DALLAS-FORT WORTH INTERNATIONAL AIRPORT

CONTRACT NO. 9500646

Terminal D – Revolving Exit Door Removal

Issued for Bid
October 11, 2019

Project Manual

Permit # A17-196B
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](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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PART 1 – GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

The Work of this Contract comprises the removal of existing revolving doors along the SIDA wall between landside and airside and replacing them with pairs of double swing doors and construction of a security vestibule in Terminal D. Construction will be on the landside with limited work on the airside. Temporary security walls will need to be constructed and the work will be phased to maintain the SIDA wall and exiting at all times. The Contractor shall be responsible for reviewing all existing conditions associated with the Work prior to commencement of work activities.

The Work will include selective modifications and extension of the existing base building systems including Fire Protection, Fire Alarm, Security, Communications, PAVE, HVAC and Electrical.

1.2 FORMS

A. The Contractor and all Subcontractors must obtain and pay for all Airport Identification/Access Badges and Access Permits as required by the Airport.

B. All appropriate forms and applications must be obtained, completed and submitted. A minimum required list of forms and applications is as follows:

1. AOA Area Access or Parking Revenue Area (PRA) Access Permits Form (1 page). This form can be obtained from Airport Design, Code, and Construction Department (DCC).

2. Access Badge Application (3 pages). This form can be obtained on the Airport website: https://www.dfwairport.com/badge/

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-eighty (180) 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 equals two-hundred-forty (240) consecutive Calendar Days from NTP.

B. The Owner reserves the right to request the completion of work based on critical Milestones established in the Contract Documents.

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. Exceptions to above work hours:

1. Any Work within an aircraft parking apron and Object Free Area (OFA) of an active Taxiways or Taxilane will be restricted to the following:

   a. From 22:45 hours to 05:15 hours.

   b. Work activities within these areas may be canceled and the area reopened in the event of airfield emergencies, late airline complexes, and unforeseen conditions that could create significant delays to the Airport.

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Contract No. 9500646  Issued for Bid
Terminal D – Revolving Exit Door Removal  01 11 00 - 1  October 11, 2019
2. 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. **Blackout Dates**

The following 2019/2020 dates have been established as construction blackout dates in the landside and customer service areas. During the noted 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:

**2019**

- Labor Day – Thursday, August 29 at 00:00 am through Tuesday, September 3, 2019 at 11:59 pm
- Thanksgiving – Thursday, November 21 at 00:00 am through Tuesday, December 3, 2019 at 11:59 pm
- Christmas/New Year – Friday, December 20 at 00:00 am through Thursday, January 2, 2020 at 11:59 pm

**2020**

- Spring Break – Thursday, March 5 at 00:00 am – Monday, March 23, 2020 at 11:59 pm
- Memorial Day – Thursday, May 21 at 00:00 am through Tuesday, May 26, 2020 at 11:59 pm
- July 4 – Thursday, July 2 at 00:00 am through Monday, July 6, 2020 at 11:59 pm
- Labor Day – Thursday, September 3 at 00:00 am through Tuesday, September 8, 2020 at 11:59 pm
- Thanksgiving – Thursday, November 19 at 00:00 am through Tuesday, December 1, 2020 at 11:59 pm
- Christmas/New Year – Friday, December 18, 2020 at 00:00 am through Tuesday, January 5, 2021 at 11:59 pm

In addition to these blackout dates, everyone should note that weather forecasts/events will have a role when considering planned outages or construction work. During inclement weather or forecasted weather events, non-emergency utility outage requests will normally not be approved. Utility outages that do not impact stakeholder operations will be evaluated on a case by case basis during the blackout periods.

a. For all utility outages, a Utility Outage Request form must be submitted 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 REQUIREMENTS FOR ALTERNATIVES

A. Submit Alternatives with full description of proposed Alternate and effect on adjacent or related components.

B. Alternates quoted on Bid Form will be reviewed and accepted or rejected at Owner’s option. Accepted Alternates will be identified in Owner-Contractor Agreement.

C. Coordinate related work and modify surrounding work to integrate Work of each Alternate.

1.6 SELECTION AND AWARD OF ALTERNATIVES

When alternatives are used, the Board reserves the right to Contract for any combination of Base and or Alternatives stated, or none of the above. Contractor must bid on the base and all alternatives. Bids addressing only the base or alternate items will be considered non-responsive.

1.7 TOILET ROOMS

The Contractor may use the existing public toilets within the rental car center for use by construction personnel. Any damage to the facilities as a result of construction personnel use will be repaired by the Contractor at no cost to the Owner.

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 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
B. General Wage Decision Rates for Tarrant and Dallas County, Texas - https://www.wdol.gov/dba.aspx

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

General Decision Number: TX190270 01/04/2019  TX270

Superseded General Decision Number: TX20180322

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 $10.60 for calendar year 2019 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 $10.60 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 2019. 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.

Modification Number     Publication Date
0             01/04/2019

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
WAGE RATE REQUIREMENTS
Section: 01 29 85

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CARP1421-002 04/01/2016

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<td>MILLWRIGHT.........................$ 26.60</td>
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* ELEV0021-006 01/01/2018

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<td>ELEVATOR MECHANIC.................$ 39.97</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.


----------------------------------------------------------------
ENG0178-005 06/01/2014

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| POWER EQUIPMENT OPERATOR
(1) Tower Crane...............$ 29.00 | 10.60 |
(2) Cranes with Pile Driving or Caisson Attachment and Hydraulic Crane 60 tons and above......$ 28.75 | 10.60 |
(3) Hydraulic cranes 59 Tons and under...............$ 27.50 | 10.60 |

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IRON0263-005 06/01/2017

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PAIN0053-004 04/01/2014

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<td>PAINTER (Brush, Roller, and Spray (Excludes Drywall Finishing/Taping)).............$ 16.40</td>
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PLUM0146-003 05/01/2016
### Rates Fringes

**PIPEFITTER (Excludes HVAC Pipe Installation)**

- $29.48  
- 8.30

**SUTX2014-048 07/21/2014**

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<td>BRICKLAYER</td>
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<td>CARPENTER, Excludes Drywall Hanging, Form Work, and Metal Stud Installation</td>
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<td>DRYWALL FINISHER/TAPER</td>
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<td>DRYWALL HANGER AND METAL STUD INSTALLER</td>
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<tr>
<td>-----------------------------------------------</td>
<td>-------------</td>
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<tr>
<td>LABORER: Roof Tearoff</td>
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<td>LABORER: Landscape and Irrigation</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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<tr>
<td>OPERATOR: Bulldozer</td>
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<td>OPERATOR: Drill</td>
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<td>OPERATOR: Forklift</td>
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<td>OPERATOR: Grader/Blade</td>
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<tr>
<td>OPERATOR: Loader</td>
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<td>OPERATOR: Mechanic</td>
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<td>OPERATOR: Paver (Asphalt, Aggregate, and Concrete)</td>
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<td>OPERATOR: Roller</td>
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<tr>
<td>SPRINKLER FITTER (Fire Sprinklers)</td>
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<td>TILE FINISHER</td>
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<td>TILE SETTER</td>
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<tr>
<td>TRUCK DRIVER: Dump Truck</td>
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<tr>
<td>TRUCK DRIVER: Flatbed Truck</td>
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</table>
TRUCK DRIVER: Semi-Trailer
Truck.............................$ 12.50             0.00

TRUCK DRIVER: Water Truck.......$ 12.00             4.11

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
- END OF SECTION-
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 considered to be 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. Owners Allowance: Include an Owners Allowance of $_________ dollars in the bid price. This allowance will be used by the Owner to add additional work to the project.

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.

– END OF SECTION –
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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 for the Project is 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 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 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. 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. Arrange for a Life Safety Inspection by the DCC after setup, after tear down and annually while the staging area is in operation.

F. Enclose the staging area with a security fence.

G. 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.

H. Obtain approval of separate and distinct storage areas, including employee parking from the OAR and the EAD.

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

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

K. Stockpile all materials inside the Contractor staging area.

L. 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.

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

N. 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.

O. 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.

P. 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. Comply with IFC Chapter 3 which includes the following general precautions against fire: establish designated Smoking Areas, post No Smoking signs, provide orderly storage, and remove construction debris, waste, and packing materials from the staging area before it becomes a nuisance / fire hazard.

C. 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.

D. 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.

E. Maintain all-weather roads to ensure emergency equipment access to structures, equipment, and material storage areas. Repair potholes and ruts as they are identified and no later than 48 hours after identification.

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. Repair any damage to existing pavement.

3.4 CLOSURE

A. 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.

B. 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

This Section includes the following:

A. Start up and testing of equipment and systems.
B. Identification and documentation of all infrastructure, systems, and equipment (Systems) issues and failures.
C. Corrective Actions and acceptance of corrected Systems.
D. Coordination of Commissioning requirements.

1.2 DESCRIPTION

A. Purpose

To obtain an approved Commissioning Plan and final Commissioning Report accepted by the Airport Commissioning Authority as required by Airport Board Policy (ABP).

B. Design and Construction Phase Commissioning Goal

Issuance of a Commissioning Plan to reflect the design intent of the final system configurations and operations necessary to obtain a permit for construction.

C. Post-Construction Phase Commissioning Goal

Issuance of an approved final Commissioning Report to reflect all Systems commissioned have been installed, operated, and tested to meet the construction specification requirements and have met the minimum operational and training requirements of the Owner as necessary for the Owner acceptance and issuance of a Certificate of Occupancy (CO).

D. Systems to be commissioned will be listed in detail in the Specifications listed below, and in PART 3 of this Section, when applicable with the Project’s Scope of Work:

1. Division 22 - Plumbing
2. Division 23 – Heating, Ventilation, and Air Conditioning (HVAC)
3. Division 26 – Electrical

1.3 DEFINITIONS

A. Basis of Design:  The Basis of Design (BOD) is a document that details the Architect/Engineer’s design plan to achieve the Owner’s Project Requirements (OPR).  This document includes assumptions, existing conditions, and performance boundaries.

B. Commissioning:  A systematic process of verifying and documenting that the performance and maintainability of Systems fulfill the operational and functional requirements of the Owner and the Owner’s representatives, users, and operators.  Commissioning is intended to achieve the following specific objectives according to the Contract Documents.

1. Verify that all applicable Systems are installed according to the Contract, manufacturer’s recommendations, and to industry accepted minimum standards and that they receive adequate operational checkout by the Installing Subcontractor(s).
3. Verify that all Operations and Maintenance (O&M) documentation is complete.
4. Verify that the Owner’s operating personnel are adequately trained.

C. Commissioning Agent (CxAg):  The person selected to chair the Commissioning Team and coordinates and oversees the development and execution of the Commissioning Plan.  The CxAg will be a selected and employed by the Owner.  The CxAg will be a licensed professional engineer in the State and experienced in the Commissioning of mechanical and electrical systems of the type and complexity installed in this Project.  The CxAg will have experience in construction process, direct digital control systems, and test adjust and balance operations.  The
CxAg shall not be associated with or employed by the Contractor or any Subcontractor or equipment/system supplier connected with the Project.

D. Commissioning Coordinator: An authorized representative of the Owner, Contractor, Installing Subcontractor(s) or other members of the Commissioning Team who are designated in writing to the Commissioning Team, who attend Commissioning meetings and who act as the responsible central point of contact between their companies and the Commissioning Team.

E. Commissioning Authority (CxAu) or Designee (CxAuD). DFW Airport Board manager responsible for ensuring compliance with the DFW Airport Board Commissioning Policy and approving proponents for commissioning, the project commissioning plan, and the Final Commissioning Report.

F. Commissioning Plan: The plan prepared by the CxAg providing guidance and outlines the execution of the Commissioning process, verifying that the Systems perform at or above the expected level as specified in the Contract Documents. The Commissioning Plan is a detailed account of the Commissioning activities as they relate to the Project. The plan includes a listing of Commissioning Team members, phases of the Project, each team member’s Commissioning related responsibilities during each phase and the expected deliverables from each team member. Communication protocols between the members of the team and their respective companies are defined in the plan. As a living document, the plan will be continuously updated to reflect the evolving process as developed by the Commissioning Team. The Final Commissioning Plan is inclusive of the completed initial approved Commissioning Plan plus all approved and completed commissionable items associated with construction phase changes as provided for in the following:

1. Requests For Information
2. Design Change Notices
3. Approved Addenda or Alternatives
4. Approved final submittals, including control systems sequences of operation.

G. Commissioning Team: The group responsible for working together to implement the Commissioning process. The group can consist of all or part of the following members as dictated by the complexity and length of a Project:

1. Commissioning Authority (CxAu)
2. Senior Commissioning Manager (Sr. CxM)
3. Senior or Implementation Project Manager
4. Project Manager
5. Commissioning Manager (CxM)
6. Commissioning Agent (CxAg)
7. Architect/Engineer
8. Construction Manager at Risk (CMAR)
9. Contractor Commissioning Coordinator
10. Contractor
11. Controls Subcontractor (CC)
12. Electrical Subcontractor (EC)
13. Mechanical Subcontractor (MC)
14. Fire Protection Subcontractor (FPC)
15. Owner’s Authorized Representative (OAR)
16. Owner’s Authorized Facility Manager
17. Owner’s Authorized Central Utility Plant (CUP) Manager
18. Quality Assurance (QA) Inspectors
19. Design Code and Construction Department (DCC) Inspector
20. Design Code and Construction Department (DCC) Representative
21. Information Technology Systems (ITS) Representative
22. Department of Public Safety (DPS) Representative
23. Energy, Transportation and Asset Management (ETAM) Representative
24. Environmental Affairs Department (EAD) Representative
25. Testing, Adjusting and Balancing (TAB) Subcontractor
26. Other Installing Subcontractors or equipment suppliers.

H. Contractors Test Report: The Contractors’ tests are defined as any form of start-up, adjustment, or calibration performed on individual pieces of equipment as specified within the Contract Documents. The CxAg will provide a test report form to be used by the Installing Subcontractor as a cover sheet to the actual test results, for the documentation of each specified contractors test. The Contractor is responsible to upload the digital documents to the Owner’s designated electronic project management system, the Unifier software application, or as otherwise directed by the OAR for the Project.

I. Deficiency: An issue or observation that prohibits the successful passing of any step on the verification test procedure for any Systems that are specified in the Commissioning scope of the Project.

J. Issue: An observable item reported as a possible risk or concern to the Project.

K. Installing Subcontractor: The Subcontractor or supplier responsible for the actual installation of the System.

L. Owners Project Requirements (OPR): A written document detailing the functional requirements of the Project and the expectations of how it will be used and operated by the Owner. The document may include Project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information. This document may evolve as the Project progresses.

M. Pre-Functional Checklist (PFC)/System Readiness Checklist (SRC): A checklist created by the CxAg designed to demonstrate that the system is completely installed and ready for operational testing. At the end of installation, the Installing Subcontractor completes the operational checklist to certify that the work is complete and the system is ready for independent testing.

N. Functional Performance Test (FPT): A test that confirms each system will perform as specified functionally. The Installing Subcontractor shall perform each FPT. The CxAg will coordinate, witness, and document the FPT. During the FPT, the Installing Subcontractor shall sequence the system as outlined in the approved FPT procedure and provide the required test equipment and building automation system access as required.

1.4 COMMISSIONING AIRPORT BOARD POLICY and COMMISSIONING PLAN

A. Under Airport Board Policy ET.001 – Commissioning, it is the policy of the Board that all Board buildings and other appropriate facilities and Systems be commissioned. The policy provides the requirements for commissioning acceptance by the Airport’s Commissioning Authority and the Commissioning Authority Designees.

B. The Commissioning Plan provides guidance in the execution of the Commissioning process based on the Project Scope of Work.

C. Commissioning Process
The following provides a brief overview of typical Commissioning tasks during construction and the general order in which they should occur on the Project.

1. Commissioning during construction begins with a scoping meeting conducted by the CxAg where the Commissioning process is reviewed with the Commissioning Team members.

2. Additional meetings may be required throughout construction to plan, scope, coordinate, schedule future activities and resolve problems.

3. Equipment documentation including Architect/Engineer approved submittals are provided to the CxAg including detailed start-up procedures.

4. The CxAg works with the Commissioning Team in developing start-up documentation formats, including PFCs to be completed during the start-up process.

5. The checkout and performance verification proceeds from simple to complex, from component level to Systems and intersystem levels with PFCs being completed prior to functional testing.

6. The Installing Subcontractor(s), under his own direction, execute and document the PFCs and perform start-up and initial checkout. The Contractor documents that the PFCs and start-up were completed according to the approved plans. The Installing Subcontractor(s) will provide a minimum three (3) Working Days, notification to the CxAg, OAR, and other Owner's personnel of the date and time scheduled for performing start-up and initial checkout processes prior to the start up, so that they may witness start-up and the initial checkout.

7. The CxAg, in cooperation with the Installing Subcontractor(s), suppliers, and manufacturers develops specific equipment and system FPT procedures for all designated divisions and any other Systems identified as requiring Commissioning as part of the Project.

8. All other Divisions shall have the Contractor and the Installing Subcontractor(s), in cooperation with the suppliers and manufacturers; develop specific equipment and system FPT procedures to be submitted for Architect/Engineer approval and in accordance with the Project Specifications for use by the Commissioning Team for review, comment, and report form development. The FPT procedures are executed by the Installing Subcontractor(s), witnessed and documented by the CxAg after completion of the Installing Subcontractor(s) start-up procedures.

9. Items or issues associated with non-compliance in material, installation, setup, or sequence of operation are corrected at the Contractor’s expense and the system retested.

10. The Contractor reviews the O&M documentation for completeness and schedules and coordinates the Owner’s personnel training. All O&M documentation must be submitted in accordance with Section 01 78 23 and approved prior to the start of training. Refer to Section 01 79 00 for additional requirements.

