compression (on analog inputs) and ambient analysis control. All setup, monitoring, configuration, testing and control shall be under software control.
4. Ambient Analysis and Control shall be accomplished via an adjustment of signal levels via external noise sensing and/or computer commands. Connections for 24 ambient sensors shall be incorporated via rear panel connections and allow for single or dual sensor control of desired zones.
5. Power Amplifier Cards: The T112 Mainframe with DSP can provide up to twelve (12) main channels of amplification and two (2) backup channels for redundancy. Six of the amplifier cards function as primary cards to drive connected loudspeaker circuits.

6. Automatic Backup Amplifier Switching: The seventh card functions as a redundant backup that is automatically switched to in the event of a card failure.

7. Internal Monitoring: The Smart Mainframe Power Amplifier shall include internal audio bus monitoring and provide for visual as well as audio monitoring of the internal signal chain.

8. Automatic Testing: Testing of the Smart Mainframe Power Amplifier shall be automatic or manually on demand and allow selection of the monitor points in the signal chain internal to the amplifier and current level to the loudspeaker lines and report with a resolution of 0.5dB.

9. Local Inputs: Twelve (12) balanced audio inputs.
10. Input Power: 120VAC (T9160L) utilizing (2) Belden/Volex 17250
    a. No power to amplifiers, quiescent: 75W
    b. 6 power amplifier cards, quiescent: 387W
    c. 6 power amplifier cards (1/8 power): 875W
    d. 6 power amplifier cards (Full Power): 4080W.

11. Audio Distribution: CobraNet based network audio
12. Maximum Number of Cards: Shall support up to 7 digital amplifier cards
13. Maximum Number of Paging Zones Assignable to Frame: 12 Zones
14. Maximum Number of Amplifier/Loudspeaker Outputs: 12 total zones.
15. Maximum Number of Local Program/BGM Inputs: 12 balanced audio inputs.
16. Rack Units: 4 RUs, 7” vertical space in a 19” wide equipment cabinet.
17. Network Audio: (2) 100 Base-T modular-8 RJ-45, one primary and one redundant.
18. Control: (1) 100 Base-T modular-8 RJ-45.
19. Operating Temperature Range: +32 degrees F to 104 degrees F.

I. Digital Amplifier Cards: The TitanONE dual channel power amplifier modules are Class D, switch mode. Switch mode operation combined with high voltage MOSFET devices make it possible to eliminate transformers. The amplifier card contains no onboard attenuation controls. Attenuation is handled by the TitanONET112 Smart Mainframe.

1. Acceptable products:
   a. AtlasIED T602-120V-T1, 2 channels, 300W, 70V.
   b. Or approved equal.

J. Titan Line Driver: Provide line output modules as necessary to interface Titan IED to Dante™ loudspeaker system.

1. Acceptable products:
a. IED T2LD-120V Line Driver.
b. Approved Equal

K. Ambient Noise Sensor Collector: The T112 has connectors on the rear of the chassis for up to twenty-four (24) IED540S ambient analysis sensors. One or two sensors can be used per main amplifier channel. Each ambient sensor intelligently reports the noise level at its location.

L. Ambient Analysis Sensors: IED Model 540S. Provide omni-directional condenser microphone capable of monitoring the ambient sound level of a space using an A-weighted curve, allowing the system to adjust the speaker output level. The sensor shall contain a preamplifier and analog conversion module to convert the signal for input to the ambient analysis system.

1. Mounting: 2-gang junction box
2. Finish: Stainless Steel

M. Paging Microphone: Fully programmable touch screen user interface units shall be supplied.

1. Acceptable products:
   a. IED550CSH Desktop Unit with Handheld Microphone.
   b. IED570CH Wall Mount Unit with Handheld Microphone.

N. End of Line Filter Module: IED Model 596EOL. Provide module to monitor the integrity of a single continuous series-wired speaker circuit.

O. Loudspeaker Cable: Trunk loudspeaker cable to Zone Tie Box shall be 12 AWG, stranded, unshielded twisted pair.

1. Acceptable product:
   a. West Penn 25227B
   b. Or approved equal

P. Branch loudspeaker cable shall be 14 AWG, stranded, unshielded twisted pair. Maximum distance for total load of 200 watts is 300 ft.

1. Acceptable product:
   a. West Penn 25226B.
   b. Or approved equal.

Q. Ambient Noise Sensor Cable: Shielded twisted pair at 20 AWG tinned-copper conductors; color coded, low-loss polyethylene insulation; with 20 AWG stranded tinned copper drain wire shielded, or as recommended by the equipment manufacturer.

R. UTP Cable: Refer to Section 27 15 00.
S. Homerun Conduits: Speaker circuit home run conduits from the Zone Tie Box (ZTB) to the first speaker in each zone shall be sized to allow future installation of Circuit Integrity cable. These conduits shall be supported every five feet. When speaker circuit home runs for multiple zones are combined in the same conduit, the conduit shall be sized so that the same quantity of installed speaker cables could be replaced with a 0.42" outside diameter fire alarm speaker cable(s) without exceeding NFPA 70 fill ratios.

2.4 DESIGN CRITERIA

A. Programming: The Contractor shall coordinate all hardware and software requirements for Public Address and Voice Evacuation functionality with the DFW Board. This shall include, but is not limited to network connectivity, paging priorities, digital message assembly, system access, microphone paging, paging station button functionality and screens.

B. Levels and Intelligibility: The system shall meet all code requirements for a Voice Evacuation system including power, circuit monitoring and integrity, notification, and survivability. The Contractor shall optimize the system to maximize intelligibility as limited by the architectural acoustics of each space. This shall include adjustments to levels, equalization, timing, and other software tuning.

1. The audio distributed by the sound system shall be 15dB above the ambient background level in all zoned areas.
2. The audio distributed by the sound system shall not vary more than 3dB throughout a public address zone.
3. The following values were used for initial design: ambient sound level of 80dBA in bag make-up and mechanical spaces, and an ambient sound level of 60dBA in all other spaces including those occupied by the travelling public.

C. Digital Message Distribution Operation: The system shall be provided so all voice messages are intelligible at destination areas. Messages shall be coordinated such that dissimilar messages are not distributed within the same area at a given time. Messages shall not be lost due to coordination or priority preemption, unless they are no longer timely.

D. Background Music: Background music distributed over the PA/VE System shall be ducked or muted for any page message within the area affected by the page message. Priority shall be assigned such that emergency paging function shall immediately cancel all other audio announcements or messages in the affected zones. Local paging functions shall have a higher priority than background music, and recorded messages in the local paging zone. Recorded messages shall override background music in all zones.

E. Fault Tolerance and Degraded Mode Operations: The system design shall be based on distributed intelligence. All equipment shall be powered by a high-quality UPS as required by code. Failed or abnormal performance of any active
system component shall generate a supervisory signal at the local paging interface, system workstation, and notify the FA System. The system shall be tied into the FA system for reporting of trouble alarms. Coordinate with the DFW Board to determine which PA/VE system faults send a code required trouble signal to the Fire Alarm System. Standby amplifier channels shall automatically take over for failed amplifier channels. Amplifier outputs shall be protected so they can survive a shorted output line while reporting an off normal condition to the system workstations.

F. LAN Distribution: The system shall be capable of distributing data between PA/VE nodes and from microphone stations to PA/VE nodes utilizing TCP/IP protocol over the DFW Airport Board Ethernet LAN. LAN switches are provided by the DFW Board.

G. Multi-Zone Operation: The system shall perform simultaneous distribution of independent announcements or messages to different zones or groups of zones. The system shall be capable of distributing a minimum of 8 different concurrent messages from any given public address node.

H. Ambient Noise Analysis System: The Ambient Noise Analysis system shall adjust signal levels in response to either ambient noise levels or computer commands. Three (3) modes of operation shall be possible:

1. Automatic: Changes attenuation levels in response to noise levels reported by remote sensors.
2. Controlled: Changes attenuation levels based on remote sensors of automatic channel.
3. Fixed Attenuation: Fixed attenuation as set by the computer and User.

I. High-Quality Sound Reproduction: The system shall provide clean audio, free from noises such as pops, clicks, hiss/hum and access/disconnect tones at all loudspeakers at all times during operation including standby mode. Distortion shall be within specified limits.

J. Capacity: At each equipment location, provide 20 percent spare system capacity including, but not limited to all amplifier card slots, inputs, outputs, patch ports, terminal strip positions, etc.

PART 3 - EXECUTION

3.1 INSTALLERS

A. The Contractor must currently be and have been in the business of selling, installing, and maintaining similar systems at large international Airport for a minimum of five (5) years. The Contractor must have been actively engaged in designing, installing, maintaining and operating similar systems and services as outlined in this document. The Contractor shall be an IED Master Certified Contractor.
B. The Contractor must be a Certified Installer of Innovative Electronic Designs, Inc. (IED) products, holding all current necessary certifications.

C. The Contractor must have a minimum of three (3) sites that are actively using the same or similar solutions, and each of those solutions must be currently in operation and have been in operation for at least the preceding twelve (12) months.

D. Code Certification: The Contractor shall be certified to install and maintain voice evacuation systems that are NFPA 72 certified. The Contractor shall hold a current State of Texas Fire Alarm Contractor License.

E. System Specific Certification: The Contractor shall have a working knowledge of the specified digital audio signal processing and amplification equipment. A current IED Titan Certification or equivalent is required.

F. The Contractor shall have a fully staffed service department capable of responding to system needs as specified. The minimum requirement is a fully staffed service department within 60 miles of the Dallas/Fort Worth International Airport.