11. The Contractor reviews and coordinates the training provided by the Installing Subcontractor(s), suppliers, manufacturers, the CxAg documents and verifies that the training was conducted and met the minimum requirements of the Owner. Refer to Section 01 79 00 for demonstration and training requirements.

12. Deferred testing is conducted, as specified for standard testing.

13. Final Commissioning Plan shall be completed and documented prior to Substantial Completion.

14. A Commissioning summary log is required in the Commissioning Plan and report to identify all Systems designated to have warranties and their warranty duration. Refer to Section 01 78 33 for acceptance procedures for generic and final warranty manual submissions.
1.5 RESPONSIBILITIES

A. The Contractor shall:

1. Develop and provide a complete list of Systems to be commissioned and of Systems requiring Owner personnel training for inclusion into the Commissioning Plan.

2. Facilitate the coordination of the Commissioning work and ensure that Commissioning activities are being scheduled into the master schedule.

3. Include the cost of Commissioning in the Contract Amount.

4. Furnish a copy of all Contract Documents, Addenda, Requests for Information (RFI), Change Orders, and approved submittals and Shop Drawings related to commissioned Systems to the CxAg.

5. Ensure each purchase order or subcontract written, includes requirements for submittal data, O&M data, Commissioning tasks and training.

6. Assist with the development and documentation of Commissioning test procedures for all Systems with the Installing Subcontractor(s).

7. Ensure that all Installing Subcontractor(s) execute their Commissioning responsibilities according to the Commissioning Plan, Contract Documents, and schedule.

8. Designate a Commissioning Coordinator who shall attend Commissioning scoping meetings and other necessary meetings scheduled by the CxAg to facilitate the Commissioning process.

9. Coordinate the training of the Owner’s personnel, including reviewing and approving the training plans and coordinate the digital recordings of the Owner’s personnel training including clear audio recording of all questions and inquiries and their associated responses, in accordance with Section 01 79 00.

B. The Contractor shall ensure that all Installing Subcontractor(s):

1. Include the cost of Commissioning as a line item in the sub-contract price.

2. Provide submittal data, O&M data, Commissioning tasks and training according to Contract Documents in each purchase order or subcontract written.

3. Designate a Commissioning Coordinator who shall attend Commissioning scoping meeting and other meetings scheduled and required by the Commissioning Agent to facilitate the Commissioning process.

4. Provide normal cut sheets and shop drawing submittals of approved equipment as part of the submittals.

5. Provide documentation prior to normal O&M Manual(s) submittal to the Contractor and CxAg for development of start-up and FPT procedures.

   a. Provide the following to the Contractor and CxAg:

      1) Detailed manufacturer installation and start-up instruction.
      2) Operating, troubleshooting and maintenance procedures.
      3) Full details of any Owner-contracted tests.
      4) Full factory test reports.
      5) Full warranty information which clearly identifies all responsibilities of the Owner to keep the warranty in force.
      6) Installation, start-up and checkout materials that are shipped with the equipment.
      7) Actual field checkout sheet forms to be used by the factory or field technicians.
b. Provide the proposed O&M Manual(s) format, organization, and content to the CxAg for review and comment. The manual shall follow the guidelines in accordance with Section 01 78 23.

c. Provide additional documentation, deemed necessary by the CxAg, for the Commissioning process.

6. Prepare and provide a copy of the O&M Manual(s) and submittals of the commissioned Systems using normal submittal procedures through the Contractor to the CxAg for review and comment.

7. Assist in clarifying the operation and control of commissioned Systems in areas where the Project Specifications, control drawings, or equipment documentation are insufficient for writing detailed testing procedures. Coordinate efforts with the Architect/Engineer as required.

8. Coordinate with the CxAg and provide the specific FPT procedures to ensure feasibility, safety, equipment protection, and provide necessary written alarm limits to be used during the tests to the CxAg through the Contractor.

9. Develop a full start-up and initial checkout plan using the manufacturer’s start-up procedures and the PFCs for all commissioned Systems. Submit through the Contractor to the CxAg for review and comment prior to start-up.

10. Execute the SRCs for all commissioned Systems during the start-up and initial checkout process.

11. Perform and clearly document all completed start-up and system operational checkout procedures, providing a copy to the Contractor and the CxAg.

12. Address and resolve current Punch List items prior to beginning FPTs.

13. Provide skilled technicians to execute starting of equipment and to execute the FPT. Ensure that technicians are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments, and problem solving.

14. Perform FPTs for specified Systems. Assist the CxAg in interpreting the monitoring data, as necessary.

15. Correct all deficiencies which include differences between specified and observed performance as interpreted by the Contractor and/or CxAg and the Architect/Engineer and retest the equipment.

16. Prepare the O&M Manual(s) according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

17. Prepare redline and CAD (electronic) drawings for all final as-built drawings for Contractor-generated coordination drawings.

18. Provide training of the Owner’s operating personnel as required in the Commissioning Plan. Refer to Section 01 79 00 for demonstration and training requirements.

19. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty. Develop, execute and document Contractor maintenance plans for Systems placed into service prior to beneficial occupancy. Provide records and reports of all pre-turnover maintenance.

20. Provide the equipment for testing in accordance with the Project Specifications.

C. The Contractor shall ensure that equipment suppliers:

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep all applicable warranties in force.
2. Include all special tools, including software and instruments only available from the supplier and specific to a piece of equipment, required for testing equipment according to these Contract Documents in the base bid price provided to the Contractor. This bid price does not include stand-alone data logging equipment that may be used by the CxAg.

3. Provide information requested by the CxAg regarding Systems sequence of operation and testing procedures.

4. Review test procedures for Systems installed by factory representatives.

D. Architect/Engineer

1. Designate a Commissioning Coordinator who shall attend the Commissioning scoping meeting and other necessary meetings scheduled by the CxAg to facilitate the Commissioning process.

2. Provide the Basis of Design (BOD) documentation to the Contractor for inclusion in the O&M Manual(s).

3. Review SRCs for Systems to be commissioned.

4. Assist in clarifying the operation and control of commissioned Systems in areas where Project Specifications, control drawings, or equipment documentation are insufficient for writing detailed testing procedures.

5. Review O&M Manual(s) according to the Contract Documents.

6. Provide technical assistance for resolution of non-conformances or deficiencies as appropriate.

E. Commissioning Agent (CxAg)

The primary role of the CxAg is to coordinate the development and execution of the Commissioning Plan, and to observe and document performance of commissioned Systems, in particular, whether Systems are functioning in accordance with the documents design intent and in accordance with the Contract Documents. The CxAg is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CxAg may assist with problem solving non-conformances or deficiencies, but ultimate responsibility for such corrections are the responsibility of the Contractor, Installing Subcontractor(s), manufacturer, and/or Architect/Engineer, as appropriate.

The CxAg will:

1. Coordinate the development of and maintains the Commissioning Plan.

2. Coordinate the Commissioning activities.

3. Coordinate the Commissioning work and coordinate with the Commissioning Team to ensure that Commissioning activities are being incorporated into the master schedule.

4. Assist with the revisions to the Commissioning.

5. Plan and conduct a Commissioning scope and coordination meetings.

6. Request and review information required to perform Commissioning tasks, including O&M materials, Contractor start-up and checkout procedures.

7. Prior to start-up operations, gather and review the current control sequences and interlocks and work with the Installing Subcontractor(s) and the Architect/Engineer until sufficient clarity has been obtained, in writing, to be able to assure detailed testing procedures are written.

8. Review the submittals of the Contractor and Installing Subcontractor(s) applicable to Systems being commissioned for compliance with Commissioning requirements, along with normal construction submittals.
9. Create, review, approve, and distribute preliminary pre-functional tests and PFCs.

10. Review and approve the start-up and initial checkout plan for Systems as developed by the Installing Subcontractor.

11. Perform site visits, to observe component and system installations. Attend selected planning and Project construction meetings to obtain information on construction progress. Review Project construction meeting minutes for revisions/substitutions relating to the Commissioning process. Assist in resolving any discrepancies.

12. Approve pre-functional tests and PFC completion by reviewing the PFC and by selected site observation and spot-checking.

13. Approve Systems startup by reviewing start-up reports and by selected site observation.

14. Analyze any FPT data as well as trend logs and monitoring data to verify performance.

15. Coordinate, witness, and approve manual FPTs performed by the Installing Subcontractor(s). Coordinate re-testing as necessary until satisfactory performance is achieved.

16. Review equipment warranties to ensure that the Owner’s responsibilities are clearly defined and provide a listing of warranties indicating equipment and duration of warranty.

17. Witness and document the training of the Owner’s operating personnel. Provide a sign in sheet for each session and conduct survey after each session.

18. Compile and maintain a Commissioning issues record log. Acceptance of the Commissioning process is dependent on the resolution of all Commissioning issue log items.

19. Review and approve the preparation of the Systems O&M Manual(s) in accordance with Section 01 78 23. Compile and provide listing of equipment for the O&M Manual(s).

20. Provide a final Commissioning Report including suggestions for improvement in the process.


22. Identify additional areas or Systems that should be included in the warranty manual information provided or in other areas under the Contract Documents.

23. Assist the Owner’s personnel in developing reports, documents, and requests for services to remedy outstanding problems.

1.6 SCHEDULING

The CxAg will work with the Commissioning Team to schedule the Commissioning activities. The CxAg will provide sufficient notice to the Commissioning Team for scheduling Commissioning activities. The Contractor shall integrate all Commissioning activities into the master schedule. All parties will address scheduling problems and provide the necessary notifications in a timely manner in order to expedite the Commissioning process.

1.7 QUALITY ASSURANCE

The Contractor and each Subcontractor involved with Systems to be commissioned on the Project will assign a Commissioning Coordinator with at least five (5) years’ experience with coordination of construction disciplines and verification testing of complete systems. This position is not a full time position unless the complexity of the job requires such a full time position. The Commissioning Coordinator(s) will be submitted for approval of the CxAg subject to satisfactory experience and performance. The Commissioning Coordinator(s) responsibilities shall include:
A. Coordination meetings.
B. Planning.
C. Scheduling.
D. Documentation.
E. Maintain close communication and coordination with the CxAg.
F. Development of testing procedures in coordination with the Installing Subcontractor(s).
G. Submitting the Contractor's test report submittal to the CxAg.
H. SRCs submittal.
I. Perform system verification tests.
J. Corrective Actions rectification and documentation.
K. Specified training planning and coordination.

1.8 QUALITY CONTROL
A. Ensure that the Contractor and each Installing Subcontractor follows the established Contractor's Quality Control (QC) program and procedures.
B. Ensure that the Contractor and each Installing Subcontractor corrects all deficiencies and incorporate the necessary adjustments to O&M Manual(s) and as-built drawings for applicable issues identified in any seasonal testing.

1.9 SUBMITTALS
A. The CxAg will provide the Contractor with specific requests for the type of submittal documentation required to facilitate the Commissioning work. These requests include the submission of electronic versions of all submittals, documents, manuals, etc. and will be integrated into the normal submittal process and protocol of the construction personnel and added to the Contractor’s submittal register. At a minimum, each request will include:
   1. Manufacturer and model number.
   2. Manufacturer's printed installation and detailed start-up procedures.
   3. Full sequences of operation.
   4. O&M data.
   5. Performance data.
   6. Any performance test procedures.
   7. Control drawings.
   8. Details of Owner contracted tests.
   9. List of installation materials that are shipped with the equipment.
   10. Field checkout sheet forms to be used by the factory or field technicians.
   11. Factory test results.
B. All documentation requested by the CxAg will be included in each Installing Subcontractor(s) contributions to the O&M Manual(s).
C. The CxAg will review and approve submittals related to the commissioned Systems for conformance to the Contract Documents as it relates to the Commissioning process, to the functional performance of the Systems, and to adequacy for developing test procedures. This review is intended primarily to aid in the development of FPT procedures and only secondarily to verify compliance with the Systems specifications.
D. The Contractor shall ensure that each Installing Subcontractor(s) designates a Commissioning Coordinator and provides information facilitating the incorporation and coding identification of Commissioning activities in the Construction Schedule within four (4) weeks of the Notice to Proceed (NTP).

E. The Contractor shall submit a detailed verification testing schedule to the CxAg at least four (4) weeks prior to start of testing.

F. The Contractor shall ensure that each Installing Subcontractor(s) submits test reports through the Contractor to the CxAg upon successful completion of each test.

G. The Contractor shall ensure that each Installing Subcontractor(s) submits information for the O&M Manual(s) (format, content, and organization) through the Contractor to the Architect/Engineer and the CxAg for review within at least ninety (90) Calendar Days prior to the start of scheduled verification testing.

H. The Contractor and each Installing Subcontractor(s) shall submit the O&M Manual(s) in accordance with the individual Specification Sections requiring an O&M Manual(s) and Section 01 78 23.

I. The supplier and Installing Subcontractor shall certify that the installed and operating Systems have been completed (with all deficiencies corrected) and that they are performing to in accordance with the Contract Documents including all tests and other requirements stipulated therein.

1.10 TRAINING

A. The Contractor shall coordinate O&M training activities through the Commissioning Plan. The Contractor shall provide training plans for equipment software systems and major components as specified in individual Project Specifications a minimum of ninety (90) Calendar Days prior to beginning verification testing.

B. The Training Plan shall include:
   1. Equipment or Systems involved in training session.
   2. Trainer’s name, company, and experience.
   3. Course outline/syllabus and list of training materials.
   4. Time required for the training session(s).

C. Suggested Training Topics:
   1. Preventive maintenance procedures and frequencies.
   2. Visual inspection parameters including operating sound and noise warnings.
   3. Normal range of gauge and meter readings.
   4. Use of special tools.
   5. Source of operating supplies, lubricants, cleaning materials, etc.
   6. Manufacturer contact names and telephone numbers.
   7. Warranty periods and enforcement procedures.
   8. Design and normal functional operating parameters (capacities, flows, temperatures, speeds, energy consumption, etc.
   9. Breakdown or malfunction conditions and troubleshooting.
   10. Routine testing procedures.

D. The Contractor shall document performance of training session by completing the O&M training form provided by the OAR. Indicate on the form:
   1. Date of training.
2. List of attendees and their affiliation.
3. Planned duration of training (hours and/or minutes).
4. Topics agenda, instructor names & company affiliation, instructor contact information.
5. Detailed list of planned handouts.

E. The Contractor shall obtain written acceptance of training session from the CxAg on the O&M training form.

F. The Contractor shall record all training sessions and submit for review and approval in accordance with Section 01 79 00 and submit the final documentation after incorporating all edits required by the review in accordance with Section 01 79 00 with a fully executed O&M training form.

PART 2 – PRODUCTS

2.1 TEST EQUIPMENT

A. The Contractor or Installing Subcontractor shall provide all standard testing equipment required to perform startup and initial checkout and the required FPT shall be provided by the Installing Contractor for the equipment being tested.

B. The Contractor or Installing Subcontractor shall provide special equipment, software, tools, and instruments that are only available from the supplier and specific to a piece of testing equipment (test tools) required for adequate testing. The cost of such test tools shall be included in the base bid price to the Contractor and will become the property of the Owner when testing is complete.

C. The Contractor or Installing Subcontractor shall repair any damage to these test tools and calibrate the tools so they are fully functional when turned over to the Owner and provide full documentation on the use, maintenance and calibration with these test tools.

D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Contract Documents.

E. Calibration records for all testing equipment shall be provided to the CxAg through the Contractor.

PART 3 – EXECUTION

3.1 MEETINGS

A. Scoping Meeting

Approximately 30-60 Calendar Days prior to start-up of construction or installation of the Systems to be commissioned, the CxAg will schedule, plan and conduct a Commissioning scoping meeting with the entire Commissioning Team in attendance. Multiple scoping meetings may be required due to multiple features of the Work as the construction progresses. The Contractor shall prepare and distribute meeting minutes to all parties. Information gathered from this meeting will allow the CxAg to revise the Commissioning Plan to its “final” version, which will also be distributed to all parties.

B. Miscellaneous Meetings

Additional meetings may be planned and conducted by the CxAg as construction progresses covering such topics as coordination, deficiency resolution, and planning issues with the respective Installing Subcontractor(s).

3.2 REPORTING

A. The CxAg will provide regular updates and reports to the Commissioning Authority and OAR.

B. The CxAg will regularly communicate with all members of the Commissioning Team to apprise them of the Commissioning progress and scheduling changes through memos, progress reports, etc.
C. The CxAg will prepare Non-Conformance Reports (NCRs) with the review and testing as described in this Section.

D. A final Commissioning Report by the CxAg will be provided focusing on evaluating the Commissioning process issues and identifying areas where the process could be improved. All acquired documentation, logs, minutes, reports, NCRs, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the report. PFCs, FPTs, and monitoring reports will be part of the final Commissioning Report.

3.3 SYSTEMS TO BE COMMISSIONED

A. The Division 22 and 23 Installing Subcontractor(s) shall take the lead in Commissioning of the following mechanical Systems:
   1. Chiller water piping
   2. Heating water piping
   3. Variable frequency drives
   4. Air handling units
   5. Fan coil units
   6. VAV terminal units
   7. Fan powered terminal units
   8. General exhaust fans
   9. Plumbing systems
   10. HVAC test and balance
   11. Building management and control systems

B. The Division 26 Installing Subcontractor(s) shall take the lead in Commissioning of the following electrical Systems:
   1. Lighting control system
   2. Electrical switchgear
   3. Automatic transfer switches
   4. Uninterrupted power systems
   5. Fault current analysis verification
   6. Grounding systems
   7. Lightning protection systems
   8. Emergency lighting

C. The Owner’s representatives will take the lead in Commissioning of the following Systems:
   1. Division 21 - Fire suppression systems
   2. Division 27 - Access control and CCTV systems
   3. Division 27 - Communications and technology systems (Ethernet, fiber, phones, etc.)
   4. Division 28 - Fire alarm and voice evacuation system
   5. Division 28 - Public address system

3.4 CONTRACTOR TESTS

A. The Contractor shall ensure that each Installing Subcontractor and suppliers provide a list and schedule of specified Contractor tests to the CxAg.
B. Unless specified otherwise, the Contractor shall provide a minimum of two (2) weeks notice to the CxAg prior to execution of specified Contractor’s tests.