3.2 EXAMINATION

A. Refer to Section 27 05 00.

3.3 INSTALLATION AND APPLICATION

A. Refer to Section 27 05 00.

B. Refer to Section 27 05 28 for pathway and raceway requirements.

1. Junction and outlet box sizes shall be in accordance with the NEC, Article 314.28. Minimum box size shall be 4-11/16-inches square.

C. Special Techniques

1. Arrange equipment within cabinets to provide adequate ventilation and access.
2. Properly ground system per applicable Sections.
3. Support backboards and cabinets under the provisions of Divisions 26 and 27, or as required by manufacturer's instructions if more restrictive.
4. Cable and Wiring
   a. Refer to 27 05 53 for conduit labeling requirements.
   b. Installation of conductors shall comply with Division 27 Section 27 15 00 “Communications Copper Horizontal Cabling,” and meet all applicable manufacturer recommendations, local, state and national codes.
c. Grounding Cable Shields: All shields and pair shields shall be grounded at one (1) point only. Cables that originate from processing equipment and serve field devices shall be grounded to the signal ground terminal in the processing equipment.

d. Install PA/VE System wiring away from any surface that may become hot, including and not limited to, hot water piping and heating ducts.

e. Raceway for PA/VE System wiring shall not be shared by power or any other electrical wiring that is not part of the low-voltage public address systems.

f. Microphone cabling shall be isolated from power, speaker, and ambient sensor cabling.

g. Speaker cabling shall be isolated from power, microphone, and ambient sensor cabling.

h. Ambient Sensor cabling shall be isolated from power, microphone, and speaker cabling.

i. Speaker circuits shall be wired in a single circuit each without paralleled branches.

j. Connect speaker circuit shield to equipment ground only at amplifier.

k. Provide protection for exposed cables where subject to damage.

l. Use suitable cable fittings and connectors.

m. All cables shall be cut to the length dictated by the run. No splices shall be permitted in any pull boxes. For equipment mounted in drawers or on slides, the interconnecting cables shall be provided with a service loop of appropriate length.

n. Install all cables no closer than 12” from any horizontal or backbone cabling, power system cable/raceway, or fluorescent/ballasted light fixtures.

o. Leave a minimum of 12” excess cable at each termination at speaker and termination blocks.

p. Leave a minimum of 12’ excess cable at the central system equipment/rack.

q. Provide protection for exposed cables where subject to damage.

r. Cables shall not be installed with a bend radius less than that specified by the cable manufacturer.

s. Label cable at both ends indicating the originating and terminating location of each end with plain English language descriptor identifying the zone and/or function. This labeling/identification shall be fully documented in as-built drawings. Physical zone descriptions shall be posted at zone tie boxes and key to cable identification labels.

t. Test polarity of existing speaker circuits and for shorts prior to connecting wiring to new amplifier.

u. Final connections, balancing, adjustments, testing, etc. shall be by factory trained technicians. When system is complete, it shall be demonstrated to owner’s representative who shall be given complete instructions, part, manuals and maintenance information.
D. Interface with Other Work: Refer to “System Description” in Part 2 for interface requirements.

E. Systems Integration: Refer to “System Description” in Part 2 for integration requirements.

3.4 FIELD QUALITY CONTROL

A. Refer to Section 27 05 00.

B. Phases of Testing: Provide the phased testing in the sequence listed below.
   1. Pre-Testing: Refer to testing requirements below.
   2. Factory Acceptance Testing: Refer to testing requirements below.
   3. Integration Testing: Refer to testing requirements below.
   4. Final Test and Completion (FTC): Refer to testing requirements below.

C. Pre-Testing: Prior to any work on the system, the Contractor shall complete pre-testing for any speakers to be reused. Pre-testing shall consist of feeding pink noise into the system using octaves centered at 4,000 and 500 Hz. Use a sound level meter with octave band filters to measure the level at each speaker measured at a distance of 36” (thirty-six inches) for each speaker. The Contractor shall record this measurement in the Shop Submittal Drawings in AutoCAD Format. The Owner shall be notified of any deficiencies observed in pre-testing. At the Owner’s Discretion the Contractor shall replace malfunctioning or damaged items with new, and retest until satisfactory performance and conditions are achieved. A unit price shall be provided for a new surface or flush mounted speaker. This test shall be performed in off hours and in the presence of a representative of the DFW Board. The pretesting shall also include an Acoustic Coverage Test.

D. Factory Acceptance Testing: Refer to Section 27 05 00.

E. Final Test and Completion (FTC)
   1. Testing and completion shall comply with NFPA 72, 2013 Ed.
   2. Operational Test: Perform an operational system test to verify conformance of system to these Specifications. Perform tests that include originating program material distribution, page material distribution, message distribution coordination, zone distribution selection, message assembly, system supervisory, alarm and monitoring functions, ambient noise control functionality, and paging operator workstation features. Observe sound reproduction for proper volume levels and freedom from noise. All zones shall be included in the test.
   3. Signal-To-Noise Ratio Test: Measure the ratio of signal to noise of the complete system at normal gain settings using the following procedure: Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1,000, 3,000, 8,000, and 12,000, Hz into each pre-amp channel and measure the distortion in
the power amplifier output. The maximum distortion at any frequency is three percent (3%) total harmonics.

4. Acoustic Coverage Test: Feed pink noise into the system using octaves centered at 4,000 and 500 Hz. Use a sound level meter with octave band filters to measure the level at approximately 40-foot spacing intervals in each zone. For spaces with seated audiences, the maximum permissible variation in level is plus or minus 2 dB and the levels between locations in the same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.

5. Power Output Test: Measure the electrical power output of each power amplifier at normal gain setting at 50, 1,000, and 12,000 Hz. The maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.

6. The documentation of tests, measurements and adjustments performed shall include a list of personnel and the list of certified test equipment used.

7. All information recorded from all testing shall be shown on the as-built documents.

F. Manufacturer: Provide manufacturer field quality control to assure that all systems and components adhere to the manufacturer’s requirements.

G. System Startup: Pre-test: Once all system components are installed, perform pre-testing to ensure all components are correctly connected and installed. Adjust and balance the audio system to meet all requirements.

H. Adjustment: Adjust all system components as necessary to meet system requirements.

1. This includes but is not limited to balancing audio levels, adjusting speaker locations, adjusting speaker tap settings, etc. Tap settings shown on the drawing plans are minimums. The Contractor shall tap all speakers within a zone to the highest setting possible for the specified amplifier.

2. Replace all damage or malfunctioning equipment prior to closeout activities and perform additional field quality control and system startup testing as necessary.

3. All adjustments shall be at the Contractor’s expense.

3.5 CLOSEOUT ACTIVITIES

A. Refer to Section 27 05 00.

B. Operational Conformity Test: Where existing speakers are reused, perform the operational conformity test verifying speakers operate in the same manner as they were previously installed based on the original Pretest measurements. The Contractor shall record this measurement in the Record Drawings in AutoCAD Format. Observe sound reproduction for proper volume levels and freedom from
noise. This test shall be performed in off hours and in the presence of a representative of the DFW Board.

3.6 MAINTENANCE

A. System Certification: Upon successful completion of the installation and subsequent inspection, DFW shall be provided with a numbered certificate, from the manufacturing company, registering the installation (if applicable).

B. Support Availability: The Contractor shall commit to make available local support as noted in the Warranty section.

C. Provide the manufacturer’s standard maintenance and support services for all hardware and software associated with this system at no additional charge for a period of not less than one (1) year.

D. It may be the responsibility of the DFW Board or the DFW Board operator’s representative to provide the operational maintenance and support of the installed system after the warranty and maintenance period. Coordination through the DFW Board, or the DFW Board operator’s representative shall be required by the installation Contractor to ensure that all documentation for the manufacturer’s maintenance and support programs are in place.

E. Contractor shall provide a proposal for an Extended Warranty as noted in the Warranty section of this Specification. The proposal shall include all warranty items noted in this Section.

F. All lead technicians performing installation shall have a minimum of two (2) years’ experience on the proposed system and be manufacturer certified on all hardware/software applications prior to work.

END OF SECTION
1.1 SUMMARY

A. Electronic Access Control Systems
B. Video Surveillance Systems
C. Grounding and Bonding
D. Cable Pathways
E. Cable management

1.2 RELATED WORK SPECIFIED UNDER OTHER DIVISIONS

A. Foundations and pads required for equipment furnished under this Division.
B. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting.
C. Flashing of conduits into roofing and outside walls.
D. Heating, ventilating and air conditioning equipment.
E. Electrical service to equipment rooms.
F. Cutting and patching for low voltage systems work, except for errors and omissions under this Division.

1.3 QUALITY ASSURANCE

A. Comply with applicable local, state and federal codes.
B. The Texas Department of Public Safety requires that portions of this work defined as regulated under the provisions of SB 1252, 78th Legislative Session of the State of Texas be performed by a contractor holding a valid and current Class B Security Contractor Company License.
C. Comply with applicable requirements of recognized industry associations which produce standards for the various trades.
D. Warrant Work under this specification against faulty material or Workmanship in accordance with Division 01. If the project is occupied or the systems placed in operation in several phases at the request of the Owner, then the warranty of each system or piece of equipment used shall begin on the date of substantial completion for each phase. The use of building equipment for temporary service and testing does not constitute the beginning of the warranty.

E. Equipment and material provided under this Division shall be periodically inspected and serviced by competent installers. This function becomes the responsibility of the Owner once the system is accepted by the Owner. The one-year material and workmanship warranty is not intended to supersede normal inspection or service and shall not be construed to mean the Contractor shall provide free service for normal maintenance items such as periodic cleaning and adjustment due to normal use, nor to correct without charge, breakage, maladjustment and other trouble caused by improper maintenance.

F. Upon completion of contract and progressively as work proceeds, clean-up and remove dirt, debris and scrap materials. Maintain the premises in a neat and clean condition at all times during construction. Protect and preserve access to head-end equipment at all times. Clean items with factory finishes. Touch-up minor damage to surfaces; refinish entire piece of equipment when sustained major damage. All electronics must be protected from dust and other airborne debris. Contractor shall identify all types of quality control mechanisms they employ. List all types.

1.4 STANDARDS

A. The Contractor’s performance of the Work shall comply with applicable federal, state and local laws, rules and regulations. The Contractor shall give required notices, shall procure necessary governmental licenses, permits, and inspections and shall pay without burden to The Owner, all fees and charges in connection therewith unless specifically provided otherwise. In the event of violation, the Contractor shall pay all fines and penalties, including attorney’s fees and other defense costs and expenses in connection therewith.

B. Federal Communications Commission

1. Equipment requiring FCC registration or approval shall have received such approval and shall be appropriately identified.

C. Codes, Standards and Ordinances

1. Design, manufacture, test and install telecommunications cabling networks per manufacturer’s requirements and in accordance with the National Electrical Code, state codes, local codes, requirements of authorities having jurisdiction and particularly the following standards:

   a. NECA 1 – Standard for Good Workmanship in Electrical Construction, 2015
c. ANSI/TIA-568.0-D-1 – Generic Telecommunications Cabling for Customer Premises – Addendum 1, 2017

d. ANSI/TIA-568.1-D – Commercial Building Telecommunications Infrastructure Standard, 2015

e. ANSI/TIA-568.1-D-1 – Commercial Building Telecommunications Infrastructure Standard – Addendum 1: Updated References, Accommodation of New Media Types, 2018

f. ANSI/TIA-606-C – Administration Standard for Telecommunications Infrastructure, 2017

g. ANSI/TIA-607-C – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, 2015

h. NFPA 70 – National Electrical Code, 2017

i. Federal, state, and local codes, rules, regulations, and ordinances governing the Work, are as fully part of the specifications as if herein repeated or hereto attached. If the Contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the Owner’s Representative in writing. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.


k. Underwriters Laboratories, Inc. (UL): UL 1479 – Tests of Through-Penetration Firestop Systems

l. Americans with Disabilities Accessibility Guidelines

m. Code of Federal Regulations, Title 29, Chapter XVII, Part 1910 (OSHA)

n. Uniform Building Code (UBC)

o. International Building Code (IBC)

p. Texas Department of State Health Services (TDSHS)

q. Texas Department of Public Safety (TxDPS)

r. DFW Airport Design Criteria Manual

s. Applicable codes and directives of authorities having jurisdiction

1.5 COMPLETENESS OF WORK

A. The Contract Documents depict low voltage systems which are intended to be complete and functioning systems. All products, materials, labor, and programming necessary to render a fully functional system to fulfill the design intent shown on the documents shall be provided by the Contractor.

B. Catalog numbers referenced throughout this Division’s drawings and specifications are intended to convey a general understanding of the type of quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra charge shall be allowed because a catalog number is found to be incomplete or obsolete.

1.6 PRE-INSTALLATION CONFERENCE
A. Arrange and schedule pre-installation conference prior to beginning any work of this section Communications.

B. Agenda: Clarify questions in writing related to work to be performed, scheduling, coordination, etc. with consultant and/or project manager/Owner representative.

C. All individuals, who will be in an on-site supervisory capacity, shall be required to attend the pre-installation conference. This includes project managers, site supervisor and lead installers. Individuals who do not attend the conference will not be permitted to supervise the personnel that install, terminate or test communications cables on the project. The Contractor’s RCDD that will oversee the installation is required to attend the pre-installation conference.

D. The manufacturer that will be providing the extended warranty is required to have a representative attend the pre-installation conference.

1.7 SEQUENCE AND SCHEDULING

A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and if accepted will be used to track work status.

B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.

C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

D. Submit schedule for installation of equipment and cabling. Indicate delivery, installation and testing for conformance to specific job completion dates. As a minimum, dates are to be provided for bid award, installation start date, completion of station cabling, completion of riser cabling, completion of testing and labeling, cutover, completion of the final punch list, start of demolition, Owner acceptance and demolition completion.

1.8 SUBMITTALS

A. Comply with provisions of Division 01.

B. Provide all submittal requirements under this section as a single package.

1.9 ALTERNATES, SUBSTITUTIONS AND CHANGE ORDERS

A. If a proposed alternate material is equal to or exceeds specified requirements, Contractor shall provide manufacturer’s specifications in writing for written approval.
prior to purchase and installation of proposed materials. The proposed material substitution shall not void or change manufacturer’s warranty.

B. Contractor shall provide a complete cabling infrastructure according to these written specifications and drawings. If the Owner changes the scope of work to be performed by the Contractor, it shall be in writing. Contractor shall respond to these changes with a complete material list, labor, and taxes in writing presented to the Owner for approval. Contractor shall not proceed with additional scope of work without a signed approval by the Owner.

C. Additional work performed by the Contractor will not be paid by Owner without signed approval of these changes prior to implementing changes. Submit a copy of signed change order upon billing.

1.10 USE OF THE SITE

A. Use of the site shall be at the Owner’s direction in matters in which the Owner deems it necessary to place restriction.

B. Access to the building wherein the Work is performed shall be as directed by the Owner.

C. The Owner will occupy the premises during the entire period of construction for conducting his or her normal business operations. Cooperate with the Owner to minimize conflict and to facilitate the owner’s operations.

D. Schedule necessary shutdowns of plant services with the Owner and obtain written permission from the Owner. Refer to article - CONTINUITY OF SERVICES herein.

E. Proceed with the Work without interfering with ordinary use of streets, aisles, passages, exits and operations of the Owner.

F. All Contractor personnel must check in with the facilities engineering department and/or the General Contractor upon arrival and upon departure.

1.11 DELIVERY AND STORAGE

A. Insofar as possible, deliver items in manufacturers’ original unopened packaging. Where this is not practical, cover items with protective materials, to keep them from being damaged. Use care in loading, transporting, unloading and storage to keep items from being damaged.

B. Store items in a clean dry place and protect from damage.

C. Storage space on project site may be limited. The Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.

D. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
E. Provide protective covering during construction to prevent damage or entrance of foreign matter.

F. Contractor is responsible for on-site security of tools, test equipment and materials.

G. Replace at no expense to the Owner, product damaged during transporting, storage, handling or the course of construction.

1.12 CONTRACTOR CLOSE OUT SUBMITTALS

A. Submit Closeout documentation in accordance with Division 1 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 1 of the Project Manual, or a minimum of four (4) sets.

   1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues
   2. Test reports on all systems (electronic file format and hard copy)
   3. As-built door and device schedules
   4. As built documentation of all systems installed under this project
   5. As built documentation of TR modifications and associated cabinet and wall elevations

B. Warranty and Maintenance:

   1. Test Report Binder(s)
   2. Record Drawings

1.13 RECORD DRAWINGS

A. Keep a hard copy set of project drawings at the job site exclusively for recording deviations from the Construction Drawings.

B. Record locations and depths of buried and concealed conduits from fixed, easily identifiable objects, such as building walls. Where conduits are concealed in walls, indicate distances off of building corners or other building features not likely to be disturbed by future alterations.

C. Mark deviations in a different color so that work of various systems can be easily identified.

D. When Work is completed, record all deviations in an electronic format using AutoCAD 2007 in a format usable to the Owner. Coordinate this format with the Owner.

E. Submit two copies of completed "record drawings" on electronic media such as CD or DVD to Owner's Representative for distribution.

PART 2 – PRODUCTS

Contract No. 9500700
Terminal D
Gate Area of the Future

28 05 00 - 6

Issued for Bid

Common Work Results for

January 17, 2020

Electronic Safety and Security
2.1 MATERIALS AND EQUIPMENT

A. All materials and equipment used in carrying out these specifications are to be new and have UL listing, or listing by other recognized testing laboratory when such listings are available.

B. Model numbers and manufacturers included in this specification are listed to establish as standard of product quality.

C. Other qualified manufacturers may be substituted only with The Owner’s written consent. To request a substitution, the Contractor shall submit complete technical data, samples, and if requested, results of independent testing laboratory tests of proposed equipment.

1. If the proposed System includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review.

2. Material not specifically identified within this document, but which is required for the successful implementation of the intended system(s), shall be of the same class and quality as the specified material and equipment.

3. Include a list of previously installed projects using proposed equipment that are similar in nature to specified system.

PART 3 – EXECUTION

3.1 COORDINATION

A. Insofar as it is possible to determine in advance, advise the General Contractor to leave proper chases and openings. Place all outlets, anchors, sleeves, and supports prior to pouring concrete or installation of masonry work. Should the Contractor neglect doing this, any cutting and/or patching required is to be done at this Contractor’s expense. Visit site and be informed of conditions under which work must be performed. No subsequent allowance will be made because of error or failure to obtain necessary information to completely estimate and perform work involved.

B. Carefully coordinate with other divisions to ensure proper power requirements, grounding, fireproofing and interlocking controls between the fire alarm system, security system, and other owner furnished systems.

C. Notify other tradesmen of any deviations or special conditions necessary for the installation of work. Interferences between work of various Contractors to be resolved prior to installation. Work installed not in compliance with specifications and drawings and without properly checking and coordinating as specified above shall, if necessary, be removed and properly reinstalled without additional cost to the Owner.

D. The Owner or the Owner’s Representative shall be the mediating authority in all deviation and disputes arising on project.
E. Coordinate with local telephone and cable service providers to assure that proper points of service, demarcation location and grounding requirements are in accordance with contract drawings. Duct bank is to be provided by Division 26. This Contractor shall be involved regarding discussions about services to the building.