C. The Contractor shall submit test reports to the CxAg and the Architect/Engineer within one (1) week of completion of each test.

3.5 SUBSTANTIATING SYSTEM READINESS

The Contractor shall:

A. Construct or install Systems and confirm readiness for testing prior to start of verification test procedures.

B. Inform the CxAg in writing of the System readiness for verification testing at least two (2) weeks prior to the scheduled start of testing. Complete the SRCs and submit to CxAg.

C. Perform and document instrumentation and digital controller calibration or provide documentation verifying manufacturer’s performance of calibration prior to verification testing. The CxAg may observe calibration procedures.

D. Not commence with any system verification testing until such System is documented ready for testing via submittal of the SRC to the CxAg.

3.6 START-UP, PRE-FUNCTIONAL/SYSTEM READINESS CHECKLISTS AND INITIAL CHECKOUT

The following procedures apply to all equipment and systems to be commissioned as part of the Project.

A. The Installing Subcontractor(s) responsible for startup of any System shall develop detailed start-up plans for all equipment which are a part of that System. Each piece of equipment will receive a full pre-functional checkout. The CxAg will assist in the development of detailed start-up plan to ensure that each of the manufacturer-recommended procedures has been completed. The parties responsible for the PFC and startup will be identified in the Commissioning scoping meeting and in the PFC. The party responsible for executing FPTs are identified in the testing requirements.

1. The CxAg will assist in the development of checklists that indicate required procedures to be executed as part of startup and initial checkout of the systems and the party responsible for their execution.

2. The Contractor shall determine which Installing Subcontractor is responsible for executing and documenting each of the line items tasks and shall note the responsible party on the form. Each form may have more than one party responsible for its execution.

3. The Contractor shall ensure that the Installing Subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining or adding to the Architect/Engineer checklists with the manufacturer’s detailed start-up and checkout procedures from the O&M Manual and the normal field checkout sheets.

   The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.

   The full start-up plan may consist of:

   a. The PFCs.

   b. The manufacturer’s standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.

   c. The manufacturer’s normal field checkout sheets.

4. The Contractor shall ensure that the Installing Subcontractor submits the full start-up plan to the CxAg for review and approval.
5. The CxAg will review and approve the procedures and the format for documenting them, noting any procedures that need to be added.

6. The full start-up procedures and the approval form may be provided to the Contractor for review and approval, depending upon the management protocol.

B. Execution of PFCs and Start-up.

1. Two (2) weeks prior to start-up, the Contractor, the Installing Subcontractor(s) and suppliers will schedule start-up and checkout with the CxAg. The performance of the PFCs, startup, and checkout are directed and executed by the Installing Subcontractor or supplier with oversight by the Contractor. When checking off PFCs, signatures may be required of other Installing Subcontractors for verification of completion of work.

2. The CxAg shall observe the procedures for each piece of primary equipment, unless there are multiple units, whereby a statistical sampling strategy may be used as approved.

3. The CxAg may observe a sampling of the PFCs and start-up procedures for lower-level components of System equipment.

4. The Contractor, in conjunction with Installing Subcontractor(s), and suppliers shall execute start-up and provide the CxAg with a signed and dated copy of the completed start-up and pre-functional tests and PFCs.

5. Only individuals with direct knowledge and witnessed that a line item task on the PFC was actually performed shall initial or check that item off.

C. Deficiencies, Non-conformance and Approval in Checklists and Start-up.

1. The Contractor shall ensure that the Installing Subcontractor clearly lists any outstanding items of the initial start-up and pre-functional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies shall be submitted to the CxAg within two (2) Working Days of the test completion.

2. The Contractor and the CxAg shall review the report and submit either an NCR or an approval to the Installing Subcontractor. The Contractor and CxAg shall work with the Installing Subcontractor to correct test deficiencies or incomplete items. The Installing Subcontractor or suppliers shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CxAg as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original NCR. When satisfactorily completed, the CxAg will recommend approval of the execution of the checklists and start-up of each system using a standard form.

D. Pre-functional Test Form

After the initial Systems submittal phase, the CxAg shall prepare Pre-Functional Test forms for each item of Systems equipment as part of the Commissioning process. The Contractor shall review the respective Pre-Functional Test forms for accuracy, completeness, and provide comments to the CxAg.
3.7 VERIFICATION/FUNCTIONAL PERFORMANCE TESTS

A. Objective
   a. The objective of Functional Performance Tests (FPTs) and verification tests is to demonstrate that each System is operating according to the documented design intent and the requirements within the Contract Documents. Functional testing facilitates bringing the Systems from a state of Substantial Completion to full dynamic operation. Each System shall be operated through all modes of operation where there is a specified System response. The Contractor or Installing Subcontractor shall verify each sequence within the sequences of operation.

B. FPTs and verification testing may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results. The CxAg will determine which method is most appropriate for tests that do not have a method specified. Simulating conditions shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical. Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Contractor and the Installing Subcontractor executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor and the Installing Subcontractor shall return all affected Systems, due to these temporary modifications, to their pre-test condition.

C. The Contractor and the Installing Subcontractor shall perform verification test procedures as outlined in the approved verification test plan.

D. The Installing Subcontractor shall provide input into the Contractor’s master scheduling process with regards to timing and duration of verification test procedures.

E. The CxAg will review and provide comment on final detailed verification test procedures. The Contractor and the Installing Subcontractor shall develop the verification test procedures from information incorporated in the System shop drawings and submittals. The Cx Ag will provide feedback on the efficiency of the procedures and possible alternate approaches to achieving the same results.

3.8 FUNCTIONAL PERFORMANCE TEST FORMS

A. The Contractor and the Installing Subcontractor(s) shall provide personnel and equipment, to perform the FPT procedures. After the finalization of the Pre-Functional Test forms, the CxAg will prepare FPT forms for each System which is a part of the Commissioning process. The Contractor shall review the respective FPT forms for accuracy, completeness, and provide comments to the CxAg.

B. Sample FPT forms are required with each Commissioning Plan submission for acceptance.

3.9 CORRECTIVE ACTIONS

A. The Contractor shall perform or ensure the Installing Subcontractor(s) or suppliers provide Corrective Actions for the resolution of deficiencies identified in the Commissioning Issue Log.

B. The CxAg will document deficiencies discovered during the Commissioning process on an Issue Log within one (1) Working Day of discovery.
   1. Deficiency Identification Process:
      a. Document date of identification.
      b. Describe nature of deficiency.
c. Distribute original Issue Log to the Installing Contractor’s Commissioning Coordinator.
d. Distribute copies to:
   1) Contractor
   2) Architect/Engineer
   3) Other contractors impacted by deficiency.

2. The Contractor shall ensure the Installing Subcontractor performs the following:
a. Obtains the original form.
b. Records the date of direction.
c. Provides a description of Corrective Action required.
d. Records the name of person issuing the direction.
e. Determines the estimated date to complete the Corrective Action.
f. Distributes the original form to CxAg.
g. Distributes copies of the form to:
   1) Architect/Engineer
   2) Contractor
   3) Installing Subcontractor’s Commissioning Coordinator
   4) Other contractors impacted by the deficiency

3. The Contractor shall ensure the Installing Subcontractor or supplier completes the following actions when Corrective Actions are completed by the Installing Subcontractor, supplier, and/or the Contractor:
a. Obtains the original form.
b. Records date of correction.
c. Provides a description of final equipment status or Corrective Action performed.
d. Records the name of Installing Subcontractor that performed the work.
e. Submits the original form using normal submittal procedures through the Contractor to the CxAg.

   f. Distributes copies of the form:
      1) Architect/Engineer
      2) Contractor’s Commissioning Coordinator.
      3) Commissioning Coordinator for the Installing Subcontractor or the supplier
      4) Other contractors impacted by the deficiency.

4. The CxAg will perform a verification of the Corrective Action completion and record:
a. Date of the retest.
b. Determined status - Resolved or Corrective Action required.
c. Name of person performing verification.
d. Distributes copies to:
   1) Architect/Engineer
   2) Installing Contractor's Commissioning Coordinator.
   3) Contractor.
   4) Other contractors impacted by deficiency.

C. Cost of Retesting
The cost for retesting a Pre-functional Test or PFT due to the action of, or a deficiency caused by, the Contractor or Installing Subcontractor shall be the sole responsibility of the Contractor. Any costs for retesting not due to the actions of, or a deficiency caused by, the Contractor or Installing Subcontractor, may be negotiated with the Owner in accordance with the Contract Documents.

D. Failure Due to Manufacturer Defect
If ten (10) percent or three (3) of any individual item (size alone does not constitute a difference), whichever is greater, fails to perform in accordance with the Contract Documents (mechanically or substantively) due to manufacturing defect, which in the sole determination of the OAR renders the item unable to meet its performance requirements, all identical units will be considered unacceptable. In such a case, the Contractor shall provide the OAR and CxAg with the following:

1. Within one (1) week of notification, the Installing Subcontractor or manufacturer’s representative shall examine all other identical units and record the findings. The findings shall be provided within two (2) weeks of the original notice.

2. Within two (2) weeks of the original notification, the Installing Subcontractor or manufacturer’s representative shall provide a signed and dated, written explanation of the problem, cause of failure, and all proposed solutions including full equipment submittals of the original installation.

3. The OAR is solely responsible to determine whether a replacement of all identical units or a repair is acceptable.

4. Upon acceptance of a solution to the deficiency or non-conformance, the Contractor, Installing Subcontractor, and/or manufacturer’s representative shall replace or repair all identical items and extend the warranty accordingly, if the original equipment warranty had begun, at no cost to the Owner. The replacement/repair work shall proceed with reasonable speed beginning within one (1) week from when parts can be obtained.

E. Approval
The CxAg notes each satisfactorily demonstrated FPT on the test form. The CxAg recommends acceptance of each test using a standard form. The OAR will provide any final approval on each test using the same form and will provide a signed copy to the CxAg and the Contractor.

3.10 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS
A. The Contractor shall provide a demonstration of the operation of the Commissioned Systems at approximately ten (10) months into the initial warranty period. The CxAg will witness the demonstration of the Systems and prepare an “Opposite Season” report as well as a “Lessons Learned” report for the Project if required by the Commissioning Plan.

B. The intent of the ten (10) month demonstration will be to identify any operational concerns, document suggested solutions and review the long-term operational and re-commissioning requirements of the Systems.
C. The Contractor shall use FPT forms to document performance.

3.11 OPERATION AND MAINTENANCE MANUALS

A. The following O&M Manual requirements do not replace O&M Manual documentation requirements elsewhere in the respective Project Specification Sections.

B. The Architect/Engineer shall compile and prepare design documentation for all Systems specified in each division of the Specification Sections and deliver this documentation to the Contractor for inclusion in the O&M Manual(s) prior to the training of Owner personnel.

C. The CxAg shall receive a copy of the O&M Manual(s) for review.

D. Field checkout sheets and logs should be provided to the CxAg for inclusion in the Commissioning Record Book section of the O&M Manual(s).

E. Review of the Commissioning related sections of the O&M Manual(s) shall be performed by the Architect/Engineer, the Contractor, and the CxAg.

3.12 TRAINING OF OWNER PERSONNEL

A. The Contractor shall be responsible for training coordination, scheduling, and ultimately to ensure that training of the Owner’s personnel is completed in accordance with the requirements of this Section.

B. The CxAg shall be responsible for witnessing and approving the content and adequacy of the training of the Owner personnel for commissioned Systems.

3.13 WRITTEN WORK PRODUCTS

The Contractor’s written work products shall consist of the start-up and initial checkout plan described and the completed start-up, initial checkout and PFCs, manufacturer’s factory documentation and testing; field testing inspection forms, Contractor inspection forms, and O&M Manual(s) both in electronic and hard copy in accordance with this Section. These work products shall be submitted to the CxAg to be included in the final Commissioning Report as required.

PART 4 – FORMS

The forms and documents to be used for the Commissioning processes shall be in accordance with the Building Commissioning Association (BCA), AABC Commissioning Group (ACG), National Environmental Balancing Bureau (NEBB), American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), or the University of Wisconsin or as otherwise provided or approved for the Project by the CxAg and the OAR.

A. Provide pictures of equipment and issues identified in the field.

B. Provide demonstration of trend logging performance of the building automation system.

C. Maintain consistency throughout Commissioning Plan and final Commissioning Report for all approved forms.

D. Provide digital hyperlinks for all Commissioning Report sections

PART 5 – 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.

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.

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 SUBMITTALS

A. Provide all submittal requirements under this section as a single package. Incomplete packages will not be reviewed.

B. Proposed Protection Measures: Submit drawings, that indicate construction detailing and proposed locations of construction of barriers.

C. 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 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.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Predemolition Photographs or Video: Submit before Work begins.

F. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

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

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

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. Reference specification sections 01 11 00 – Summary of Work for allowable hours of work.

C. Notify Owner 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 the Owner.

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 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations as applicable.

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

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Owner.

D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or preconstruction videotapes.

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 or delivery 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.
1. Comply with requirements for existing services/systems interruptions specified in Section 015100 "Temporary Utilities."

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

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."

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.
4. Comply with requirements for temporary enclosures, dust control, specified in Section 015623 "Temporary Barriers and Enclosures."
5. Coordinate with the Owner for temporary signage and/or graphics to be affixed to construction barricades.

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. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

B. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.

C. Removed and Salvaged Items:
   1. Clean salvaged items.
   2. Coordinate with the Owner for the location of items to be stored and reinstalled.
   3. 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. Protect items from damage during transport and storage.
   3. 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 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Testing Agency: Engage a qualified testing agency to inspect and scan rebar locations using a non-destructive method at core locations for floor slab conditions and to furnish reports to Architect. If core locations are required to be modified, the Contractor is not to core until the new location is provided by the Architect and coordinated with all new equipment and circulation criteria.

3.6 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 and legally dispose of them in an EPA-approved landfill.
   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 017419 "Construction Waste Management and Disposal."

B. Disposal: Transport demolished materials off Owner's property and legally dispose of them.
3.7 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.

3.8 SELECTIVE DEMOLITION SCHEDULE
A. Existing Items to Be Removed, but not limited to:
   1. Revolving Doors
   2. Storefront frames, doors and glazing
   3. Thin set terrazzo floor and base
   4. Electrical wiring, conduits and raceways
   5. Concrete floor cores
   6. Metal stud and gypsum board walls
   7. Selective acoustical panel ceiling and metal suspension system
   8. Selective laminate wall panels.

END OF SECTION
SECTION: 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:

1.2 SUMMARY
A. This Section includes the following:
1. Miscellaneous steel framing and supports.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel strapping/ blocking for precast terrazzo substrate at metal stud and drywall assemblies.
4. Stainless Steel corner guards, reveals and miscellaneous trim and accessories.

1.3 SUBMITTALS
A. Provide all submittal requirements under this section as a single package. Incomplete packages will not be reviewed.

B. Product Data

C. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

D. Welding certificates.

E. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.4 INFORMATIONAL SUBMITTALS
A. Qualification Data: For professional engineer.

B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.

C. Welding certificates.

1.5 QUALITY ASSURANCE
A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

B. Ferrous Metals:
   1. Steel Plates, Shapes, and Bars: ASTM A 36.
   2. Steel Tubing: ASTM A 500, cold-formed steel tubing

C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.


E. Aluminium Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

F. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
   1. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with G90 (Z275) coating.

2.2 FASTENERS

A. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

B. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

2.3 MISCELLANEOUS MATERIALS

2.4 FABRICATION

A. General: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

1. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
2. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.
3. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
4. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
5. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 24 inches o.c.

B. Miscellaneous Framing and Supports: Provide steel framing and supports not specified in other Sections as needed to complete the Work. Fabricate units from steel shapes, plates, and bars of welded construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

END OF SECTION
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PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Interior ornamental, free standing podium.

1.3 SUBMITTALS
A. Provide all submittal requirements under this section as a single package. Incomplete packages will not be reviewed.
B. Product Data: For each type of product.
C. Shop Drawings: For interior architectural woodwork.
   1. Include plans, elevations, sections, and attachment details.
D. Samples: For each exposed product and for each color and finish specified, in manufacturer's or fabricator's standard size.
E. Samples for Initial Selection: For each type of exposed finish.
F. Qualification Data: For fabricator.
G. Quality Standard Compliance Certificates: AWI Quality Certification Program.

1.4 QUALITY ASSURANCE
A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
1.5 FIELD CONDITIONS

A. Established Dimensions: Where emergency phone, emergency call button and associated back boxes are indicated to fit into interior architectural woodwork, establish dimensions and coordinate with other trades for routing of wiring.

PART 2 - PRODUCTS

2.1 INTERIOR ARCHITECTURAL WOODWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

2.2 INTERIOR ORNAMENTAL WOODWORK FOR STAINLESS STEEL AND PLASTIC-LAMINATE-FACED FINISH

A. Grade: Premium.

B. Type of Construction: Frameless.

C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

D. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

E. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Match DFW sample.
2. As selected by Architect from laminate manufacturer's full range.

F. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

1. Finish: # 4 directional.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches (76 mm) wide.
2. Wood Moisture Content: 5 to 10 percent.
2.4 FIRE-RETARDANT-TREATED WOOD MATERIALS
   A. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, 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 (3.2 m) beyond the centerline of the burners at any time during the test.