1. Coordinate with other trades to provide wall and ceiling access panels wherever required for access to communication equipment.

F. Intent:

1. These sections of specifications and drawings form a complete set of documents for communications systems for this project. Neither is complete without the other. Any item mentioned in one shall be as binding as though mentioned in both.

2. The intent of these specifications and drawings is to form a guide for a complete systems installation. Where an item is reasonably necessary for a complete system but not specifically mentioned, such as pull boxes, fittings, expansion fittings, support hangers, etc. provide same without additional cost to Owner.

3. Communication equipment room layouts indicated on drawings are diagrammatical only. The exact location of outlets and equipment to be coordinated and governed by project conditions. The Designer reserves the right to make any reasonable changes (approximately 6 feet) in location of junction boxes or equipment prior to roughing in of such without additional cost to Owner.

G. Deviations:

1. No deviations from specifications and drawings to be made without full knowledge and consent of the Designer.

2. Should the Contractor find during progress of work that existing conditions make desirable a modification of the requirements of any particular item, report such item promptly to the Designer for his decision and instructions.

H. Main Horizontal Pathway/Raceway:

1. Unless otherwise noted on the drawings, all communications/low voltage systems cabling shall be routed above accessible corridor ceilings parallel to room walls and corridors via cable tray or J-hook supports. Cabling shall be segregated by function as follows:

a. Voice/data cabling
b. All other systems

3.2 CONTINUITY OF SERVICES

A. The Contractor shall not take any action that will interfere with, or interrupt, existing building services unless previous arrangements have been made with the owner’s representative. Arrange the Work to minimize shutdown time.

B. Owner’s personnel will perform shutdown of operating systems. The Contractor shall give three (3) days’ advance notice for systems shutdown.
C. Should services be inadvertently interrupted, immediately furnish labor, including overtime, material, and equipment necessary for prompt restoration of interrupted service.

3.3 TRENCHING, EXCAVATION, BACKFILLING AND REPAIRS

A. Trenching, Excavation and Backfilling is the responsibility of the General Contractor. This Contractor is to coordinate all requirements with the GC. Failure to properly coordinate this effort resulting in additional trenching, excavation, backfilling or repairs shall be performed without additional cost to Owner.

3.4 PLYWOOD BACKBOARD AND WALL BACKING

A. Contractor shall provide 4' W x 8' H x 3/4" D fire retardant plywood backboard as indicated in all Communication Rooms. Plywood is to be painted with two coats of flat white fire retardant paint on all six sides and installed 6" above finished floor. The fire rating on the plywood shall be masked prior to painting and the mask removed after installation such that the fire rating is always visible.

B. General Contractor is to provide appropriate backing in walls as required for mounting brackets and other wall mounted equipment per manufacturer requirements.

C. Where work is to be done in an existing Telecommunication Room (TR), the Contractor shall ensure plywood in the TR is flame retardant. If the existing plywood does not comply the Contractor shall replace it with plywood compliant with 3.4-A.

3.5 FIRESTOPPING

A. Select appropriate type or types of through penetration firestop devices or systems appropriate for each type of communications penetration and base each selection on criteria specified herein.

B. Selected systems shall not be less than the hourly time delay ratings indicated in the Contract Documents for each respective fire-rated floor, wall or other partition of building construction. Firestop for each type of communications penetration shall conform to requirements of an independent testing laboratory design drawing or manufacturer's approved modification when used in conjunction with details shown on the Drawings.

C. Perform all necessary coordination with trades constructing floors, walls or other partitions of building construction with respect to size and shape of each opening to be constructed and device or system approved for use in each instance.

D. Coordinate each firestop selection with adjacent Work for dimensional or other interference and for feasibility. In areas accessible to public and other "finished" areas, firestop systems Work shall be selected, installed and finished to the quality of adjacent surfaces of building construction being penetrated.
E. Use materials that have no irritating or objectionable odors when firestopping is required in existing buildings and areas that are occupied.

F. Provide damming materials, plates, wires, restricting collars and devices necessary for proper installation of Firestopping. Remove combustible installation aids after firestopping material has cured.

G. All firestops shall be installed in accordance with the manufacturer's instructions in order to maintain the specific rating assigned by the independent testing laboratory.

H. Existing raceways, cable trays and cabling that penetrate existing building construction shall be firestopped to the extent necessary to fill cavities that may exist between existing building construction and existing communications penetrations or existing conduit sleeve, and between existing conduits and existing conduit sleeve.

I. If required by inspecting authorities:
   1. Expose and remove Firestopping to the extent directed by inspecting authority to permit his or her inspection
   2. Reinstall new firestopping and restore Work where removed for inspection

3.6 TESTS

A. On completion of Work, installation shall be entirely free of damaged conductors, software errors, incomplete jack termination including labeling and faceplates and dust. Perform a thorough operation test in the presence of the Owner or their representative. Provide documentation of all test results as outlined in each system’s specifications. Include labor, materials and instruments for above tests.

B. Furnish to the Owner, as a part of closing documents, a copy of such tests including identification of each cable, also the dedicated communication service ground test as required by each system’s individual manufacturer indicating compliance with their requirements.

C. Prior to final observation and acceptance, test and leave in satisfactory operating condition, all systems and equipment including but not limited to the following:
   1. Grounding
   2. Firestopping of all sleeves and conduits
   3. Telephone and LAN systems
   4. Turn in test results on cabling

3.7 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, dust, and construction debris and repair damaged finish, including chips, scratches and abrasions. This includes touching up paint removed for grounding.
B. Contractor shall provide a clean work environment, free from trash/rubbish accumulated during and after cabling installation.

C. Maintain construction materials and refuse within the area of work. Clean the work area at the end of each day.

D. Contractor shall keep all liquids (drinks, sodas, etc.) off finished floors, carpets, tiles, racks and equipment. If any liquid damage to above finishes or equipment, Contractor shall provide professional services to clean or repair scratched/soiled finishes or damaged equipment at own expense.

3.8 PERMITS

A. The Contractor shall secure all necessary permits required for the execution of this Work. Work shall not start until all permit applications are approved.

3.9 OBSERVATIONS

A. When field observation services are a part of the project scope, the Designer’s office will provide periodic observation of the progress of Work specified herein. The purpose of the observation service is to ensure compliance of Contractor's Work with specifications and drawings. The Designer’s office may also observe tests required of this Contractor as called for in other sections of the specifications.

B. Specifications and drawings represent Work to be done in view of total project requirements. To eliminate possible conflict with other trades, final location of conduits, jacks, outlets, components, etc., is the responsibility of this Contractor. Contractor to provide all supervision required for his personnel to ensure that installation is made in accordance with specifications and drawings and all safety rules and regulations are observed. In the event of conflicts of Work on project with other trades, Contractor is to make every reasonable effort to resolve conflict through meetings and discussions with other parties involved, by preparation of drawings or other appropriate action. Only after this has been done shall the Designer's assistance be requested through the RFI process.

C. When the Designer is requested to visit the project to aid in resolution of conflicts, or for witnessing tests, he shall be given a minimum of 48 hours’ notice prior to time their presence is requested at job site.

3.10 WARRANTY-GUARANTEE

A. The Designer reserves the right to accept or reject any part of the installation which does not successfully meet requirements as set out in these specifications.

B. This Contractor shall, and hereby does, guarantee all Work installed under this division shall be free from defects in workmanship and materials for a period of one year from date of final acceptance. This Contractor further agrees to repair or replace any
defective material or workmanship which is or becomes defective within the terms of
this warranty-guarantee.

C. All surplus parts and pieces to the installation shall be maintained as a spare parts
inventory at the building site. Parts replaced during the warranty period shall have a
warranty matching that of the original part from date of replacement.

END OF SECTION
SECTION 28 31 00 - FIRE DETECTION AND ALERT NOTIFICATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. The Contractor shall secure, and pay for, as part of this contact agreement, the services of a qualified Fire Detection and Alert Notification Contractor to install monitor modules, control modules, manual pull stations, notification appliances, auxiliary power supply(s) (APS), and control panels that will connect to the Fire Alarm Control Panel (FACP) via data loop.

B. The extent of the fire detection and alert notification work is shown on the Contract Drawings and contained in the Specifications. This Fire Detection and Alert Notification Contractor shall review all other discipline/subcontractor drawings, specifications, and other documents to become cognizant of the entire extent of his/her work, which are not detailed on the drawings. Submission of a proposal shall be evidence that this Contractor has reviewed all of the Contract Documents and performed all necessary walk downs to determine the complete scope of work.

C. The Fire Detection and Alert Notification Contractor is directed to examine all Contract Drawings in detail. Failure of the Fire Detection and Alert Notification Contractor to examine all areas, which may require special considerations and misinterpretation of the Contract Documents resulting there from, shall be entirely his/her responsibility.

D. Fire detection and alert notification system components shall be installed as shown on the Contract Drawings with design criteria as specified in this Section. However, the Fire Detection and Alert Notification Contractor shall note that this specification requires that the Fire Detection and Alert Notification Contractor must prepare and submit drawings, system schematics and any other documents needed for the procurement of approvals and the provision of complete, functional and approved fire detection and alert notification system. As a result, the Contract Drawings and this Section serve the purpose of indicating design criteria for the Fire Detection and Alert Notification Contractor’s use and guidance in preparing documents required to be submitted for review.