2.5 MISCELLANEOUS MATERIALS
   A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber.
   B. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

2.6 FABRICATION
   A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
   B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.
   C. Shop-cut openings to maximum extent possible to receive appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
   D. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation.

PART 3 - EXECUTION

3.1 PREPARATION
   A. Before installation, condition interior architectural woodwork to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION
   A. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed in the shop.
   B. Install interior architectural woodwork level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects. Where not possible to repair, replace interior architectural woodwork. Adjust joinery for uniform appearance.

B. Clean interior architectural woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION
SECTION: 06 42 19
PLASTIC-LAMINATE-FACED WOOD PANELING

PART 1 - GENERAL

A. Section Includes:

2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced wood paneling that is not concealed within other construction.

B. Related Requirements:

1. Section 092216 "Non-Structural Metal Framing" for, flat strap blocking and backing plate required for installing paneling that is concealed within other construction before paneling installation.

1.2 SUBMITTALS

A. Provide all submittal requirements under this section as a single package. Incomplete packages will not be reviewed.

B. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Shop Drawings: For plastic-laminate-faced wood paneling.

1. Include plans, elevations, sections, and attachment details.
2. Show details full size.
3. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.

D. Samples for Initial Selection: For each type of plastic laminate.

E. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.


B. Installer Qualifications: Fabricator of products.
PART 2 - PRODUCTS

2.1 PANELING, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-faced wood paneling (decorative laminate surfacing) indicated for construction, finishes, installation, and other requirements.

2.2 PLASTIC-LAMINATE-FACED WOOD PANELING

A. Grade: Premium.
B. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed surfaces matching existing panels.
D. Panel Core: Fire-retardant particleboard or fire-retardant MDF.
   1. Thickness: 3/4 inch (19 mm).
E. Panel Reveals: Matte black plastic laminate.
F. Adhesives for Bonding Plastic Laminate: Contact cement.
G. Fire-Retardant-Treated Paneling: Panels shall consist of fire-retardant plastic laminate and fire-retardant particleboard or fire-retardant, medium-density fiberboard (MDF). Panels shall have a flame-spread index of 25 or less and a smoke-developed index of 450 or less per ASTM E 84, and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
H. Assemble panels by gluing and concealed fastening.

2.3 MATERIALS

A. Materials, General: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
B. Wood Moisture Content: 8 to 13 percent.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials 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 Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.

C. Fire-Retardant Fiberboard: MDF panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

2.5 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal anchors and inserts at inside face of walls.

2.6 FABRICATION

A. Complete fabrication, including assembly, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition paneling to humidity conditions in installation areas.

B. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install paneling to comply with quality standard grade of paneling to be installed.

B. Install paneling level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm). Install with no more than 1/16 inch in 96-inch (1.6 mm in 2400-mm) vertical cup or bow and 1/8 inch in 96-inch (3 mm in 2400-mm) horizontal variation from a true plane.
1. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/32 inch (0.8 mm).

C. Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective paneling, where possible, to eliminate defects. Where not possible to repair, replace paneling. Adjust for uniform appearance.

B. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION
SECTION: 07 84 13

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

1.2 SUBMITTALS

A. Provide all submittal requirements under this section as a single package. Incomplete packages will not be reviewed.

B. Product Data: For each type of product indicated.

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

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

D. Qualification Data: For Installer.

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

1.3 CLOSEOUT SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements", with a licensed fire protection engineer on staff.
B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems bearing marking of qualified testing and inspection agency.

C. Preinstallation Conference: Conduct conference at the project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Grace Construction Products.
3. Hilti, Inc.
6. RectorSeal Corporation.
7. 3M Fire Protection Products.
9. USG Corporation.

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Ratings determined per ASTM E 814 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: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

G. Low-Emitting Materials: Penetration firestopping sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

H. 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 manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

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. Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

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

D. Install fill materials for firestopping by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.3 FIELD QUALITY CONTROL

A. Contractor to engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.4 PENETRATION FIRESTOPPING SCHEDULE

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

B. Where Intertek ETL SEMKO-listed systems are indicated, they refer to design numbers in Intertek ETL SEMKO's "Directory of Listed Building Products" under "Firestop Systems."

C. Where FM Global-approved systems are indicated, they refer to design numbers listed in FM Global's "Building Materials Approval Guide" under "Wall and Floor Penetration Fire Stops."

D. Firestopping with No Penetrating Items:

2. Intertek ETL SEMKO-Listed Systems
3. FM Global-Approved Systems

E. Firestopping for Metallic Pipes, Conduit, or Tubing:
2. Intertek ETL SEMKO-Listed Systems
3. FM Global-Approved Systems

F. Firestopping for Nonmetallic Pipe, Conduit, or Tubing:
2. Intertek ETL SEMKO-Listed Systems
3. FM Global-Approved Systems

G. Firestopping for Electrical Cables:
1. UL-Classified Systems: C-AJ-3001-3999.
2. Intertek ETL SEMKO-Listed Systems
3. FM Global-Approved Systems

H. Firestopping for Cable Trays with Electric Cables:
2. Intertek ETL SEMKO-Listed Systems
3. FM Global-Approved Systems

I. Firestopping for Miscellaneous Electrical Penetants
2. Intertek ETL SEMKO-Listed Systems
3. FM Global-Approved Systems

J. Firestopping for Miscellaneous Mechanical Penetrants:
1. UL-Classified Systems: C-AJ-7001-7999.
2. Intertek ETL SEMKO-Listed Systems
3. FM Global-Approved Systems

K. Firestopping for Groupings of Penetrants:
1. UL-Classified Systems: C-AJ-8001-8999
2. Intertek ETL SEMKO-Listed Systems
3. FM Global-Approved Systems

END OF SECTION
SECTION: 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:

1. Interior joints in vertical surfaces.
2. Interior silicone joint sealants.

B. Related Sections:

1. Division 07 "Penetration Firestopping".
2. Division 09 "Gypsum Board".
3. Division 09 "Acoustical Panel Ceilings".

1.2 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.3 SUBMITTALS

A. Provide all submittal requirements under this section as a single package. Incomplete packages will not be reviewed.

B. Product Data: For each joint-sealant product indicated.

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

D. Compatibility and adhesion test reports. From sealant manufacturer, indicate the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

E. Product test reports.
1.4 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

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

B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

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

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 790.
b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
c. Pecora Corporation; 890.
d. Sika Corporation, Construction Products Division; SikaSil-C990.
2.4 LATEX JOINT SEALANTS

A. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF.

B. Products:
   1. Bostik Findley; Chem-Calk 600.
   4. Sonneborn, Division of ChemRex Inc.; Sonolac.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

   1. Products:
      a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.

2.6 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), O (open-cell material), or B (bi-cellular material with a surface skin), as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

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

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.

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

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

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

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

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

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

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type 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.

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

F. 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.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

H. 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.

3.4 PROTECTION

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

3.5 JOINT-SEALANT SCHEDULE

A.

<table>
<thead>
<tr>
<th>TYPE</th>
<th>POLYMER</th>
<th>EXPOSURE/TRAFFIC</th>
<th>USES/APPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elastomeric</td>
<td>Silicone</td>
<td>Interior moving joints in vertical surfaces and horizontal nontraffic surfaces</td>
<td>• Control and expansion joints on expose interior surfaces of walls.</td>
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<tr>
<td></td>
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<td></td>
<td>• Perimeter joints of interior openings where indicated.</td>
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<td></td>
<td></td>
<td></td>
<td>• Vertical control joints on exposed surfaces of interior walls and partitions.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Perimeter joints between interior wall surfaces and frames of interior doors, windows</td>
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<tr>
<td>Latex</td>
<td>Acrylic Latex Sealants</td>
<td>Interior</td>
<td>• Interior non-moving exposed sealants in gypsum drywall construction.</td>
</tr>
<tr>
<td>Tape</td>
<td></td>
<td>Exterior or interior</td>
<td>• Interior and exterior concealed sealants in sheet metal construction.</td>
</tr>
<tr>
<td>Acoustical</td>
<td></td>
<td>Interior</td>
<td>• Interior sealants in acoustically rated construction.</td>
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END OF SECTION
SECTION: 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

A. Section includes:
   1. Interior standard steel doors and frames.

B. Related Requirements:
   1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.3 SUBMITTALS

A. Provide all submittal requirements under this section as a single package. Incomplete packages will not be reviewed.

B. Product Data: For each type of product.
   1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

C. Shop Drawings: Include the following:
   1. Elevations of each door type.
   2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
   7. Details of accessories.

D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.
E. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Amweld Building Products, LLC.
2. Ceco Door Products; an Assa Abloy Group company.
4. Pioneer Industries, Inc.
5. Steelcraft; an Ingersoll-Rand company.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Doors and Frames:
1. Doors:
   2. Thickness: 1-3/4 inches (44.5 mm).
      a. Type: Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (seamless)
      b. Face: Uncoated steel sheet, minimum thickness of 0.032 inch (0.8 mm).
      c. Edge Bevel: Provide manufacturer's standard beveled or square edges.
      d. Core: Manufacturer's standard.
      e. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated doors.

3. Frames:
   a. Materials: Uncoated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
   b. Fabricate frames as full profile welded unless otherwise indicated.
   c. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
   d. Frames for Level 4 Steel Doors: 0.067-inch- (1.7-mm-) thick steel sheet.


2.4 FRAME ANCHORS

A. Jamb Anchors:
   1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
   2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).
   3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M; hot-dip galvanized according to ASTM A 153/A 153M, Class B.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
D. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

E. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

2.6 FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer’s standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. General: Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer’s written instructions.

B. Hollow-Metal Frames: Comply with SDI A250.11 or NAAMM-HMMA 840.
   1. Fire-Rated Openings: Install frames according to NFPA 80.
   2. Floor Anchors: Secure with postinstalled expansion anchors.
   4. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
      a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
      b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
      c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
      d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
   1. Non-Fire-Rated Steel Doors: Comply with SDI A250.8 or NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.
   2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

3.3 CLEANING AND TOUCHUP

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION
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SECTION: 08 41 13
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Industrial grade interior storefront framing for window walls.

1.2 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure, but not limited to, deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:
   a. Deflection exceeding specified limits.
   b. Loosening or weakening of fasteners, attachments, and other components.
   c. Failure of operating units.

B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria.

C. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.

1.3 SUBMITTALS

A. Provide all submittal requirements under this section as a single package. Incomplete packages will not be reviewed.

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

C. Shop Drawings: For aluminum-framed entrances. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction.
2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances, showing the following:
   a. Joinery, including concealed welds.
   b. Anchorage.
   c. Expansion provisions.
   d. Glazing.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Qualification Data: For Installer.

F. Maintenance Data: For aluminum-framed entrances to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.5 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of aluminum-framed entrances that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 MANUFACTURERS

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

1. CMI Architectural.
2. EFCO Corporation.
5. TRACO.
6. Tubelite Inc.

2.3 DOOR SYSTEMS

A. Framing Members: Manufacturer's standard extruded aluminum, minimum 0.125 inch (3.2 mm) thick and reinforced as required to support imposed loads.

1. Nominal Size: As indicated on Drawings.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
   d. Structural Profiles: ASTM B 308/B 308M.

2.4 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: As indicated.
4. Grade: Industrial (Heavy Duty)
B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.

2.5 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

2.6 ENTRANCE DOOR HARDWARE

A. Removable Mullions: BHMA A156.3 extruded aluminum.
   1. When used with panic exit devices, provide keyed removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305. Use only mullions that have been tested with exit devices to be used.

2.7 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
2.9 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: Custom color to match DFW standard.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.

B. Metal Protection:

1. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components plumb and true in alignment with established lines and grades.

D. Install glazing as specified in Section 088000 "Glazing."

END OF SECTION
SECTION: 08 7 100

DOOR HARDWARE

PART 1 - GENERAL

A. Section Includes:

1. Mechanical door hardware for the following:
   a. Swinging doors.

2. Electrified door hardware.

B. Related Requirements:

1. Section 081113 "Hollow Metal Doors and Frames" for astragals provided as part of labeled fire-rated assemblies and for door silencers provided as part of hollow-metal.
2. Section 280500 "Common Work results for Electronic Safety and Security".
3. Section 281300 "Automated Access Control".

1.2 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Conference participants shall include Contractor and Owner Security Representatives. Address delivery of keys.
1.4 SUBMITTALS

A. Provide all submittal requirements under this section as a single package. Incomplete packages will not be reviewed.

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

C. Shop Drawings: For electrified door hardware.
   1. Include diagrams for power, signal, and control wiring.
   2. Include details of interface of electrified door hardware and building safety and security systems.

D. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   1. Content: Include the following information:
      a. Identification number, location, hand, fire rating, size, and material of each door and frame.
      b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
      c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
      d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
      e. Fastenings and other installation information.
      f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
      g. Mounting locations for door hardware.
      h. List of related door devices specified in other Sections for each door and frame.

E. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the

F. Qualification Data: For Installer.

G. Sample Warranty: For special warranty.

H. Maintenance Data: For each type of door hardware to include in maintenance manuals.
1.5 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including excessive deflection, cracking, or breakage.
   b. Faulty operation of doors and door hardware.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Five years from date of Substantial Completion unless otherwise indicated below:
   a. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

A. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2.3 SCHEDULED DOOR HARDWARE

A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.

   1. Door hardware is scheduled in Part 3.

2.4 HINGES

A. Butts and Hinges: BHMA A156.1. Listed under Category A in BHMA’s "Certified Product Directory."

B. Template Hinge Dimensions: BHMA A156.7.

C. Manufacturers:

   1. Baldwin Hardware Corporation (BH).
   2. Hager Companies (HAG).
   3. McKinney Products Company; an ASSA ABLOY Group company (MCK).
   4. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

D. Electrified Functions for Hinges: Comply with the following:

   1. Power Transfer: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle.
   3. Power Transfer and Monitoring: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle, and with concealed electrical monitoring switch.

2.5 MECHANICAL LOCKS AND LATCHES

A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1. FED-STD-795, "Uniform Federal Accessibility Standards"

   1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

B. Electrified Locking Devices: BHMA A156.25.

C. Lock Trim:

   1. Levers: Wrought.
      a. Match style with hardware at nearby doors
   2. Escutcheons (Roses): Wrought.
   3. Dummy Trim: Match lever lock trim and escutcheons.
D. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:


2.6 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:


2.7 ELECTROMAGNETIC LOCKS

A. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Securitron Magnalock Corporation; an ASSA ABLOY Group company.

2.8 LOCK CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5, Grade 1.

B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Seven.
2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.

C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

D. Construction Keying: Comply with the following:

1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

E. Manufacturer: Same manufacturer as for locks and latches.

F. Manufacturers:

2. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
3. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).

2.9 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
   b. DORMA USA, Inc.
   c. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2.10 KEYING


B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
   a. Notation: "DO NOT DUPLICATE." And Information to be furnished by Commissioner.

2. Quantity: In addition to one extra key blank for each lock, provide the following:
   b. Master Keys: Five.

2.11 OPERATING TRIM

A. Standard: BHMA A156.6.

B. Materials: Fabricate from stainless steel, unless otherwise indicated.

2.12 SURFACE CLOSERS

A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1. FED-STD-795, "Uniform Federal Accessibility Standards"

1. Comply with the following maximum opening-force requirements:
a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.

B. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
   b. DORMA USA, Inc.
   c. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2.13 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

B. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.

2.14 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

2.15 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware.
through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Fire-Rated Applications:

   a. Steel Through Bolts: For the following unless door blocking is provided:
      1) Surface hinges to doors.
      2) Closers to doors and frames.
      3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.

4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.16 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

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

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner or furnish permanent cores to Owner for installation.

E. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Architect.

1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

F. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.6 DOOR HARDWARE SCHEDULE

A. Hardware Sets:
### HW 1.0 Interior/Double/Egress/Nonrated/Hollow Metal (Temp Cond 1 – Emergency Exit)

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<th>Quantity</th>
<th>Item Description</th>
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<td>MCK-12HD</td>
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<td>E##L-CEPT</td>
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<tr>
<td>2 ea</td>
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**INGRESS**  Momentary Key or Card Reader  
**EGRESS**   Card Reader, Then Exit Device

### HW 1.1 Interior/Double/Egress/Nonrated/Hollow Metal (Final Cond – Emergency Exit)

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<thead>
<tr>
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**INGRESS**  Momentary Key or Card Reader  
**EGRESS**   Card Reader, Then Exit Device

### HW 2.0 Interior/Double/Egress/Nonrated/Aluminum/Glass (Final Cond)

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<td>2 ea</td>
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**INGRESS**
- Momentary Key or Card Reader

**EGRESS**
- Exit Device
  - Provide floor stop when door is adjacent to glass panel

END OF SECTION
SECTION: 08 80 00

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Glazed storefront and glazing accessories.

1.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets deterioration of glazing materials; or other defects in construction.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

1.3 SUBMITTALS

A. Provide all submittal requirements under this section as a single package. Incomplete packages will not be reviewed.

B. Product Data: For each glass product and glazing material indicated.

C. Product Certificates: For glass and glazing products, from manufacturer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association’s Certified Glass Installer Program.

B. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

C. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

D. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.5 WARRANTY

A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Strength: Where float glass is indicated, provide annealed float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

B. Optical Performance Properties:

1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.

C. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written
instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.3 GLASS TYPES

A. Glass Type GL-1: Clear laminated glass.
   1. Minimum Thickness of Each Glass Ply: 3 mm.
   2. Interlayer Thickness: 0.030 inch
      Interlayer color: Clear

B. Glass Type GL-2: One-way mirror laminated glass.
   1. Clear annealed glass: 3 mm. minimum
   2. Silver sputter coat: second surface
   3. Interlayer Thickness: 0.060 inch (1.52 mm) clear
   4. Gray tinted annealed glass: 3 mm. minimum
      a. Light transmittance: 4%
      b. Reflection out (subject): 42%
      c. Reflection in (observer): 12%

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

C. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
3.4 CLEANING AND PROTECTION

A. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

C. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

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

PART 1 - GENERAL

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

1.2 SUBMITTALS
A. Provide all submittal requirements under this section as a single package. Incomplete packages will not be reviewed.
B. Product Data: For each type of product.
   1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."
C. Evaluation Reports: For embossed steel studs, runners and firestop tracks, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

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 E 119 by an independent testing agency.
B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
C. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft. (239 Pa).

2.2 FRAMING SYSTEMS
A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.

B. Studs and Runners: ASTM C 645. Use either steel studs and runners.

1. Steel Studs and Runners:
   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) CEMCO; California Expanded Metal Products
      2) Clark Dietrich Building Systems
      3) Phillips Manufacturing Co
   b. Minimum Base-Metal Thickness: 20 gauge.
   c. Depth: As indicated on Drawings.

2. Embossed Steel Studs and Runners are not acceptable.

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to runners while allowing 1-1/2-inch (38-mm).
   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) CEMCO; California Expanded Metal Products
      2) Clark Dietrich Building Systems
      3) Phillips Manufacturing Co

2. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs, installed with stud’s friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
3. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
4. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
   a. 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) CEMCO; California Expanded Metal Products
      2) Clark Dietrich Building Systems
      3) Phillips Manufacturing Co
D. Firestop Tracks: Top runner 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.

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. CEMCO; California Expanded Metal Products
   b. Clark Dietrich Building Systems
   c. Phillips Manufacturing Co

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. CEMCO; California Expanded Metal Products
   b. Clark Dietrich Building Systems
   c. Phillips Manufacturing Co

2. Minimum Base-Metal Thickness: As indicated on Drawings.

F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch (1.367-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.

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. CEMCO; California Expanded Metal Products
   b. Clark Dietrich Building Systems
   c. Phillips Manufacturing Co

2. Depth: As indicated on Drawings.
3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.


1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. CEMCO; California Expanded Metal Products
   b. Clark Dietrich Building Systems
   c. Phillips Manufacturing Co

2. Minimum Base-Metal Thickness: As indicated on Drawings.
3. Depth: As indicated on Drawings.
H. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
   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. CEMCO; California Expanded Metal Products
      b. Clark Dietrich Building Systems
      c. Phillips Manufacturing Co
   2. Configuration: hat shaped.

I. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
   1. Depth: As indicated on Drawings.
   2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch (0.8 mm).
   3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-(1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum uncoated-metal thickness of 0.0179 inch (0.455 mm), and depth required to fit insulation thickness indicated.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. CEMCO; California Expanded Metal Products
      b. Clark Dietrich Building Systems
      c. Phillips Manufacturing Co

2.3 AUXILIARY MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

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

C. Install 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.

3.4 INSTALLING FRAMED ASSEMBLIES

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


2. Multilayer Application: As required by horizontal deflection performance requirements.

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

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
   
a. Install two studs at each jamb unless otherwise indicated.
b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
   
a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

6. Curved Partitions:
   
a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (150 mm) o.c.

D. Direct Furring:
   
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

E. Z-Shaped Furring Members:
   
1. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

2. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (305 mm) from corner and cut insulation to fit.

END OF SECTION
SECTION: 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior gypsum board.

1.2 SUBMITTALS

A. Provide all submittal requirements under this section as a single package. Incomplete packages will not be reviewed.

B. Product Data: For each type of product indicated.

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 E 119 by an independent testing agency.

2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36 or ASTM C 1396, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Gypsum.
b. CertainTeed Corporation.
c. Georgia-Pacific Building Products.
e. United States Gypsum Company.

B. Gypsum Board, Type X, Abuse-Resistant Gypsum Board, Type C:

1. Thickness. 5/8 inch.
2. Long Edges: Tapered.
2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc.
2. Shapes:
   a. Cornerbead.
   b. LC-Bead: J-shaped; exposed long flange receives joint compound.
   c. L-Bead: L-shaped; exposed long flange receives joint compound.
   d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
   e. Expansion (control) joint.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

   1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

   a. Use setting-type compound for installing paper-faced metal trim accessories.

   3. Fill Coat: For second coat, use drying-type, all-purpose compound.
   4. Finish Coat: For third coat, use setting-type, sandable topping compound.
   5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

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

   1. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

E. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4 to 1/2-inch-wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

3.2 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Regular Type: Vertical surfaces, unless otherwise indicated.
2. Ceiling Type: Ceiling surfaces.
3. Moisture- and Mold-Resistant Type: As indicated on Drawings.

3.3 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.
4. U-Bead: Use at exposed panel edges.

3.4 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare...
gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Surfaces receiving medium- or heavy-textured finishes before painting or heavy wallcoverings where lighting conditions are not critical. (Not present in this project)
4. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
   a. Primer and its application to surfaces are specified in other Division 09 Sections.
5. Level 5: Surfaces receiving gloss and semigloss enamels and surfaces subject to severe lighting.
   a. For use at wall locations adjacent to linear ceiling lighting.
   b. Primer and its application to surfaces are specified in other Division 09 Sections.

3.5 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION
SECTION: 09 51 13

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 DEFINITIONS
A. AC: Articulation Class.
B. CAC: Ceiling Attenuation Class.
C. LR: Light Reflectance Coefficient.
D. NRC: Noise Reduction Coefficient.

1.3 SUBMITTALS
A. Provide all submittal requirements under this section as a single package. Incomplete packages will not be reviewed.
B. Product Data: For each type of product indicated at each location.
C. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.
   1. Acoustical Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
   2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- (150-mm-) long Samples of each type, finish, and color.
D. Maintenance Data: For finishes to include in maintenance manuals.

1.4 MATERIALS
A. Furnish materials that match products of existing installation and that are packaged with protective covering for storage and identified with labels describing contents.
1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer’s standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
2.3 ACOUSTICAL PANELS ACT-1

A. Product: Subject to compliance with requirements, provide panels as manufactured by one of the following or approved equal.

   1. Provide 2’ x 4’ and match adjacent in color and texture.
      a. Armstrong Industries.
      b. Celotex Corporation
      c. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Color: White

C. Thickness: 1 inch (25 mm).

2.4 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Provide manufacturer’s standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer’s extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer’s designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.

C. Match adjacent suspension system.

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 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer’s written instructions and CISCA’s "Ceiling Systems Handbook."
B. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
2. 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. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

C. Suspended Ceilings: Install main and cross runners, moldings and trim level to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

3.3 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION
SECTION: 09 65 13
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Vinyl base.

1.3 SUBMITTALS
A. Provide all submittal requirements under this section as a single package. Incomplete packages will not be reviewed.
B. Product Data: For each type of product.
C. Samples for Initial Selection: For each type of product indicated.

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 (10 deg C) or more than 90 deg F (32 deg C).

1.5 FIELD CONDITIONS
A. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL BASE:
A. Manufacturers:
   1. Armstrong Commercial Flooring
   2. Johnsonite
3. Mannington Mills, Inc.
4. Approved equal

B. Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).
   2. Style and Location:
      a. Style B, Cove: Provide in areas with resilient floor coverings.

C. Minimum Thickness: 0.125 inch (3.2 mm).
D. Height: 4 inches (102 mm).
E. Lengths: Coils in manufacturer's standard length.
F. Colors and Patterns: Match adjacent base.

2.2 VINYL MOLDING ACCESSORY
A. Description: Vinyl joiner for tile and carpet transition strips.
B. Colors and Patterns: As indicated by manufacturer's designations.

2.3 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.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

3.3 RESILIENT BASE INSTALLATION
A. Comply with manufacturer's written instructions for installing resilient base.
B. Apply resilient base to walls in rooms and areas where base is required.
C. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch resilient base during installation.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. 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
SECTION: 09 65 19
RESILIENT TILE FLOORING

PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Vinyl composition floor tile.

1.3 SUBMITTALS
A. Provide all submittal requirements under this section as a single package. Incomplete packages will not be reviewed.
B. Product Data: For each type of product.
C. Shop Drawings: For each type of resilient floor tile.
   1. Include floor tile layouts, edges.
D. Samples for Initial Selection: For each type of floor tile indicated.
E. Qualification Data: For Installer.
F. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.4 QUALITY ASSURANCE
A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1.5 DELIVERY, STORAGE, AND HANDLING
A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.
1.6 FIELD CONDITIONS
   A. Close spaces to traffic during floor tile installation.
   B. Close spaces to traffic for 48 hours after floor tile installation.
   C. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
      1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 VINYL COMPOSITION FLOOR TILE
   A. Manufacturers:
      1. Armstrong World Industries
      2. Johnsonite
      3. Mannington Mills, Inc.
   B. Tile Standard: ASTM F 1066, Class 2, through pattern.
   C. Wearing Surface: Smooth.
   D. Thickness: 0.125 inch (3.2 mm).
   E. Size: 12 by 12 inches (305 by 305 mm).
   F. Colors and Patterns: Match existing adjacent tile.

2.3 INSTALLATION MATERIALS
   A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
   B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
   C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.
PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
B. Concrete Substrates: Prepare according to ASTM F 710.
C. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION
A. Comply with manufacturer's written instructions for installing floor tile.
B. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
C. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
D. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
E. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION
A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
B. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
C. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
D. Cover floor tile until Substantial Completion.
END OF SECTION
SECTION: 09 66 23

RESINOUS MATRIX TERRAZZO FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Thin-set, epoxy-resin terrazzo for floors, precast wall base and patching.

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, inspect and discuss condition of substrate and other preparatory work performed by other trades.

1.3 SUBMITTALS

A. Provide all submittal requirements under this section as a single package. Incomplete packages will not be reviewed.

B. Product Data: For each type of product.

C. Shop Drawings: Include terrazzo installation requirements. Include plans and component details, and attachments to other work. Show layout of the following:

   1. Terrazzo patterns and locations.

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 location, 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 size indicated below:

   1. Precast Terrazzo: 6-inch- (150-mm-) square Samples.

E. Qualification Data: For Installer.

F. Material Certificates: For each type of terrazzo material or product, from manufacturer.

G. Mockup: Provide an in-place mock up at each local area for Owner review and approval. Mock ups may remain in place if approved by the Owner.
1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an installer who is a contractor member of NTMA.

B. Source Limitations: Obtain primary terrazzo materials from single source from single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.

1.5 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. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.6 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 terrazzo.

C. Review methods and procedures related to terrazzo including, inspect and discuss condition of substrate and other preparatory work performed by other trades.

D. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.

E. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.

F. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NTMA Standards: Comply with NTMA’s "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.2 EPOXY-RESIN TERRAZZO

A. Epoxy-Resin Terrazzo: Comply with NTMA’s "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and aggregate proportions and mixing.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Crossfield Products Corp., Dex-O-Tex Division; Cheminert.
   b. Sherwin Williams Company, General Polymers; Terrazzo 1100.
   c. Terrazzo & Marble Supply Companies; Terroxy Resin Systems.

2. Thickness: 1/4 inch (6.4 mm) nominal.

3. Custom Mix Color and Pattern: Match existing.

B. Materials:

1. Primer: Manufacturer's product recommended for substrate and use indicated.

2. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix.
   a. Physical Properties without Aggregates:
   b. Hardness: 60 to 85 per ASTM D 2240, Shore D.
   c. Minimum Tensile Strength: 3000 psi (20.7 MPa) per ASTM D 638 for a 2-inch (51-mm) specimen made using a "C" die per ASTM D 412.
   d. Minimum Compressive Strength: 10,000 psi (6.9 MPa) per ASTM D 695, Specimen B cylinder.
   e. Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D 1308.
      1) Distilled water.
      2) Mineral water.
      3) Isopropanol.
      4) Ethanol.
      5) 0.025 percent detergent solution.
      6) 1.0 percent soap solution.
      7) 10 percent sodium hydroxide.
      8) 10 percent hydrochloric acid.
      9) 30 percent sulfuric acid.
     10) 5 percent acetic acid.
   f. Physical Properties with Aggregates: For resin blended with Georgia white marble, ground, grouted, and cured per requirements in NTMA's "Terrazzo Specifications and Design Guide"; comply with the following:
   g. Flammability: Self-extinguishing, maximum extent of burning 1/4 inch (6.35 mm) per ASTM D 635.
   h. Thermal Coefficient of Linear Expansion: 0.0025 inch/inch per deg F (0.0025 mm/mm per 0.5556 deg C) for temperature range of minus 12 to plus 140 deg F (minus 24 to plus 60 deg C) per ASTM D 696.

3. 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.
   b. 24-Hour Absorption Rate: Less than 0.75 percent.
   c. Dust Content: Less than 1.0 percent by weight.

4. Finishing Grout: Resin based
C. Precast Terrazzo Base: Minimum 3/8-inch- (10-mm-) thick, epoxy terrazzo units cast in maximum lengths possible, but not less than 36 inches (900 mm). Comply with manufacturer's written instructions for fabricating precast terrazzo base units in sizes and profiles indicated.

1. Type: Straight.

2. Top Edge: Straight, unfinished.

3. Outside Corner Units: With finished returned edges at outside corner.


2.3 MISCELLANEOUS ACCESSORIES

A. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

B. 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.

C. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect terrazzo color or physical properties; 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, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.

B. Verify that substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

C. 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.
D. Comply with NTMA's written recommendations and manufacturer recommendations for terrazzo and accessory installation.

3.3 CLEANING AND PROTECTION

A. Cleaning:
   1. Remove grinding dust from installation and adjacent areas. 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. 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
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Metal Substrates.
2. Gypsum board.

1.2 SUBMITTALS

A. Provide all submittal requirements under this section as a single package. Incomplete packages will not be reviewed.

B. Product Data: For each type of product indicated.

C. Samples: For each finish and for each color and texture required.

1.3 QUALITY ASSURANCE

A. Mockups: Apply benchmark samples 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. DFW Representative will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

   a. Wall and Ceiling Surfaces: Provide samples of at least 2 sq. ft.

2. Apply benchmark samples after permanent lighting and other environmental services have been activated.

3. Final approval of color selections will be based on benchmark samples.

   a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Product: Subject to compliance with requirements, provide products indicated or comparable product from one of the following:

1. Benjamin Moore & Co.
2. Pratt & Lambert
3. PPG Architectural Finishes, Inc.
4. Sherwin-Williams Company

B. Colors: Match existing interior finishes and Architect’s sample.

C. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
   1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.2 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
   1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION AND APPLICATION

A. Comply with manufacturer's written instructions and applicable to substrates indicated.

B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
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. 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.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.3 INTERIOR PAINTING SCHEDULE

A. Metal Substrates (Aluminum, Steel, Galvanized Steel):

1. Latex System:
   a. Prime Coat: Primer, rust-inhibitive, water based: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.

B. Gypsum Board Substrates:

1. Latex System:
   c. Topcoat: Ceiling application: Latex, interior, flat, (Gloss Level 1): S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes the following:
   1. Interior directional signs.

1.2 DEFINITIONS
A. Room Identification and Directional Signage: Identifying devices shown and scheduled Drawings and Specifications to include interior sign panels and frames for room identification and direction throughout the building.


1.3 SUBMITTALS
A. Provide all submittal requirements under this section as a single package, as applicable. Incomplete packages will not be reviewed.

B. Product Data: Submit manufacturer's technical information, specific product identification and installation instructions for each sign type. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

C. Shop Drawings: Submit shop drawings for fabrication and installation of each sign type specified. Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, lettering layout, spacing, fasteners and anchoring devices, reinforcement, accessories, and installation details.
   1. Provide message list for each sign, including large-scale details of wording, lettering, artwork, and Braille layout.

D. Samples for Initial Selection: For each type of sign material indicated that involves color selection:
   1. Submit paint samples to allow color comparison with Pantone Matching System (PMS) and to confirm gloss finish. Provide sample of actual paint to be used,
applied to 4-inch by 4-inch minimum piece of actual sign material, for review and approval prior to use.

E. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
   1. Panel Signs: Full-size Samples of each type of sign required

F. Qualification Data: For fabricator.

G. Maintenance Data: For signs to include in maintenance manuals.

H. Warranty: Special warranty specified in this Section.

1.4 FABRICATION

A. Fabrication shall not begin until the Owner and Architect have approved all submittals in writing.

1.5 PRODUCT DELIVERY

A. Delivery and Storage: Deliver signs, frames and all components in a timely manner for installation without causing delay. Components shall be stored in a manner to prevent damage to the contents.

B. Damage: Any damage to the signs and accessories, prior to acceptance and not a result of vandalism, will be cause for their rejection, requiring replacement at no additional cost to the Owner.

1.6 QUALITY ASSURANCE

A. Qualifications: All work performed within this section, including fabrication and installation, shall be by a firm with a minimum of 5 years experience in the architectural sign industry, and specifically, in the manufacture of architectural identification with raised letters, numbers and Braille.

   1. Installer Qualifications: An authorized representative of signage manufacturer for installation and maintenance of units required for this Project

B. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA), the applicable edition of the Illinois Accessibility Code (IAC), and with code provisions as adopted by authorities having jurisdiction.

   1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction,
PART 2 - PRODUCTS

2.1 GENERAL

A. Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

B. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally.