E. The Contract Drawings and specifications form complimentary requirements. Provide work specified and not shown, and work shown and not specified as though explicitly required by both. Although work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices and materials necessary for a sound, secure, complete and approved installation. Completely coordinate work of this specification with work of other trades.
F. The Fire Detection and Alert Notification Contractor is directed to bring to the attention of the General Contractor and/or Fire Protection Engineer, in writing, any discrepancies, and/or matters as they may relate to codes, standards, and recommendation and/or job conditions. Failure of the Fire Detection and Alert Notification Contractor to do so prior to bidding shall indicate acceptance of all documents herein and all job conditions.

G. The Fire Detection and Alert Notification Contractor shall bring to the attention of the Fire Protection Engineer any conflicts between these drawings and codes or standards for resolution. The Fire Detection and Alert Notification Contractor shall not discuss these matters with the Building or Fire Official without the approval of the Fire Protection Engineer.

H. Should the Fire Detection and Alert Notification Contractor perform any work that does not comply with the requirements of the specifications and applicable Codes, Standards and References, they shall bear all costs arising in correcting the work to the satisfaction of the Fire Protection Engineer.

I. The Fire Detection and Alert Notification Contractor shall include costs in their estimate(s) to fully complete all renovation including all interconnecting, coordination and installation details and components and extending the system into and throughout all spaces. The Contractor shall also include costs for startup, pre-testing and acceptance testing, and for making all the systems fully operational, and for scope and design contingencies.

J. Provide contract cost breakdown in accordance with other sections of this specification and submit a breakdown of material and labor costs to aid the General Contractor and Fire Protection Engineer in determining the value of the work installed as the job progresses. The cost breakdown shall itemize categories of material and portions of systems to place a value on the work as it is installed. Unit cost on additional devices will be required as part of the contractors bid.

K. The Fire Detection and Alert Notification Contractor will be required to prepare detailed shop drawings as herein before specified. This information, in the form of a single “Package”, shall be submitted to the General Contractor and Fire Protection Engineer for review and approval. Equipment within the “Package” shall bear approval or listing of a testing laboratory approved by the Texas State Board of Insurance, Fire Department and the Owner’s Insurer prior to submission to Fire Protection Engineer for their review.

L. Give all notices, file all plans and other documents, obtain all permits and all licenses, pay all fees and obtain all approvals from all Authorities Having Jurisdiction as required to perform work in accordance with all requirements and with the Specifications and Contract Drawings, all of which are considered a part of these Contract Documents.
1.2 DESCRIPTION OF WORK

A. This Section covers installation, programming and testing for fire detection and alert notification system improvements as hereinafter described, and as shown on the engineering drawings.

B. Provide all required labor, warranty labor, materials, equipment, system programming, testing, submittals and services necessary for a complete and operational fire detection and alert notification system as hereinafter described, and as shown on the engineering drawings.

C. It is intended that the engineering drawings and specification shall describe and provide for a working installation complete in every detail and all items necessary for such complete installation shall be provided whether or not specifically mentioned herein or shown on the engineering drawings.

D. Scope of Work

1. Fire Alarm System Integrator and the Contractor shall furnish and install all work shown on the plans and described in the specifications. All work and costs shall be performed under this Contract.
2. The Fire Alarm System Integrator authorized by the DFW Airport Board is Honeywell, Inc.
3. Demolition work is required for this system and includes deprogramming and carefully removing system components and devices.
4. The Contractor shall maintain the existing fire alarm system in all operational and occupied areas throughout construction.
   a. The Contractor shall understand existing SLC and fire alarm notification circuit arrangement and maintain circuit connectivity to devices outside of the construction area.
   b. The Contractor shall coordinate programming of addressable devices and notification circuits prior to and throughout construction phase.

1.3 REFERENCES

A. All work shall be installed in accordance with all applicable codes and referenced design standards:
   1. 2015 International Building Code with local amendments
   2. 2015 International Fire Code with local amendments
   3. 2005 International Mechanical Code with local amendments
   4. 2013 NFPA 72, National Fire Alarm and Signaling Code
   5. 2014 NFPA 70, National Electrical Code
   6. 2013 NFPA 13, Sprinkler Systems
   7. ADA - Americans with Disabilities Act
   8. DFW Airport Design Criteria Manual and the Basis of Design Documents


B. If there is a conflict between the applicable codes, referenced design standards, or local amendments and this specification, it is the Contractor’s responsibility to immediately bring the conflict to the Fire Protection Engineer for resolution.

1.4 SYSTEM OPERATION

A. The fire detection and alert notification system substructure shall operate as follows: Initiation circuits shall meet the minimum requirements of Class B. Supervisory circuits shall meet the minimum requirements of Class B. Notification circuits shall meet the minimum requirements of Class B, Style 1. Signaling line circuits shall meet the minimum requirements of Class B. Auxiliary circuits, where not installed as signaling line circuits, shall meet the minimum requirements of a Class B notification circuit. Circuits for relay coil operation shall be 24 volt maximum with a separate or integral field collapsing diode.

B. The control panels and auxiliary power supplies shall receive their power from 120 volt AC dedicated branch circuits. The circuit disconnecting means shall have a red marking, shall be accessible only to authorized personnel, and shall be identified as “FIRE ALARM NOTIFICATION CIRCUIT”. The 24 volt DC power for all system initiation, supervisory, notification and control circuits shall be provided by the Fire Detection and Alert Notification control panel power supplies or listed auxiliary power supplies.

C. Upon loss of building power, the entire system shall transfer to secondary within ten (10) seconds, and without loss of signals. The system shall operate under secondary power in normal or trouble conditions for twenty-four (24) hours and have sufficient power to support complete alarm condition operation for a subsequent fifteen (15) minutes of evacuation alarm operation at maximum connected load.

1.5 QUALITY ASSURANCE

A. All work shall meet the requirements of the Owner, Architect, Engineer and Authority Having Jurisdiction (AHJ).
B. All equipment and components shall be UL listed for the actual intended use, unless hereinafter specifically excluded from such a listing.

C. Installation and supervision of installation shall be in strict compliance with the requirements of the regulations, licenses, and permits for fire detection and alert notification system installers in this jurisdiction.

D. Installer must have been actively engaged in the business of selling, installing, and servicing fire detection and alert notification systems for at least five (5) years.

E. Installer must be registered with and licensed by the State of Texas as a Fire Alarm Contractor.

F. Installer must be an authorized representative of the Equipment Manufacturer (EM) and have technical factory training specifically for the system proposed.

G. The EM shall have a representative supervise the final connection of devices, wiring, and programming of the control panels. The EM representative shall be National Institute for Certification in Engineering Technologies (NICET) certified as Level II or higher Fire Alarm Protection / Fire Alarm Systems Engineering Technician.

1.6 REGULATORY REQUIREMENTS

A. All work shall meet the requirements of all applicable codes and referenced design standards.

B. No approvals or interpretations of the design documents shall be pursued except through the Engineer.

C. Any work performed prior to the satisfactory review of the shop drawings by the Engineer, approval by the AHJ, and determined to be noncompliant with the contract documents or applicable codes by the Owner or AHJ will be replaced at the Contractors’ expense.

D. The system will not be acceptable until final testing and receipt of the Inspection and Testing Form has been obtained.

1.7 SUBMITTALS

A. The engineering drawings have been prepared using AutoCAD. These documents will be made available either in electronic or hard copy form. Utilization of these documents for the development of shop drawings and submittals does not relieve any responsibilities required herein.

B. In the submittals, the Contractor must clearly identify all areas and sections of this specification to which they take exception or are not capable of providing.
C. Submittals will be disapproved unless required equipment literature, calculations, and complete shop drawings are submitted together as one package for review.

D. The Fire Protection Engineer and Airport Fire Prevention Bureau shall review and recommend approval, disapproval, or other appropriate recommendations on the Contractor’s submittals. This review is to verify conformance to the project specifications and design concepts expressed in the contract documents. The Contractor shall allow sufficient time to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of details and dimensions, or substantiating installation or performance of equipment and systems designed by the Contractor, all of which remain the Contractor’s responsibility to the extent required by the contract documents. The Engineer’s review shall not constitute approval of safety precautions of construction, means, methods, techniques, sequences of procedures, or approval of a specific assembly.

E. Prior to release of equipment for shipment or installation, submit to the Fire Protection Engineer, DFW ITS Life Safety Department and Airport Fire Prevention Bureau the following:

1. Five (5) sets of shop drawings in addition to the specific quantity required for this project. Three (3) sets of shop drawings to the Fire Protection Engineer and Airport Fire Prevention Bureau, (1) set to DFW ITS Life Safety Department, and (1) electronic set (AutoCAD) copy/file to the Fire Protection Engineer. The three (3) sets of shop drawings for the Airport Fire Prevention Bureau shall be hard, bond type paper. Submittal must be comprehensive of the entire project, complete in all detail, and include, but not limited to, the following:

   a. Floor plans showing equipment placement, point to point wiring, wiring types and sizes, conduit types and sizes, wiring and raceway routes, and proposed mounting methods for conduit and backboxes. Floor plans shall be AutoCAD generated.

   b. Sequence of Operations (Event Matrix) to include a detailed description of the operation of each system function for all possible alarm conditions.

   c. Riser diagram showing typical wiring connections for each type of device and module.

   d. Supervisory and alarm current calculations for primary power and emergency battery sizing of all control panels and auxiliary power supplies.

      1) Battery calculations shall list the type of devices and modules, quantities, amperage draw for standby and alarm conditions for each device, the total amperage draw for each panel, and each panel’s battery amp/hour rating.

      2) The calculated load shall be the design load (summation of current at end of circuit), including all required spare capacity.
3) The battery capacity used to meet the calculated load shall be a maximum of eighty (80) percent of the amp/hour listed by the manufacturer.

e. A complete list of all proposed alphanumeric descriptions and their associated point address and circuit number.

f. Voltage drop calculations for all notification appliance circuits.