2.2 GRAPHIC PROCESS

A. Manufacturers:

1. APCO Graphics, Inc.
2. ASI Sign Systems, Inc.
3. ASI-Modulex, Inc.
4. Approved Equal.

B. Permanent Identification

1. Letters, numbers and symbols shall be permanently bonded and raised a minimum of 1/32-inch from the smooth background.
2. Grade 2 Braille characters shall appear in accordance with ADA and IAC in regard to position, size and configuration. Characters shall have smooth edges, as opposed to edges that are sharp.
3. Acceptable photomechanical and/or computer-generated graphic processes are listed below from most to least desirable.
   a. Photo-etch nylon-polymer with metal substrate
   b. Chemical or Acid etched metal
   c. Cast metal
   d. Photo-sandblast metal or plastic

4. Sign Panels and Frames shall be fabricated in accordance with the Project Documents.

C. Changeable or temporary Identification: Fabricate signs to allow insertion of changeable messages in the form of transparent covers with paper inserts printed by Owner

1. Message shall be applied to the face of the removable insert
2. Computer-cut vinyl, photo-screen print process, or paper inserts produced on a laser writer are acceptable.
3. Furnish paper and software for creating text and symbols for IBM compatible computers for Owner production of paper inserts.

D. Cast-Acrylic Sheet: Manufacturer's standard and as follows:

1. Color: As selected by Architect from manufacturer's full range.

E. PVC: Extruded, high-impact PVC plastic in color as selected by Architect.
F. Graphic Content and Style: Provide sign copy that complies with requirements indicated in the Sign Schedule on Drawings for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.

G. Changeable Message Inserts: Fabricate signs to allow insertion of changeable messages in the form of transparent covers with paper inserts printed by Owner.
1. Furnish paper and software for creating text and symbols for IBM compatible computers for Owner production of paper inserts.
2. Furnish paper cut-to-size for changeable message insert.

2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

I. Colored Coatings for Acrylic Sheet: For copy and background colors, provide Pantone Matching System (PMS) colored coatings, including inks and paints that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for application intended.

2.3 PANEL SIGNS
A. Refer to Drawings for types, text and graphics, details, and locations.

B. Materials
1. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
2. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils (0.076 mm) with pressure-sensitive adhesive backing, suitable for exterior applications.

2.4 ACCESSORIES
A. Mounting Methods: Use concealed fasteners fabricated from materials that are not corrosive to sign material and mounting surface

B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.5 FABRICATION
A. General: Provide manufacturer's standard signs of configurations indicated.
B. Typeface
1. Optima Semi-Bold, Capital with layout per drawings. Inserts may utilize upper and lower case. See Drawing 10440-26 for representative typeface.
2. Capital letter height shall be a minimum of 5/8-inch for permanent identification.

C. Permanent Identification
1. 1/8-inch to 3/16-inch panel thickness, plus raised image graphics, with square corners and edges for Room Number and Name with 1/16-inch panel thickness for Symbols and Directional panels.
2. Panel shall be fastened by means of double-face foam tape applied to the back of each panel.

D. Changeable or Temporary Identification
1. 1/16-inch matte acrylic faceplate with screen printed border, second surface, assembled with spacers and a 1/8-inch back plate with .025-inch minimum spacer thickness to allow for insert.
2. .010-inch clear polished vinyl, for changeable insert with graphics applied to face or paper inserts produced on a laser writer in accordance with specifications is acceptable.

E. Frame
1. 1/16-inch by 1/2-inch aluminum angle perimeter, with pressboard back, square corners and counter-sunk holes for installation for Room Name and Number; 1/16-inch by 3/8-inch aluminum angle for Symbol and wall mounted Directional panels.
2. Frame size shall be a minimum of 1/8-inch and maximum of 1/4-inch larger than the sign panel, in both height and width to allow for a reveal between Panel and Frame.
3. Frame shall include 1/16-inch aluminum divider between Number and Function panels, or as indicated on the Drawings.

F. Color and Finishes
1. Background colors shall be selected from Pantone Matching System (PMS). Sample of actual paint to be used, applied to 4-inch by 4-inch minimum piece of actual sign material, shall be provided for review and approval prior to use.

G. Panel Size
1. Refer to Drawings for all dimensions.
2. If message schedule includes graphic copy that exceeds specifications indicated, panel size shall be increased accordingly. Field conditions shall be verified for sufficient space to accept sign panel.

H. Braille Location
1. Center justify under room numbers.
2. Left justify under room identification or other text.
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.
C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES
A. Clear Anodic Finish: Manufacturer's standard Class 1 clear anodic coating, 0.018 mm or thicker, over a satin (directionally textured) mechanical finish, complying with AAMA 611.

2.8 ACRYLIC SHEET FINISHES
A. Colored Coatings for Acrylic Sheet: For copy and background and frame colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
B. Verify that items including anchor inserts are sized and located to accommodate signs.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
   1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.
B. Wall-Mounted Signs: Comply with sign manufacturer’s written instructions except where more stringent requirements apply.

1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
2. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.
3. Shim Plate Mounting: Provide 1/8-inch- (3-mm-) thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
4. Mechanical Fasteners: Use non-removable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer’s written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION
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:
   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:

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
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 F-1, Zone 2 of the Consolidated Renal Car (RAC) Facility -as described hereinafter 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. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
   b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
   c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
   d. Special Occupancy Hazard: As determined by authorities having jurisdiction.

3. Maximum Protection Area per Sprinkler:
   a. Office Spaces: 225 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. Light-Hazard Occupancies: 100 gpm for 30 minutes.
   b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.

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.

J. 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.

K. Provide record documents in accordance with requirements of Specification Section 01 78 39.

L. 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 – April 2005

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. Adjustable Drop Nipples:

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. Anvil International, Inc.
   b. CECA, LLC.
   c. Corcoran Piping System Co.
3. Size: Same as connected piping.
4. Length: Adjustable.
5. Inlet and Outlet: Threaded.

E. 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.
   6. 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.

2.11 AUTOMATIC AIR VENT

A. Manufacturers: Subject to compliance with requirements, provide the following:

   a. Furnish and install the FM approved ECS Ejector – Automatic Air Vent (EAAV); 175 psi rated working pressure. Install per manufacturer’s instructions. Provide at least one ECS Ejector (EAAV) per sprinkler zone connected at or near the high point of the fire protection system piping.
   b. The fire sprinkler contractor shall leave the provided isolation valve in the open position after the installation of the EAAV and the final testing of the system has been completed.
   c. The contractor shall install the ECS Ejector – Automatic Air Vent (EAAV-2) in a location that the water detection indicator installed in the bottom of the assembly can be clearly viewed from directly below.

B. Pressure Rating: 175 psi minimum.
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: 26 05 19

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Wire and cable for 600 volts and less.
   2. Wiring connectors and connections.
   3. Building Wire
      a. Power distribution circuitry.
      b. Control system circuitry (other than HVAC)
      c. Lighting circuitry
      d. Appliance and equipment circuitry
      e. Other systems circuitry as designated
      f. Wire and cable for control wiring.

1.2 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Contracting; National Electrical Contractors Association.

B. NEMA WC 3: Rubber insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

C. NEMA WC 5: Thermoplastic insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.


1.3 SUBMITTALS

A. Product Data: Provide for each cable, wire, and connector type.

B. Project Record Documents: Record actual locations of components and circuits.

1.4 QUALITY ASSURANCE

A. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
1.5 WARRANTY

A. Provide 1 year warranty on all equipment, materials, and workmanship from date of final completion unless alternate term is specified elsewhere.

PART 2 - PRODUCTS

2.1 GENERAL

A. Minimum building wire size shall be #12 AWG.

B. Minimum control wire size shall be #14 AWG.

C. Conductor shall be 98% conductivity stranded copper with 75 deg C thermoplastic insulation rated 600V. Refer to 2.2 G for exceptions.

D. Available manufacturer’s offering products that may be incorporated into the Work include, but are not limited, to the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. Alpha Wire.
5. General Cable Technologies Corporation.

2.2 WIRING REQUIREMENTS

A. Concealed Dry Interior Locations: Use only building wire with Type THHN, THWN, or XHHW-2 insulation in raceway or metal clad cable.

B. Exposed Dry Interior Locations: Use only building wire with Type THHN, THWN, or XHHW-2 insulation in raceway or metal clad cable.

C. Above Accessible Ceilings: Use only building wire with Type THHN, THWN, or XHHW-2 insulation in raceway or metal clad cable.

D. Wet or Damp Interior Locations: Use only building wire with Type THWN or XHHW-2 insulation in raceway or metal clad cable.

E. Use solid copper conductor branch circuits 10 AWG and smaller.

F. Use stranded conductors for control circuits.

G. Branch circuit voltage drop shall not exceed 3%. Feeder voltage shall not exceed 2%. Voltage drop shall be calculated in accordance with Sect 3, IEEE 141. For dedicated circuits or specific purpose loads, use 125% of device amperage. For convenience outlet loads or lighting loads, use 20A or breaker trip amps for calculation, whichever is larger.

H. Typical branch circuits, #12 AWG, 20 amp
1. 120/208 V Systems, 1ph or 3ph; not to exceed 100ft from panelboard to most distant outlet or device.
2. 277/480 V Systems, 1ph or 3ph; not to exceed 230ft from panelboard to most distant outlet or device.

I. Where length of circuit exceeds these typical values, increase wire size to achieve maximum 3% voltage drop.

J. Typical 20A 4 wire (three phase and neutral) circuits shall be #10AWG; derating in accordance with NEC Tables 310.15 and 310.16.

K. Three phase conductors (connected to different phases) may share a single neutral for non-dimmed lighting circuits only. Other single phase circuits shall have a separate neutral for each phase conductor.

L. Isolated ground circuits shall include a separate green/yellow ground conductor, in addition to the green circuit ground conductor, for each outlet connected.

2.3 REMOTE CONTROL AND SIGNAL CABLE
A. Remote control and signal circuits shall comply with provisions of NEC Article 725.

B. Conductor shall be 98% conductivity copper, stranded,

1. Remote Control and Signal Cable, Class 1. #14 AWG, 600V type THHN, THWN.
2. Remote Control and Signal Cable, Class 2 and Class 3. #16 AWG, twisted shielded pair in pvc jacket, 300V type TFF.
3. Remote Control and Signal Cable, Plenum rated. Cable shall be jacketed and UL Listed as plenum cable.

2.4 METAL CLAD CABLE
A. Description: NFPA 70, Type MC.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation Temperature Rating: 60 degrees C.

E. Insulation Material: Thermoplastic.

F. Armor Material: Steel.

G. Armor Design: Interlocked metal tape.

H. Type MC cable may be used for branch circuits as follows:

1. Vertical or horizontal in existing and new walls.
2. Fixture whips not to exceed 20ft. in length.
3. Circuit phase and neutral conductors with ground, and/or isolated ground as required.
2.5 WIRING CONNECTORS

A. Split Bolt Connectors: Not permitted.

B. Solderless Pressure Connectors:
   1. Mechanical, pre insulated for conductors #8 AWG and larger.

C. Spring Wire Connectors:
   1. Product: Insulated spring wire with plastic caps for 10 AWG and smaller
      a. Manufacturer:
         1) Amp, Inc.
         2) Burndy Corp
         3) General Electric Co
         4) Ideal Industries, Inc.
         5) 3M Minnesota Mining and Mfg Co
         6) O Z Gedney Co
         7) Thomas & Betts Co.
   2. Substitutions: or approved equal.

D. Parallel and tee connectors shall be used where specifically detailed.
   1. Manufacturer: ILSCO GTA, GTT with insulating cover, or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire and cable has been completed.

C. Verify that raceway installation is complete and supported.

D. Verify that field measurements are as indicated.

E. The control conduit, wire and wiring diagrams may not be indicated on the electrical drawings. Refer to applicable sections of the specifications and comply with requirements for installation of control wiring systems. Furnish necessary material, including rough-in raceway systems, conductors, devices, equipment, relays, connections and other work required to provide complete control systems specified in other sections of the specifications.

F. Building and Control wiring shall be installed in complete raceway systems in accordance with the drawings.
3.2 PREPARATION

A. Re-used existing conduit and underground raceway systems; completely and thoroughly swab raceway before installing wire.

B. Verify that voltage drop will not exceed 3% in branch circuit wiring, and not exceed 2% for feeder wiring.

3.3 WIRING INSTALLATION

A. Install wire and cable securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Wire and cable, including control wire and cable shall be installed in complete raceway systems unless specifically noted otherwise.

C. Route wire and cable as required to meet project conditions.

1. Wire and cable routing indicated is approximate unless dimensioned.
2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
3. Include wire and cable of lengths required to install connected devices within 10 ft of location shown.

D. Use wiring methods indicated.

E. Pull all conductors into raceway at same time. Do not use a pulling means, including fish tape, cable or rope which can damage the raceway.

F. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

G. Protect exposed cable from damage.

H. Place an equal number of phase conductors for each phase of a circuit in same raceway.

I. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.

J. Use suitable cable fittings and connectors.

K. Neatly train and lace wiring inside boxes, equipment, and panelboards.

L. Clean conductor surfaces before installing lugs and connectors.

M. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

N. Conductor splices and taps shall be accessible in wireways and junction boxes.

O. Terminate spare conductor with electrical tape at both ends.
P. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

Q. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

R. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

3.4 FIELD QUALITY CONTROL

A. Torque test conductor connections and terminations to manufacturer’s recommended values.

B. Conductors in vertical conduits or raceways shall be supported in the manner and location as required by NEC.

C. Lighting fixtures shall not be used for raceways for circuits other than parallel wiring of fixtures.

D. Demonstrate and document proper operation of control systems installed under this Section. Repair, adjust, or replace as required.

END OF SECTION
SECTION: 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes:
   1. Grounding and bonding components.
   2. Provide components necessary to complete the grounding system(s) consisting of:
      a. Power system grounding.
      b. Equipment and raceway grounding and bonding.
      c. Metal frame of the building.

1.2 REFERENCE STANDARDS

1.3 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 CONNECTORS AND ACCESSORIES
A. Mechanical Connectors: Bronze.
   1. No strap grounding clamps shall be used; connections requiring bolting shall be made up with Monel metal bolts, washers and nuts. Surfaces shall be cleaned or ground to expose virgin metal.
B. Wire: Stranded copper.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions prior to beginning work.

B. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

A. Conductor connections shall be made by means solderless connectors such as serrated bolted clamps or pressure connectors. Split bolts are not permitted. Non-accessible ground connections shall be made by exothermic weld and coated to prevent corrosion.

B. Bonding jumpers shall be installed around nonmetal fittings or insulating joints to ensure electrical continuity. Bonding shall be provided where necessary to ensure electrical continuity.

C. Provide bonding to meet requirements described in Quality Assurance.

D. Bond together metal siding not attached to grounded structure; bond to ground.

E. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

3.3 FIELD QUALITY CONTROL

A. Perform inspections and tests listed in NETA STD ATS, Section 7.13.

END OF SECTION
SECTION: 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes:
   1. Hangers and supports for electrical equipment and systems.

1.2 DEFINITIONS
A. EMT: Electrical metallic tubing.
B. IMC: Intermediate metal conduit.
C. RMC: Rigid metal conduit.

1.3 PERFORMANCE REQUIREMENTS
A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
B. Design supports for multiple raceways capable of supporting combined weight of systems and components.
C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.4 ACTION SUBMITTALS
A. Product Data: For the following:
   1. Equipment supports.

1.5 QUALITY ASSURANCE
A. Comply with NFPA 70.
PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Available Manufacturers:
      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

5. Toggle Bolts: All-steel springhead type.


PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.
3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT IMC RMC EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Existing Concrete: Expansion anchor fasteners. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts, Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69, Spring-tension clamps.

2. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount conduit, cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 099123 “Interior Painting” for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Conduit, fittings and conduit bodies.
   2. Outlet, pull, and junction boxes.

1.2 RELATED REQUIREMENTS

A. Section 07 84 13 - Penetration Firestopping.

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC).
B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT).
C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC).
E. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT); National Electrical Contractors Association.
F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association.
H. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
I. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
J. NEMA RV 3 - Application and Installation Guidelines for Flexible and Liquidtight Flexible Metal Conduits.
1.4 SUBMITTALS
A. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, metallic tubing, nonmetallic conduit, fittings, conduit bodies, and boxes and wireway.
B. Project Record Documents: Accurately record actual routing of conduits and wireway larger than 2 inches.

1.5 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Accept conduit on site. Inspect for damage.
B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
C. Protect PVC conduit from sunlight.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS
A. Conduit Size: Comply with NFPA 70.
   1. Minimum Size: 3/4 inch unless otherwise specified. 1/2” flexible fixture whips are permitted.
B. Outdoor Locations Above Grade: Use rigid steel conduit, intermediate metal conduit, or electrical metallic tubing.
C. Wet and Damp Locations: Use rigid steel conduit, intermediate metal conduit, electrical metallic tubing.
D. Dry Locations:
   2. Exposed: Use rigid steel conduit, intermediate metal conduit, electrical metallic tubing.
2.2 METAL CONDUIT

A. Manufacturers:

5. or approved equal.

B. Rigid Steel Conduit: ANSI C80.1.

C. Intermediate Metal Conduit (IMC): Rigid steel.

D. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.3 FLEXIBLE METAL CONDUIT

A. Manufacturers:

4. or approved equal.

B. Description: Interlocked steel construction Type FMC. Prefabricated BX or AC not permitted.

C. Fittings: NEMA FB 1.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:

4. or approved equal.

B. Description: Interlocked steel construction with PVC jacket.

C. Fittings: NEMA FB 1.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

5. or approved equal.

B. Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression type. Use steel compression fittings only for EMT.

2.6 OUTLET BOXES, INTERIOR, WEATHERPROOF, JUNCTION AND PULL BOXES, CONDUIT
BODIES, FITTINGS, AND HARDWARE.

A. Manufacturers:
   1. Adalet Div, Scott and Fetzer
   2. Allen-Stevens Conduit Fittings Corp
   3. American Metal Forming
   4. Appleton Electric
   5. Arrow Conduit and Fittings
   6. Arrow-Hart
   7. Atlas Technologies
   8. Bell Electric/Square D
   9. Burndy
   10. Crouse-Hinds
   11. Eagle Electric
   12. General Electric
   13. Gould
   14. Hubbell
   15. Keystone Columbia
   16. Killark
   17. O Z Gedney
   18. Pass and Seymour
   19. RACO
   20. Slater Electric
   21. Spring City Electrical Mfg
   22. Steel City/Midland Ross
   23. Thomas & Betts

2.7 CONDUIT AND FITTINGS

A. Conduit and fittings for electrical systems on this project shall include the following:

1. Service entrance
2. Power and lighting feeders
3. Electrical power and lighting branch circuits
4. Control Systems, (other than HVAC)
5. Other electrical systems.

B. For each electrical raceway system indicated, provide a complete assembly of conduit, tubing or duct with fittings including, but not necessarily limited to, connectors, nipples, couplings, locknuts, bushings, expansion fittings, other components and accessories as needed to form a complete system of the type indicated.
C. Conduit fittings shall be designed and approved for the specific use intended. Conduit fittings, including flexible, shall have insulated throats or bushings. Rigid conduits shall have insulated bushings, unless grounding bushings are required by NE Article 250. Grounding bushings shall have insulated throats.

D. Rigid and intermediate metal conduit shall be galvanized. Fittings shall be threaded type. Expansion fittings shall be OZGedney type DX or approved equal.

E. Electrical metallic tubing shall be galvanized. Fittings shall be all steel compression type. Expansion fittings shall be OZGedney type TX or approved equal.

F. Flexible metal conduit and fittings shall be zinc coated steel complying with FS WW-C-566C.

G. Liquid tight flexible conduit and fittings shall consist of single strip, continuous, flexible, interlocked, double wrapped steel galvanized inside and outside, forming smooth internal wiring channel with liquid tight covering of flexible PVC.

H. Nonmetallic conduit and fittings shall be suitable for temperature rating of conductor but not less than 90 deg C.

I. Crimp or set screw type fittings are not acceptable.

2.8 WALL AND CEILING OUTLET BOXES

A. Galvanized steel interior outlet wiring boxes of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices.

1. Boxes shall be minimum 4 in square with proper flange or extension ring.
2. Sectional boxes are not allowed.

B. Exterior boxes shall be corrosion resistant cast metal, with threaded conduit ends, cast metal face plate and weatherproof covers. Cap shall be weather proof in use, Taymac #20310 or equal.

C. Outlet boxes in poured concrete shall be plenum type without holes or knockouts. Joint between extension ring and box shall be sealed to prevent concrete from entering box during pour.

2.9 PULL AND JUNCTION BOXES

A. Boxes shall be galvanized sheet metal with screw on cover and welded seams, stainless steel nuts, bolts, screws and washers.

B. Boxes 12 inches or larger in any dimension shall be panelboard code gauge galvanized steel with hinged cover.

C. Construction
1. Dry Locations: NEMA 1, 2 or 12, minimum 16 gauge.
2. Outdoor Wet Locations: NEMA 3R or 4, minimum 16 gauge.
3. Indoor Wet Locations: NEMA 4, minimum 16 gauge.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on drawings.
B. Verify routing and termination locations of conduit prior to rough-in.
C. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.2 INSTALLATION

A. Rigid (hot dipped galvanized) metal conduit (RMC) shall be used:
   1. Outdoors, exposed
   2. Interior exposed up to 8'-10"AFF
   3. Hard usage areas; mechanical rooms, crawl spaces, tunnels, etc.
   4. Ramp areas open to exterior.
   5. Hazardous locations.
B. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.
C. Provide 200 lb nylon cord in empty conduit with appropriate slack at each end. Pull cord shall be flat for nonmetallic conduit.
D. Intermediate galvanized steel conduit (IMC) may be used as an alternate to RMC where permitted by NEC.
E. Electrical metallic conduit (EMC) may be used:
   1. In sizes up to and including 4" except in areas below slab, wet areas, areas exposed to outdoors, ramps, or subject to mechanical damage, NEC permitting.
   2. 20 A Branch lighting circuits where conduit is specified exposed and at least 8'-10" AFF.
   3. Exposed, above panelboards, for branch circuits.
F. Liquid tight flexible metal conduit: shall be used for connections to equipment in damp or wet areas. Min size is 3/4".
G. Flexible metal conduit (FMC): dry locations
   1. Connection to rotating, vibrating, moving or movable equipment, including dry type transformers.
   2. Maximum length shall be 3'-0".
3. Minimum length shall be 1'-6".
4. Minimum size 3/4" except fixture whips; minimum size 1/2"

H. Type BX or AC prefabricated cables are not permitted.

I. Circuits for different voltages, ie. 120 and 277 shall not be installed in the same raceway, except as specifically required at equipment locations, controllers, power poles, etc.

J. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 1, NEMA, ANSI and NEC.

K. Install steel conduit as specified in NECA 101.

L. Install nonmetallic conduit in accordance with manufacturer's instructions.

M. Arrange supports to prevent misalignment during wiring installation.

N. Penetrations by conduit, raceways, cables, sleeves, etc. through rated walls, shafts, floors, ceilings, etc shall be sealed and firestopped. Conduit seals shall be appropriately located in hazardous areas.

O. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where underground service raceway enters a building or structure.
3. At penetrations of exterior wall areas.
4. Where otherwise noted by NFPA 70.

P. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

Q. Group related conduits; support using steel channel conduit rack; provide space on each for 25 percent additional conduits.

R. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports. Use:

1. Wood screws on wood, toggle bolts on hollow masonry.
2. Toggle bolts on hollow masonry.
3. Bolts and expansion anchors in concrete or brick.
5. Beam clamps on steel joists.

S. Do not attach conduit to ceiling support wires.

T. Arrange conduit to maintain headroom and present neat appearance.

U. Route exposed conduit parallel and perpendicular to walls.
V. Route conduit installed above accessible ceilings parallel and perpendicular to walls when such exist.

W. Maintain adequate clearance between conduit and piping.

X. Cut conduit square using saw or pipe cutter; de-burr cut ends.

Y. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch size.

Z. Ground and bond conduit under provisions of Section 26 05 26.

3.3 INSTALLATION - WIREWAYS

A. Install wireway such that cover hinges are on top side to provide for gravity close feature and make the wireway weatherproof.

3.4 INSTALLATION - BOXES AND FLUSH PULL BOXES

A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and NEC compliance. Minimum box size shall be 4 x 4 x 2 1/2 trade size with appropriate extension rings.

B. Provide outlet box accessories as required for each installation, including mounting brackets, wall board hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual situations.

C. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location of outlets prior to rough in.

D. Locate and install boxes to allow access.

E. Do not install boxes back-to-back in walls. Provide minimum 6 inch separation. Provide minimum 24” separation in acoustic rated walls. If boxes are connected together, install flexible connection between the two and pack openings with fiberglass.

F. Support pull and junction boxes independent of conduit. Secure boxes rigidly to the substrate upon which they are being mounted, or solidly imbed boxes in concrete or masonry. Boxes connected to one stud are not permitted.

G. Provide knockout plugs for unused openings.

H. Use multiple gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers for separate wiring of different voltage systems.

I. Install boxes in walls without damaging wall insulation.

J. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas for accessibility.
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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.

1.2 DEFINITIONS

A. EMI: Electromagnetic interference.
B. GFCI: Ground-fault circuit interrupter.
C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
D. RFI: Radio-frequency interference.
E. SPD: Surge Protection Device.
F. UTP: Unshielded twisted pair.
G. WP: Weather proof in use.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.5 WARRANT

A. Provide 1 year warranty on all equipment, materials, and workmanship from date of final completion unless alternate term is specified elsewhere.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers’ Names: Shortened versions (shown in parentheses) of the following manufacturers’ names are used in other Part 2 articles:

1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Devices shall be manufacturers ‘Heavy Duty’ grade; or the grade immediately below the manufacturers ‘Hospital Grade’. Where Heavy Duty grade is not available for a particular device from a particular manufacturer ‘Hospital Grade’ shall be substituted. Acceptability of a grade shall be at the sole discretion of the Engineer.

C. Comply with NFPA 70.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles shall be rated 20 A. 15 A devices not permitted.

B. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Cooper; 5351 (single), CR5362 (duplex).
   b. Hubbell; HBL5351 (single), HBL5352 (duplex).
   c. Leviton; 5891 (single), 5352 (duplex).
   d. Pass & Seymour; 5361 (single), 5362 (duplex).

2.4 TOGGLE SWITCHES

A. Toggle switches shall be rated 20 A. 15 A devices not permitted.

B. Comply with NEMA WD 1, UL 20, and FS W-S-896.

C. Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. **Single Pole**:

      1) Cooper; AH1221.
      2) Hubbell; HBL1221.
      3) Leviton; 1221-2.
      4) Pass & Seymour; CSB20AC1.

2.5 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

   1. **Plate-Securing Screws**: Metal with head color to match plate finish.
   2. **Material for Finished Spaces**: 0.035-inch thick, satin-finished, Type 302 stainless steel.
   3. **Material for Unfinished Spaces**: Galvanized steel.
   4. **Material for Damp Locations**: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. **Wet-Location, Weatherproof Cover Plates**: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover; weather proof in use.

PART 3 - EXECUTION

3.1 INSTALLATION

   A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

   B. Coordination with Other Trades:

      1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
      2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
      3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
      4. Install wiring devices after all wall preparation, including painting, is complete.

   C. Conductors:

      1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
      2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Do not connect stranded wire directly to wiring devices. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install receptacles with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding or neutral terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

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:

   a. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
   c. ANSI/TIA/EIA Standards

      1) ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises, 2009
      2) ANSI/TIA-568-C.0-1 – Generic Telecommunications Cabling for Customer Premises – Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling, 2010
      4) ANSI/TIA/EIA-568-C.2 – Commercial Building Telecommunications Cabling Standard, 2009 - Part 2: Balanced Twisted Pair Cabling Components
      6) ANSI/TIA/EIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces, 2004
     12) ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers, 2006
     14) NEMA-VE-1 – Metal Cable Tray Systems, 2009
     15) NEMA-VE-2 – Metal Cable Tray Installation Guidelines, 2006
     17) Install cabling in accordance with the most recent edition of BICSI® publications:
     19) BICSI – Cabling Installation Manual

2. 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.

b. Underwriters Laboratories, Inc. (UL): UL 1479 – Tests of Through-Penetration Firestop Systems
c. Americans with Disabilities Accessibility Guidelines.
e. Uniform Building Code (UBC).
g. Texas Department of State Health Services (TDSHS).
h. DFW Airport Design Criteria Manual
i. 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. Comply with provisions of Section 27 05 00.

C. Produce Shop Drawings for Sections 27 05 28, and 27 15 00.

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.

1.10 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 IDF/TR 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 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 indicted 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:
   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 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 INSPECTION FEES AND PERMITS

A. Obtain and pay for all necessary permits and inspection fees required for communication systems installation. 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 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 completion. 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. Wire Mesh Cable Tray, Supports, and Accessories
3. Non-Continuous Cable Support Systems
4. Fire-Rated Pathway Devices
5. Multi-Service Poke-Through Devices
6. Conduit Systems
7. Junction Boxes/ Pull Boxes

D. Related Requirements:

1. Section 260533 "Raceways and Boxes for Electrical Systems" for surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

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. DFW Dallas/Fort Worth International Airport
8. EIA Electronics Industries Association
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
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 BICSI, EIA and TIA 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
3. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises, 2009
4. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard, 2009
5. ANSI/TIA/EIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces, 2004
8. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers, 2005
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 and pay for all necessary permits and fees 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, or for a period of 1 year from date of final completion, whichever is longer. 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 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 depths 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 WIRE MESH CABLE TRAY, SUPPORTS, AND ACCESSORIES

A. Wire Mesh Cable Tray

1. Provide wire mesh cable tray on the concourse and support spaces, as shown on the drawing set.  
2. Wire mesh cable tray shall be manufactured from round steel wire that is a minimum of .196” (5mm) in diameter. Wires shall be welded at intersections to form a 2” x 4” (50.8mm x 101.6mm) grid pattern. The tray shall be U-shaped with equal height sidewalls.  
3. Individual tray sections shall be 24” (609.6mm) wide unless shown otherwise on plans, with 4” (101.6mm) high sidewalls.  
4. Tray ends will be formed downward at 90° to allow easy drop-in installation with approved supports.  
5. Wire mesh cable tray shall be zinc electroplated after fabrication.  
6. Wire mesh cable tray shall be UL Classified for grounding purposes.  
7. Acceptable systems:
   a. Cablofil CF105/600EZ  
   b. Chatsworth 34821-524  
   c. Cooper B-Line FT4X24EG  
   d. Owner Approved Equivalent.
B. Wire Mesh Cable Tray Supports

1. Supports will be sized at minimum to match the width of the wire mesh cable tray that is supported. The support may be wider than wire mesh cable tray.

2. Support design will allow the support to be placed under a wire mesh cable tray at any point mid-span or directly under a pathway splice or intersection.

3. Each support location will utilize a trapeze mounted support bracket in the cable tray, allowing drop-in of installed cabling.

4. Each support will be punched with an alternating ojbround and round hole-pattern that accepts wire mesh cable tray ends which are formed downward at 90° and self-threading splice plate attachment hardware.

5. When placed directly under a splice or intersection, the support will allow drop-in attachment of cable tray. Splice hardware will splice cable trays and secure wire mesh cable trays to the support.

6. Supports will be manufactured from steel extrusion and/or sheet.

7. Wire Mesh Cable Tray Supports will be zinc electroplated after fabrication.

8. Acceptable products:
   a. Cablofil FASP 700
   b. Chatsworth 34730-524
   c. Cooper B-Line FTB24CT
   d. Owner Approved Equivalent.

C. Wire Mesh Cable Tray Splices and Fasteners

1. Provide a method of simultaneously splicing, bonding and securing intersecting wire mesh cable tray sections to supports when supports are placed directly under a wire mesh cable tray pathway at a splice point, intersection point, or at the beginning or end of a change in elevation.

2. Provide a method of splicing and bonding wire mesh cable tray sections together at a splice point or an intersection point that is not located directly over a support.

3. Provide a method for bonding and securing wire mesh cable tray to supports when supports are placed mid-span (in between a splice or intersection point) along a wire mesh cable tray pathway.

4. Provide a method for attaching a bonding conductor to the wire mesh cable tray.

5. Acceptable products:
   a. Cablofil
      1) EDRN
      2) GNDSB
      3) GNDCL
   b. Chatsworth
      4) 34738-501
      5) 34739-501
      6) 34838-001
   c. Cooper B-Line
      7) FSTLCZN
      8) GROUND BOLT
   d. Owner Approved Equivalent
D. Wire Mesh Cable Tray Accessories

1. Provide a bend radius to connect the sidewalls of adjoining wire mesh cable tray wherever a splice or an intersection in the cable tray pathway results in a 4” or wider gap between the sidewalls. The bend radius should be the same height as the sidewalls of the wire mesh cable tray.

2. Provide elevation change hinges to form cable over a smooth curve wherever cable tray changes elevations.

3. Provide conduit adapters for all conduit that transitions into the cable tray.

4. Wire mesh cable tray accessories will be manufactured from steel extrusion and/or sheet.

5. Wire mesh cable tray accessories will be pre-galvanized before fabrication.

6. Acceptable products:

   a. Cablofil

      9) Part Number RADT90KIT Bend Radius Kit
      10) Part Number EAC Elevation Change Kit
      11) Part Number CE40CC & CH Conduit Adapter

   b. Chatsworth 34740-501 Bend Radius Kit

   c. Cooper B-Line

      12) Part Number 90 DEGREE KITEG Bend Radius Kit
      13) Part Number FTxxxCCGLV Conduit Connector

   d. Owner Approved Equivalent

E. Wire Mesh Cable Tray Installation Tools

1. Provide cutting and forming tools, as required, for field fabrication of wire mesh cable tray pathways.

2. Provide tools, as required, for pulling cable around turns, bends or intersections in wire mesh cable tray pathway.

F. Wire Mesh Cable Tray Support – Installation Hardware

1. Provide installation hardware to attach wire mesh cable tray supports to building structure.

2.4 NON-CONTINUOUS CABLE SUPPORT SYSTEMS

A. Non-Continuos 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
2.5 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. Legrand FlameStopper
   d. Owner Approved Equivalent

2.6 POKE-THROUGH DEVICES

A. Multi-Service Poke-Through Devices

1. Provide floor poke-through devices for terminating power and communications.
2. The device shall provide up to 6 ports of communications connectivity and power receptacles wired for 2 circuits.
3. Unit shall be equipped with slide covers to protect device and power openings.
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
      14) Evolution Poke-Through Device
      15) 8ACT6A Device Mounting Plate
   b. Owner Approved Equivalent

2.7 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 ANSI/EIA/TIA-569A.
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.

1. Conduit Fittings
   a. All above ground fittings shall be of metallic material.
   b. Conversion fittings are required for non-metallic (below ground) to metallic (above ground) transitions.
   c. All fittings shall be compression or threaded.
   d. Fittings shall provide a secure connection for pulling communications cables.
   e. Setscrew fittings are not permitted.

2.8 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.
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 current revision levels of ANSI/EIA/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. Wire Mesh Cable Tray

1. Installation and configuration shall conform to the requirements of the current revision levels of ANSI/EIA/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. Cable Tray shall be suspended using manufacturer-approved trapeze type supports.

8. Install cables using techniques, practices, and methods that are consistent with Category 6 or higher requirements and that supports Category 6 or higher performance of completed and linked signal paths, end to end.

9. Install cables without damaging conductors, shield, or jacket.

10. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.

11. Pull cables without exceeding cable manufacturer's recommended pulling tensions. Use pulling means that will not damage media.