1) Calculations shall follow the voltage drop calculation criteria as outlined in NFPA 72 and UL 864.

2) Calculations shall use the worst case operating voltage of each control panel or power supply as a starting voltage. The starting voltage shall be 20.4 VDC, unless written documentation is provided confirming that the specific control panel or power supply is capable of maintaining a voltage higher than 20.4 VDC.

3) Calculations shall use the lowest operating voltage of the notification appliances and the associated increased current draw. The lowest operating voltage shall be the UL standard operating voltage of 16 VDC, unless approved otherwise by the Fire Protection Engineer.

2. Three (3) sets of manufacturer’s literature on all system equipment and system conductors in addition to the specific quantity required for this project.

a. Literature shall include specification and description of recommended supporting methods, enclosures or boxes, and wiring connections.

b. The exact components to be utilized on this specific project shall be indicated, by highlighting or arrows, on each data sheet of the equipment literature.

3. One (1) copy each of the qualifications and authorization of the representative of the EM.

4. The Owner, Owner’s Representative, or design firms retained by the Owner shall not be responsible for any additional costs resulting from replacement of equipment or materials not reviewed prior to installation.

F. After complete review and approval of the shop drawings by the Fire Protection Engineer and Airport Fire Prevention Bureau, the Contractor shall submit all required drawings, manufacturers’ literature, calculations and any other materials required by the AHJ to obtain a permit to the appropriate party for review.

G. Forward to the Fire Protection Engineer, in writing, any comments from the AHJ or the Insurance Underwriter within five (5) working days after the receipt of their comments.
PROJECT RECORD DOCUMENTS

A. The Contractor shall provide and maintain on site an up-to-date record set of approved shop drawing prints which shall be marked to show each and every change made to the fire detection and alert notification system from the original approved shop drawings. This shall not be construed as authorization to deviate from or make changes to the shop drawings approved by the Fire Protection Engineer without written instructions from the Fire Protection Engineer in each case. This set of drawings shall be issued only as a record set. These drawings shall be made available to the Owner, or the Owner's Representative, upon request.

B. The Contractor shall continually document software and programming changes. This documentation shall include:

1. A complete printout of the system prior to the change.
2. A complete printout of the system program subsequent to the change, with all modifications highlighted.
3. A letter prepared and signed by the individual who made the changes, describing each change made and the reason for the change. This letter shall certify that the programmer has personally reviewed and compared the before and after program printout and verified the correctness of the modification(s).
4. An equivalent means performed automatically in computer software, which verified the results of changes made is acceptable.

C. Once the fire detection and alert notification system is put into service, in whole or in part, and the associated building(s) are partially or wholly occupied, no software changes shall be performed without prior written permission of the Owner, or Owner's Representative.

D. Only a certified manufacturer's representative trained in the specific programming software shall make changes to the fire detection and alert notification system software once the system is in service.

E. Each revision to the software shall be identified by a unique version number and date.

F. Prior to final payment for the fire detection and alert notification system and the beginning of the warranty period, submit the following completed project record documents to the Owner’s Representative:

1. Copies of all test and inspection reports as required by the AHJ and NFPA 72:
   a. The Record of Completion form shall be in the format as outlined in NFPA 72.
   b. The Inspection and Testing form shall be in the format as outlined in NFPA 72.
2. DFW Airport Fire Marshall shall accept the system and is provided with all permits, licenses, acceptance tests and final acceptance requirements as per NFPA applicable codes and standards. All permits and licenses required to be in the possession of the Owner by the AHJ.

3. Accurate record (as-built) drawings of the complete installation to include, but not be limited to, the information required for the shop drawings. Record drawings of the floor plans shall be AutoCAD generated.

4. Original warranty documents including, but not limited to, those of the EM. Warranty documents shall reference and be binding to the warranty provisions specified in the warranty portion of this specification.

5. Submit to the Engineer a copy of the transmittal to the Owner's Representative for all final complete project record documents.

G. Upon completion of construction, submit the following:

1. Provide one (1) sepia bond reproducible print, two (2) prints, and a set of disks in Electronic Format of the drawings, floor plans with device locations, device addresses, wire routing and wiring diagrams reflecting “as-built” conditions to the Owner.

2. Provide two (2) complete sets of “as-built” data sheets for all system-connected equipment to the Owner.

3. Provide two (2) sets of complete “as-built” software listing of all data files, even programs, print statements, points' lists, etc. to the Owner.

4. Provide one (1) copy of all data files on diskette to the Owner.

5. Provide two (2) sets of customized “as-built” operating manuals to the Owner.

6. Provide one (1) complete set of electronic files of “as-built” drawings and wiring diagrams to the Engineer. Electronic files shall be in AutoCAD.

7. Provide a completed test form which complies with NFPA 72, signed and dated by the fire detection and alert notification system manufacturer or his agent.

8. Provide NFPA 72 completion certificate, signed by the Fire Department.

9. All items of this section shall be provided prior to final payment request.

H. A copy of all software documentation required by this section shall be maintained on-site by the Contractor, in a binder, arranged in chronological order. This binder shall be provided to the Owner's Representative at the completion of the project.

I. Submit to the owner in electronic format, all fire detection and alert notification as-builds.

1.9 RELATED REQUIREMENTS:

A. Materials and methods specified in other sections:

1. Electrical – Division 26

a. Section 26 05 26 – Grounding For Electrical Systems
b. Section 26 05 29 – Hangers and Supports for Electrical Systems  
c. Section 26 05 33 – Raceways, Conduits and Boxes  
d. Section 26 05 34 – Wireways  
e. Section 26 05 49 – Through-Penetration Firestoping for Electrical  

2. Fire Suppression – Division 21  
a. Section 21 13 13 – Wet Pipe Sprinkler  

3. HVAC – Division 23  
a. Section 23 34 00 – HVAC Fans  
b. Section 23 36 00 – VAV Air Terminal Units  

1.10 Warranty  

A. Repair all defective workmanship or replace all defective materials for a period of one (1) year from the date of acceptance by the Owner's Representative. Workmanship or equipment found to be defective during that period shall be replaced at no additional cost to the Owner.  

B. The warranty or any part of the warranty shall not be made void by any required operation or inspection of the system after final completion during the warranty period. The Owner may select qualified firms other than Warrantor to provide required tests and inspections. System testing and inspections will be conducted only by a duly licensed company under contract with the Owner to perform scheduled testing and inspections as required by the AHJ. The Owner may elect to have a representative present at the scheduled testing during the warranty period.  

C. As an option alternate bid, the Contractor shall supply pricing for extended Warranty of the system. This option shall be renewable on a yearly basis and pricing shall be supplied for a minimum of five (5) years from the expiration of the initial Warranty.  

PART 2 - PRODUCTS  

2.1 Manufacturers  

A. Products for this project shall be of the latest design. Obsolete or discontinued models are not acceptable.  

B. All equipment supplied shall be UL listed for the required function and shall be compatible with the existing fire alarm and alert notification control system.
2.2 CONTROL PANELS

A. The existing Honeywell XLS1000 fire alarm control system will remain. Provide additional modular components as necessary to satisfy system capacity requirements and to accomplish all system functions.

B. Auxiliary Power Supplies

1. Each APS shall be capable of actuation from either a host panel notification circuit, or programmed dry contacts. Each APS shall provide a trouble indication to host panel upon loss of AC power or abnormal conditions on individual output circuits. Each APS shall have a minimum of four (4) supervised output notification circuits rated individually at a minimum of two and a half (2.5) amperes available per circuit, with a total output of ten (10.0) amps. The Contractor shall be responsible for all redesign, circuiting, and additional equipment costs to provide the necessary output amperage. Each APS shall have a minimum of twenty (20) percent spare capacity on each circuit.

2. The APS shall operate from a dedicated 120 volt AC or 24 volt DC source with a listed secondary power source conforming to the same alarm and standby time requirements as the FACP.

   a. Acceptable Equipment Suppliers (provided compatibility requirements are met, i.e. synchronization): Honeywell, Inc. (XLS-BPS10 series)

3. Provide a smoke detector above remote power supplies where required.

2.3 FIELD DEVICES

A. Monitor Modules

1. Provide addressable monitor modules where required to interface with contact alarm devices, or to connect a supervised zone of conventional initiating devices (any normally open dry contact device) to an intelligent SLC loop.

2. The module shall include a unique internal identification code that is factory installed and programmed into the control panel through a mapping process which the control panel shall use to identify the type of device. Flash status/power LED under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel. The LED may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected.

3. Provide an automatic test feature to permit functional testing of the device from the main control panel. Indicate results of the test on the LCD display at the control panel.

4. Monitor modules with multiple input contact connections are acceptable if each input is capable of independent programming and functional operation.
B. Control/Relay Modules

1. Provide addressable control/relay modules where required to interface with a dry contact (Form C) relay. Provide power for the relay actuation from the intelligent SLC loop.

2. Minimum rating of Form C contacts shall be two (2.0) amperes at 24 volts and one half (0.5) amperes at 120 volts AC.

3. The module shall include a unique internal identification code that is factory installed and programmed into the control panel through a mapping process which the control panel shall use to identify the type of device. Flash status LED under normal conditions, indicating that the control module is operational and in regular communication with the control panel. The LED may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected.

4. Control/relay modules with multiple output contact connections are acceptable if each output is capable of independent programming and functional operation.

C. Signal Modules

1. Provide addressable signal modules where required to interface with audible or visual notification appliances, or to connect a supervised zone of conventional indicating appliances (any 24 volt DC polarized notification appliance) to an intelligent SLC loop. Provide notification appliance power through a separate loop from the main control panel or from supervised remote power supplies.

2. The Minimum rating of the output current shall be one and a half (1.5) amperes at 24 volts and one half (0.5) amperes at 120 volts AC.

3. The module shall include a unique internal identification code that is factory installed and programmed into the control panel through a mapping process LED under normal conditions, indicating that the control module is operational and in regular communication with the control panel. The LED may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected.

D. Isolation Modules (When used)

1. Provide isolation modules to automatically isolate wire-to-wire shorts on an SLC loop. The isolation module shall limit the number of modules or detectors that may render inoperative by a short circuit fault on the SLC loop. Upon a wire-to-wire short circuit the isolation module shall automatically disconnect the shorted circuit from the SLC loop. Upon a correction of the wire-to-wire short, the isolation module shall automatically re-connect the isolated circuit to the SLC loop.

2. The isolation module shall not require any address-setting means and its operation shall be totally automatic. It shall not be necessary to replace or reset the isolation module after its normal operation. Flash status/power LED under normal conditions, indicating that the isolation module is operation and in regular communication with the control panel. The LED
may be placed into steady illumination indicating a short circuit has been detected and isolated.

E. Intelligent Photoelectric Smoke Detectors

1. Provide analog photoelectric type smoke detectors with the capability to send data, on command, to the control panel representing the analog level of smoke density.

2. Provide a "maintenance alert" feature whereby the detector initiates a trouble condition should the units' sensitivity approach the outside limits of the normal sensitivity window.

3. The detector shall include a unique internal identification code for each detector that is factory installed and programmed into the control panel through a mapping process which the control panel can use to identify the type and precise location of the detector.

4. Provide dual alarm and power/status LED's. Flash status LED's under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LED's may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected and verified.

5. Provide a low profile design modular detector head with twist-lock base.

F. Intelligent Thermal Detectors

1. Provide analog thermal fixed temperature and rate-of-rise detectors utilizing dual electronic thermostats to measure temperature levels in its chamber. The detector shall be capable of sending data, on command, to the control panel representing the analog temperature level.

2. The fixed temperature rating shall be one hundred thirty-five (135) degrees Fahrenheit. The rate-of-rise temperature detection shall be fifteen (15) degrees Fahrenheit per minute.

3. The detector shall include a unique internal identification code for each detector that is factory installed and programmed into the control panel through a mapping process which the control panel can use to identify the type and precise location of the detector.

4. Provide dual alarm and power/status LED's. Flash status LED's under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LED's may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected and verified.

5. Provide a low profile design modular detector head with twist-lock base.

6. Heat detectors used in conjunction with elevator control shall activate prior to water-flow from the corresponding automatic sprinklers. Coordinate the heat detector response time index (RTI) with the sprinkler system.

G. Intelligent Detector Base
1. Provide a UL listed low profile twist-lock detector base with screw terminals. Provide an output connection in the base to connect an external remote alarm LED.

2. Detector base shall be capable of connecting to the control panel.

3. Provide supervision as required by NFPA 72 and the manufacturer’s equipment literature.

H. Intelligent Photoelectric Smoke Detectors for Duct Applications

1. Provide duct mounted analog photoelectric type smoke detectors with the capability to send data, on command, to the control panel representing the analog level of smoke density.

2. Provide detectors operating in air velocities of zero (0) fpm to four thousand (4,000) fpm without adverse effects on detector sensitivity.

3. Provide a "maintenance alert" feature whereby the detector initiates a trouble condition should the unit's sensitivity approach the outside limits of the normal sensitivity window.

4. Provide a molded plastic enclosure with integral conduit knockouts. Provide housing with gasket seals to insure proper seating of the housing to the associated ductwork. Provide sampling tubes that extend across the width of the duct and in compliance with the manufacturer's installation recommendations.

5. The detector shall include a unique internal identification code for each detector that is factory installed and programmed into the control panel through a mapping process which the control panel can use to identify the type and precise location of the detector.

6. Provide dual alarm and power/status LED’s. Flash status LED’s under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LED’s may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected and verified.

7. Provide a low profile design modular detector head with twist-lock base.

8. Remote test stations, where required, shall consist of a key operated switch and indicating LED. The remote test station shall be listed for use with the duct smoke detector.

9. Provide a separate addressable control/relay module for any associated control functions.

I. Addressable Manual Pull Stations

1. Provide dual action type manual pull stations. Manual pull stations shall be designed that upon activation, shall initiate a change of status at the control panel. The manual pull stations shall not be automatically resettable and shall include a visible indication of the manual pull station being activated.

2. The unit shall include a unique internal identification code that is factory installed and programmed into the control panel through a mapping process which the control panel can use to identify the type of device. Monitoring devices when used shall be located in the manual station’s back box.
3. Construct of hi-impact red molded Lexan or die-cast metal with instructions for station operation in raised white letters.
4. Where possible, provide flush mounting of pull stations. Surface mounting of pull stations will be allowed if flush mounting is not possible. Semi-flush mounted stations shall mount on a standard electrical box.

J. Visual Notification Appliances - Wall Mounted
1. Provide visual notification appliances operable at 24 volt DC and polarized supervision. The appliances shall utilize a high intensity solid state xenon strobe tube with associated lens/reflector system. The appliances shall be constructed of high-impact white thermoplastic, shall indicate “ALERT”, shall not include the "Running Man" symbol, and shall be UL listed for wall mounted applications.
2. Where possible, provide flush mounting of appliances. Where surface mounting is necessary, provide a decorative backbox skirt covering the appliance backbox.
3. Provide synchronization of all visual notification appliances. The synchronization modules shall be capable of synchronizing appliances with candela ratings ranging from 15 cd to 185 cd.

K. Audible/Visual Notification Appliances - Wall Mounted
1. Provide solid state electronic audible notification appliances with integral visual notification appliance operable at 24 volt DC and polarized supervision. The appliances shall utilize a high intensity solid state xenon strobe tube with associated lens/reflector system. The appliances shall be constructed of high-impact white thermoplastic, shall be labeled “ALERT”, shall not include the "Running Man" symbol, and shall be UL listed for wall mounted applications.
2. Where possible, provide flush mounting of appliances. Where surface mounting is necessary, provide a decorative backbox skirt covering the appliance backbox.
3. Provide synchronization of all audible and visual notification appliances. Provide a synchronized temporal pattern audible tone producing a minimum sound pressure level of seventy-five (75) dB reverberant per UL 464 using the A-weighted scale (dBA). The synchronization modules shall be capable of synchronizing appliances with candela ratings ranging from 15 cd to 185 cd.

L. Visual Notification Appliances - Ceiling Mounted
1. Provide visual notification appliances operable at 24 volt DC and polarized supervision. The appliances shall utilize a high intensity solid state xenon strobe tube with associated lens/reflector system. The appliances shall be constructed of high-impact white thermoplastic, shall indicate “ALERT”, shall not include the "Running Man" symbol, and shall be UL listed for ceiling mounted applications.
2. Where possible, provide flush mounting of appliances. Where surface mounting is necessary, provide a decorative backbox skirt covering the appliance backbox.

3. Provide synchronization of all visual notification appliances. The synchronization modules shall be capable of synchronizing appliances with candela ratings ranging from 15 cd to 185 cd.

M. Audible/Visual Notification Appliances - Ceiling Mounted

1. Provide solid state electronic audible notification appliances with integral visual notification appliance operable at 24 volt DC and polarized supervision. The appliances shall utilize a high intensity solid state xenon strobe tube with associated lens/reflector system. The appliances shall be constructed of high-impact white thermoplastic, shall indicate “ALERT”, shall not include the “Running Man” symbol, and shall be UL listed for ceiling mounted applications.

2. Where possible, provide flush mounting of appliances. Where surface mounting is necessary, provide a decorative backbox skirt covering the appliance backbox.

3. Provide synchronization of all audible and visual notification appliances. Provide a synchronized temporal pattern audible tone producing a minimum sound pressure level of seventy-five (75) dB reverberant per UL 464 using the A-weighted scale (dBA). The synchronization modules shall be capable of synchronizing appliances with candela ratings ranging from 15 cd to 185 cd.

N. Auxiliary Relays

1. Provide relays for all auxiliary control interface. Provide heavy duty type rated up to ten (10) amps at 24 volt DC. Provide with NEMA I dust cover assembly and DPDT contacts.

2. Relays shall be mounted within three (3) feet of the controlled circuit or device.

2.4 CONDUCTORS

A. Wiring will be in accordance with local, state, National Electrical Code and the ICC Electrical Code.

B. SLC conductor(s) shall be Honeywell AK-3747.

C. Notification Alarm Circuit conductor(s) shall be #12 AWG, THHN stranded.

D. All electrical characteristics (conductor-to-conductor capacitance, DC resistance, etc.) of the fire detection and alert notification conductors shall meet the requirements of the selected EM for the intended application.

E. Wire used for 120 VAC power circuits shall be minimum size of 12 AWG stranded copper conductors, with THHN insulation.
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F. Wire used for point addressable, signaling line circuits, shall be a minimum size of 14 AWG solid copper conductor, UL listed for fire alarm system use and labeled FPL.

2.5 CONDUIT/RACEWAY

A. The following raceway types shall be permitted:

1. EMT conduit (3/4 inch minimum).
2. RIGID conduit (3/4 inch minimum).
4. Metal clad cable is permitted in concealed spaces for horizontal fire detection and alert notification branch circuits and connections to devices and fixtures.

B. All raceway types shall be new. Installing used raceway is unacceptable.

C. Reuse of existing raceway is acceptable provided the raceway conforms to the requirements of the NEC and NFPA 72. The contractor shall bear all costs to replace any reused raceway that is found by the Engineer or Owner's Representative to be deficient.

D. Boxes, supports, and other accessories for the raceway installation shall be listed for the intended application.

E. All wiring shall be installed in conduit.

F. Install fire detection and alert notification system wire in conduit or approved raceway, parallel to existing building structure when possible.

G. All riser wiring and wiring between floors shall be installed in conduit.

H. Strap or bundle all cables and wires inside equipment enclosures and terminal cabinets, parallel to the enclosure sides.

I. All EMT conduit fittings shall be compression type. All rigid conduit fitting shall be threaded with plastic inserts.

J. Flexible conduit and associated junction boxes connecting sprinkler water flow and supervisory switches shall be water resistant.

K. All fire alarm conduit and junction boxes shall be RED in color. Flexible conduit between fire alarm junction boxes and device mounting boxes that are less than six (6) feet in length are not required to be RED. Device mounting boxes are not required to be RED.
PART 3 - EXECUTION

3.1 COORDINATION WITH OTHER TRADES

A. Coordinate closely with all other trades to expedite construction, accurately interface with related systems and avoid interferences.

3.2 INSTALLATION / APPLICATION

A. Furnish and install all control wiring, raceway and outlet boxes for the fire detection and alert notification system.

B. Furnish and install all backboxes, equipment and devices for the fire detection and alert notification system.

1. Backboxes shall be of the exact type recommended by the EM as shown on the equipment and device submittals.
2. Backboxes shall be installed per the manufacturer's installation recommendations.
3. Devices and equipment must be installed by personnel legally permitted and currently licensed to install the devices and equipment. The cost of installation, warranty of installation and equipment, coordination of the installation, and supervision of the installation are responsibilities of the Contractor.

C. All fire detection and alert notification junction boxes, pull boxes, cable splices and terminal cabinets shall be accessible, painted red and clearly marked “Fire Alarm”. The Contractor shall comply with any local codes or AHJ requirements for circuit identification. Any access panels required for the accessibility to the junction boxes, pull boxes, cable splices and terminal cabinets shall be the responsibility of the Fire Detection and Alert Notification Contractor.

D. All wiring conductors and conduits shall be installed in a neat and workmanlike manner at right angles to the building walls, floors and ceilings, and supported from the building structure at intervals compliant with NEC requirements.

E. All wiring conductors for the fire detection and alert notification system shall be installed in conduit.

F. All wiring conductors shall be tagged at all junction points and shall test free from grounds or crosses between conductors.

G. Power-limited wiring conductors shall not be installed in conduits with electric light, power Class 1, non-power-limited fire alarm and medium power network-powered broadband communications circuits.

H. Fire detection and alert notification cabling shall not be painted.
I. Conduits shall enter the control panel enclosures only in the approved locations, as identified in the EM installation instructions.

J. Flexible Metal Conduit (FMC) is allowed to be installed between the junction boxes, conduit body, or other conduit termination and the device back box only in accessible ceilings. FMC shall not exceed 6-feet in length without prior approval from the Engineer of Record and DFW IT for the specific location. FMC shall be securely fastened in place and supported in one of the following methods:

1. By an approved means from building structure within 12-inches of each box, conduit body, or other conduit termination and shall be supported and secured at intervals not to exceed 4 1/2 ft. Hanger assemblies used to support the FMC shall be installed in accordance with the manufacturers published instructions.

2. By an approved means from building structure at the mid-point of the FMC at a minimum to ensure the FMC and connectors do not separate under normal operation of the building. Hanger assemblies used to support the FMC shall be installed in accordance with the manufacturers published instructions.

K. Existing fire alarm devices being replaced, or their operations abandoned shall be removed immediately after the new fire detection and alert notification system is accepted by the Owner. All fire detection and alert notification equipment, equipment backboxes, accessible conduit and wiring shall be removed. Conduit and wiring that cannot be removed shall be marked “Abandoned”. All fire detection and alert notification equipment (excluding backboxes, conduit, scrap wiring, and other equipment not strictly related to the demolished fire detection and alert notification system) shall be turned over to the Owner’s Representative.

L. Install all hangers, clamps, conduit, and backboxes for the fire detection and alert notification system prior to the application of fireproofing on structural members. The hangers, clamps, conduit, and backboxes for the fire detection and alert notification system shall be installed on the edge of any beam requiring fireproofing. Backboxes shall be fastened to the flange of the beam utilizing beam clamps, and shall not be attached directly to the beam. Verify the locations of all fireproofing, prior to the installation of any fire detection and alert notification conduit or backboxes.

M. Any damage to fireproofing on the building structure as a result of the fire detection and alert notification system installation shall be repaired by a qualified Fireproofing Contractor. All damage and repair of fireproofing shall be reported to and coordinated through the General Contractor. The Fire Detection and Alert Notification Contractor shall be responsible for all fireproofing repairs at no additional cost to the Owner.

N. Intelligent loop circuits shall be provided with adequate junction boxes, be expandable, and provide a means for connection to the loop in the junction box.
O. Conduits shall enter panels from the sides or bottom. Where flexible conduits are used to connect device loop wiring to alarm devices, the Contractor shall use ½ inch flexible conduit.

3.3 EQUIPMENT MOUNTING

A. The control panels and auxiliary power supplies shall be surface mounted with no operational parts which may require maintenance mounted greater than seventy-two (72) inches above the finished floor. The control panel annunciator shall be mounted so that no switch, manually operated device, display or LED is greater than sixty (60) inches above the finished floor.

B. Duct detectors shall be mounted in the return air duct of HVAC units. Duct detectors shall be mounted in such a way as to obtain a representative sample of the airstream. Detectors shall be accessible for cleaning and shall be mounted in accordance with the manufacturer’s instructions and NFPA standards. Coordinate placement and connect all circuits.

C. Remote test stations shall be mounted in proximity of the associated device or unit, where visible in normally occupied areas, not higher than seventy-two (72) inches above the finished floor and with the final locations acceptable to the AHJ.

D. All HVAC equipment shutdown shall be initiated by relays integral to the addressable control modules. Relays shall be mounted within three (3) feet of the motor controller or control circuit of the affected equipment / BAS controllers. Provide cabling and wiring connections to HVAC shutdown controls. Final terminations to HVAC shutdown controls are by mechanical or controls contractor. Provide any required intermediate relays for connections to HVAC shutdown controls.

E. Heat detectors in elevator machine rooms, elevator shafts, and elevator pits shall be mounted within twenty-four (24) inches of the adjacent automatic sprinkler head.

F. Smoke detectors shall be mounted on the underside of the ceiling or deck, and shall be located more than three (3) feet from air supply diffusers.

G. Smoke, heat, and duct detectors shall not be installed until after the construction clean-up of all trades is complete and final. Detectors that have been installed prior to final clean-up by all trades shall be cleaned or replaced in accordance with NFPA 72.

H. Manual pull stations shall be securely mounted with the operable part of the manual pull station no greater than forty-eight (48) inches above the finished floor (AFF) for frontal wheelchair access and 54 inches AFF for side access as measured to the pull lever.

I. Wall mounted audible/visual, speaker/visual and visual appliances shall be flush mounted with their bottoms at eighty (80) inches above the finished floor or six
(6) inches below the ceiling, whichever is lower. Wall mounted horns or speakers shall be mounted a minimum of 90 inches AFF.

J. Ceiling mounted audible/visual, speaker/visual and visual appliances shall be mounted with their visual lenses having an unobstructed line of site in all directions. Exact locations of appliances shall be sufficiently distant from vertical surfaces and hanging items to permit maximum viewing from all directions.

K. Weatherproof audible/visual notification appliances shall be surface mounted at the fire department connection on the building exterior and with the final location as acceptable to the AHJ.

L. Devices and appliances shall not be supported by ceiling tiles. Devices and appliances must be attached to backbox supported by the ceiling grid.

M. All initiating devices and addressable modules shall be mounted in a location accessible for testing and maintenance.

N. Provide a label for each initiating device indicating the specific address for that device. The label shall include the node number, loop number and device number where applicable. The label shall be located on the base of all detectors and the cover plates of addressable modules.

3.4 PAINTING AND PATCHING

A. All fire detection and alert notification junction boxes, pull boxes, conduit, cable splices and terminal cabinets shall be thoroughly cleaned, removing all dirt, oil, etc. and made ready to receive paint.

B. All penetrations of fire rated assemblies (wall or floor construction) shall be firestopped to preserve the original fire resistance and smoketight integrity of the assembly. All firestopping methods shall be UL listed Through Penetration Firestop Systems or otherwise approved by the Owner, Architect, Engineer, and AHJ. Specific firestop assembly shall be identified at the penetration location with a sticker or other approved identification means.

3.5 SYSTEM TESTS

A. All test and inspections specified in this section shall be reported in writing and submitted in accordance with this specification section.

B. The system shall meet all the requirements of the listed applicable codes and the requirements of the AHJ. The system tests and test documents, including those required for and by the approved remote monitoring station, shall meet the requirements of the AHJ.

C. Provide one hundred (100) percent initial acceptance testing of the entire fire detection and alert notification system prior to the required AHJ acceptance.
testing. Before requesting the AHJ acceptance testing, furnish a written statement to the Owner's Representative indicating that the system has been installed in accordance with the approved documents and tested in accordance with the manufacturer’s specifications and the applicable NFPA requirements. The Record of Completion shall be completed and submitted as part of the written statement.

D. All testing, inspection and retesting required for certification and required for all warranty work or replacements shall meet the requirements of the AHJ. This certification, inspection, or testing shall be completed at no additional cost to the Owner.

E. Provide the testing date in writing to the Owner a minimum of two (2) weeks before the date. The Owner may elect to have a representative present for testing.

F. The fire detection and alert notification system will not be acceptable until final testing and receipt of the testing certificates have been obtained.

END OF SECTION