12. Do not exceed load ratings specified by manufacturer.

13. Follow manufacturer's recommendations for allowable fill capacity for each size of cable tray section.

C. Non-Continuous Cable Support Systems (J-hooks)

1. Installation and configuration shall conform to the requirements of the current revision levels of ANSI/EIA/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.

D. 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 PATHWAY 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. 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.

3.4 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 jumpers 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 an IDF/MDF shall not serve more than one outlets.

J. All communication conduits shall be identified with color coded orange tape marked “Communications” every 20 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-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-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 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. DFW Dallas/Fort Worth International Airport
5. EIA Electronics Industries Association
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 BICSI, EIA and TIA 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
   6. 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 and pay for all necessary permits and fees 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. 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, or for a period of 1 year from date of final completion, whichever is longer. 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 TIA/EIA-606-A compliant labeling products. All cables, faceplates, patch panels, 110 blocks, conduit, Innerduct and patch cords shall be labeled to TIA/EIA-606-A 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) T100X000VPC-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:
      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 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: RN3-01
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#
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: RN3-017
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: RN3-09
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: RN2-117WAO Jack ID
   a. Destination Cabinet/Rack #-Rack unit-Port # (e.g. YY-YY-YY).
      1) 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: RN2-017-03-21-03  
b) Voice Cable: RN-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: RN2-03-06/ MCRN-02-03  
   b) Voice: RN2-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 –RES1-01-16

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: MCRN / RN3-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 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 /RS3-01-44-17/18

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.
3. Tag shall be secured to Innerduct using self-locking ties.
## PART 4 - APPENDIX A

**DFW INTERNATIONAL AIRPORT**

**TERMINAL A, B, C & E - 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 &quot;277/480V&quot;</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>Origination/Termination Points &amp; junction boxes</td>
</tr>
<tr>
<td>208V SYSTEM - CONDUIT</td>
<td>BLUE</td>
<td>WHITE LETTERS &quot;120/208V&quot;</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>Origination/Termination Points &amp; junction boxes</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>Termination Points &amp; (junction boxes)</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>
<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>
</tbody>
</table>

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**DFW International Airport**

**Terminal D – Revolving Exit Door Removal**

**Contract No. 9500646**

**Identification for Communications Systems**

**Issued for Bid**

**27 05 53 - 17**

**October 11, 2019**
<table>
<thead>
<tr>
<th>System Description</th>
<th>Color Code</th>
<th>Labeling Requirements</th>
<th>Termination Points &amp;</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>COUPLINGS AND</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>JUNCTION BOX</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>COVERS</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;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(junction boxes)</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;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(junction boxes)</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

**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 11 00

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

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 cabinets, racks, frames and enclosures in data centers, computer rooms and communications equipment rooms.

C. Included in this section are the minimum composition requirements and installation methods for the following:

1. Wall Mount Equipment Cabinets
2. Wall Mount Equipment Racks
3. Vertical Wire Management
4. Horizontal Wire Management
5. Ladder Rack & Accessories
6. Fiber Runner and 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. AHJ Authority Having Jurisdiction
2. ANSI American National Standards Institute
3. ASTM American Society for Testing and Materials International
4. AWG American Wire Gauge
5. BICSI Building Industry Consulting Service International
6. DFW Dallas/Fort Worth International Airport
7. EIA Electronics Industries Association
8. NEC National Electric Code
9. NEMA National Electric Manufacturers Association
10. NFPA National Fire Protection Association
11. OAR Owner’s Authorized Representative
12. RCDD Registered Communications Distribution Designer
13. RFP Request for Proposal
14. RU Rack Unit
15. STD Standard
16. TGB Telecommunications Grounding Busbar
17. TIA Telecommunications Industry Association
18. TMGB Telecommunications Main Ground Bus Bar
19. 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 BICSI, EIA 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 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


3. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises, 2009

4. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard, 2009

5. ANSI/TIA/EIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces, 2004
8. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers, 2005
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 and pay for all necessary permits and fees 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 which shall include dimensions, rack/cabinet placement, cable tray/ladder racking placement, rack/cabinet elevations, and each wall within the space.

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.

B. Warranty and Maintenance:

   1. Record drawings of final room configurations
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, or for a period of 1 year from date of final completion, whichever is longer. 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 EQUIPMENT CABINETS (TSA)

**A. Wall Mount Equipment Cabinet**

1. Wall-mounted equipment cabinet shall be constructed of fully-welded, 16-gauge steel.
2. Finish shall be a durable putty powder coat.
3. Each rack shall have a load bearing capacity of 150 pounds. Load bearing capacity shall be stated in the manufacturer's product literature.
4. The cabinet rail shall be constructed of 11-gauge steel with tapped 10-32 mounting holes in universal EIA spacing with a black e-coat finish.
5. Each cabinet shall have two rack bays. The upper bay shall provide two rack units of space and shall pivot 100 degrees with positive stop for punch-downs. The lower bay shall provide two rack units of space and shall pivot 15 degrees for access to connections with 18” useable component depth.
6. Each cabinet shall include a 2-gang electrical box and a 1/4-20 grounding and bonding stud.
7. The cabinet body shall include a 7” by 4” cable-pass through, 4” cable duct knockouts on top, bottom and sides for communications cabling.
8. The cabinet body shall include ½”, ¾”, 1”, and 1 ½” knockouts on the top, bottom and sides for electrical connections.
9. Cable management shall be built into the rack body which shall include a 24” length of hook and loop fasteners, abundant cable tie points, and integral lacing bar installed on the top of rackrail.
11. Acceptable Products:
   a. Middle Atlantic Products HDR-4 Horizontal Distribution Rack
   b. Owner Approved Equivalent

**B. Ceiling Enclosures**

1. Provide ceiling enclosures for all new quads added to the airport CCTV system.
2. The enclosure shall accommodate a minimum of 2RU of active electronics and 3RU, or more, of passive connectivity.
3. The enclosure shall be designed to accommodate an electrical receptacle.
4. The enclosure shall include airflow and heat dissipation features, allowing for proper thermal management.
5. The enclosure shall be designed to mount in a conventional 2’ x 2’, or 2’ x 4’ drop tile ceiling.
6. The door shall have a 50 lb weight capacity.
7. Include door plate, equipment mounting bracket, horizontal cable management, a low decibel fan assembly, air dam and electrical junction box.
8. Provide a grounding and bonding kit.
9. Acceptable Products:
   a. Panduit PZICEA Active In-Ceiling Enclosure
   b. Panduit PZICGK Grounding & Bonding Kit
   c. Owner approved equivalent.

2.3 LADDER RACK, SUPPORTS, AND ACCESSORIES

**A. Ladder Rack**
1. Provide all components of the ladder type cable tray system (ladder rack, turns, splices, supports, and accessories) from a single manufacturer.

2. Ladder type trays shall consist of two longitudinal members (side rails) with transverse members (rungs) welded to the side rails. Rungs shall be spaced 6 inches on center. Rungs shall have a minimum cable-bearing surface of .90 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.

3. Wire mesh type trays shall not be used inside Telecommunication Rooms

4. Tray Sizes shall have minimum usable load depth of at least 90% of the tray depth noted on the drawing.

5. Tray bends to have minimum radius as required to support cable types being installed.

6. Fabricate cable tray products with rounded edges and smooth surfaces.

7. Straight ladder tray sections shall have side rails fabricated as I-Beams. All straight sections shall be supplied in standard lengths, except where shorter lengths are required to facilitate tray assembly lengths as shown on drawings.

8. Tray widths shall be as shown on drawings.

9. Splice plates shall be the bolted type made as indicated below for each tray type. 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.

   a. Aluminum Tray - 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.

   b. Steel (including Pre-galvanized and Hot-dip galvanized) - Splice plates shall be manufactured of high strength steel, meeting the minimum mechanical properties of ASTM A1011 HSLAS, Grade 50, Class 1. Each splice plate shall be attached with four ribbed neck carriage bolts with serrated flange locknuts. Hardware shall be zinc plated in accordance with ASTM B633 SC1 for pre-galvanized cable trays, or Chromium Zinc in accordance with ASTM F-1136-88 for hot-dip galvanized cable trays.

   c. Splice plates shall be furnished with straight sections and fittings.

10. Cable Tray Supports: Shall be placed so that the support spans do not exceed maximum span indicated on drawings and as recommended by the manufacturer. Supports shall be constructed from 12-gauge steel formed shape channel members with necessary hardware. Cable trays installed adjacent to walls shall be supported on wall mounted brackets.

11. Trapeze hangers shall be supported by 5/8” (minimum) diameter rods.

12. Barrier Strips: Shall be placed as specified on drawings and be fastened into the tray with selfdrilling screws.

13. Accessories - 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, specially designed ladder dropouts, barriers, etc.

   a. Fittings: Tees, crosses, risers, elbows, and other fittings to maintain minimum bending radius of cable as indicated, of same materials and finishes as cable tray.
b. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.
c. Cable Drops and Waterfalls: Provide sufficient quantities cable waterfalls above each equipment cabinet to maintain minimum bending radius of cable and not exceed rated cable capacities.

14. Acceptable Manufacturers:
   a. Legrand / Cablofil PW Cable Tray
   b. Cooper B-Line Metallic Cable Tray
   c. Owner Approved Equivalent

2.4 FIBERRUNNER, SUPPORTS, AND ACCESSORIES (DFW)

A. Channel

1. Horizontal Channel shall be manufactured, at a minimum 4" high by 5" deep.
2. Vertical Channel shall be manufactured, at a minimum 2" high by 2" deep.
3. Finish shall be in the color(s) specified below.
   a. Black
4. Refer to the drawing set to determine the length.
5. Acceptable products: ("xx" denotes color)
   a. Panduit FR4X4xx6
   b. Panduit FR2X2xx6
   c. Owner Approved Equivalent

B. Split Hinged Cover

1. Split Hinged Cover shall fit the Horizontal Channel as specified.
2. Finish shall be in the color(s) specified below.
   a. Black
3. Acceptable products: ("xx" denotes color)
   a. Panduit FRSHC4xx6
   b. Owner Approved Equivalent
   c. Owner Approved Equivalent

C. Hinged Cover

1. Hinged Cover shall fit the Vertical Channel as specified.
2. Finish shall be in the color(s) specified below.
   a. Black
3. Acceptable products: ("xx" denotes color)
   a. Panduit FRHC2xx6
D. Owner Approved Equivalent

E. Coupler

1. Coupler is used to join two channel sections, a channel section to a fitting, or to join a fitting to another fitting.
2. Finish shall be in the color(s) specified below.
   a. Black
3. Acceptable products: ("xx" denotes color)
   a. Panduit FRBC4X4xx
   b. Panduit FRBC2X2xx
   c. Owner Approved Equivalent

F. End Cap

1. End Cap shall fit the Horizontal Channel as specified.
2. Finish shall be in the color(s) specified below.
   a. Black
3. Acceptable products: ("xx" denotes color)
   a. Panduit FREC4X4xx
   b. Owner Approved Equivalent

G. Spill Over Junction

1. Spill Over Junctions shall fit the Horizontal Channel as specified.
2. The exit shall be 2".
3. Finish shall be in the color(s) specified below.
   a. Black
4. Acceptable products: ("xx" denotes color)
   a. Panduit FRSPxx
   b. Owner Approved Equivalent

H. Spill Over Hinged Cover

1. Spill Over Cover shall fit the Spill Over Junction as specified.
2. Finish shall be in the color(s) specified below.
   a. Black
3. Acceptable products: ("xx" denotes color)
   a. Panduit FRSP4Cxx
   b. Owner Approved Equivalent

I. Mounting Bracket
1. Manufactured Mounting Bracket shall fit Ladder Racking.
2. The Mounting Bracket shall allow the Channel to fit securely without modification.
3. Acceptable products:
   a. Panduit FR6LRB
   b. Owner Approved Equivalent

PART 3 - EXECUTION

3.1 INSTALLATION

A. The installation recommendations contained within ANSI/TIA-568-B, ANSI/TIA-569 and the BICSI Telecommunications Distribution Methods Manual (TDMM), including the Manufacturer’s recommended installation methods or practices for a Standards-based Structured Cabling System, are mandatory minimum standards and requirements.

B. Mount equipment and enclosures plumb and level. Permanently installed equipment to be firmly and safely held in place. Equipment supports must

C. Free-standing Equipment Cabinets

1. Provide all components of the cabinet system (cabinet, mounting rails, shelves, cable managers, power strips, environmental sensors, and thermal management accessories) from a single manufacturer.

2. Install and adjust to position all accessories including vertical cable managers, vertical power strips, equipment-mounting rails, airflow baffles using the manufacturer’s installation instructions prior to baying and/or placing the cabinet for attachment to the building. Shelves, horizontal cable managers and filler panels, if used, may be installed after the cabinet is placed.

3. Cabinets shall be secured to the structural floor using manufacturer’s installation instructions and appropriate hardware as defined by local code or the authority having jurisdiction (AHJ). Installers shall provide installation hardware. When placed over a raised floor, secure the cabinet to the structural floor through the raised floor panels using threaded rod.

4. Where Cabinets must be moved away from a wall to gain access to the rear of the cabinet a Caster set shall be used. The Cable Harness must be 42” in length and run from the wall along the floor into the Cabinet. A Nylon Split Loom shall be used to protect the Cable Harness.

5. When used in a multi-cabinet bay, cabinets shall be attached side-by-side using included baying kits according to the manufacturer’s instructions.

6. Attach overhead ladder rack or cable tray to the ceiling, independent of the cabinet. A 3” (75 mm) minimum clearance between the top of the cabinet and the bottom of the ladder rack/cable tray shall be maintained. Ladder rack/cable tray shall be positioned so that it does not interfere with hot air exhaust through the cabinet’s top panel. Use radius drops where cable enters/exits the ladder rack/cable tray. Alternately, attach ladder rack/cable tray to the top of cabinets using an elevation kit so that ladder rack/cable tray is a minimum of 3” (75 mm) above the cabinet.

7. Cabinets shall be securely bonded to the Telecommunications Grounding Busbar (TGB). Attach a bonding conductor sized as defined in J-STD-607-A and as defined by local code or the authority having jurisdiction (AHJ) between the Telecommunications Grounding Busbar and the cabinet. Attach the bonding
conductor to the cabinet using included hardware according to the manufacturer’s installation instructions. The installer shall provide the bonding conductor and other necessary hardware required to make the connections between the cabinet and the Telecommunications Grounding Busbar.

D. Wall-Mounted Cabinets

1. Provide all components of the cabinet system (cabinet, mounting rails, cable managers, power strips, and accessories) from a single manufacturer.

2. Attach the cabinet to the wall so that the front door and cabinet body can be opened fully without obstruction by other building, storage or architectural components. Follow the manufacturer’s installation instructions when securing the cabinet to the wall and backboard. When not attached to the wall, the floor, shelf or tabletop surface on which the cabinet is placed must be able to hold the combined weight of the cabinet and the equipment within the cabinet. The cabinet should not be attached to sheet rock (gypsum wall board). The cabinet must be attached directly into studs through a 3/4” (19 mm) plywood backboard. The cabinet may be attached to a masonry wall when the installer provides hardware. Use included hardware or the appropriate hardware as defined by local code or the authority having jurisdiction. The top of the cabinet when installed should not exceed 84” (2133.6 mm) above the finished floor.

3. Cables shall enter/exit the cabinet through conduit knockouts in the top and/or bottom of the rear panel of the cabinet or through the rectangular cut out in the back of the rear panel of the cabinet. Use edge-protection grommets on conduit knockouts when cables pass through a conduit knockout but are not enclosed in conduit.

4. Install and adjust to position all accessories including power strips, equipment-mounting rails, fan and filter kits and lights, prior to installing equipment into the cabinet. Verify that fans, light and power strips work prior to installing equipment. Shelves, if used, may be installed with equipment.

5. Provide a telecommunications ground for equipment within the cabinet. Attach a 19”EIA bus bar to the equipment mounting rails so that the mounting rails are bonded together. Attach a bonding conductor sized as defined in J-STD-607-A and as defined by local code or the authority having jurisdiction between the Telecommunications Grounding Busbar and the 19” EIA bus bar within the cabinet using two-hole compression lugs to connect the bonding conductor to each busbar. The installer will provide the 19” EIA bus bar, antioxidant compound, the bonding conductor and other necessary hardware required to make the connections between the cabinet and the Telecommunications Grounding Busbar.

E. Wall-Mounted Racks

1. Provide all components of the rack system (rack, mounting rails, cable managers, power strips, and accessories) from a single manufacturer.

2. Attach the rack to the wall so that the front door and rack body can be opened fully without obstruction by other building, storage or architectural components. Follow the manufacturer’s installation instructions when securing the rack to the wall and backboard. The rack should not be attached to sheet rock (gypsum wall board). The rack must be attached directly into studs through a 3/4” (19 mm) plywood backboard. The rack may be attached to a masonry wall when the installer provides hardware. Use included hardware or the appropriate hardware as defined by local code or the authority having jurisdiction. The top of the rack when installed should not exceed 84” (2133.6 mm) above the finished floor.
3. Cables shall enter/exit the rack through conduit knockouts in the top and/or bottom of the rack or through the rectangular cut out in the back of the rear panel of the cabinet. Use edge-protection grommets on conduit knockouts when cables pass through a conduit knockout but are not enclosed in conduit.

4. Install and adjust to position all accessories including power outlet, equipment-mounting rails external fan and filter kits, prior to installing equipment into the cabinet. Verify that fans and power outlet work prior to installing equipment.

5. Provide a telecommunications ground for equipment within the cabinet. Attach an EIA bus bar to the equipment mounting rails so that the mounting rails are bonded together. Attach a bonding conductor sized as defined in J-STD-607-A and as defined by local code or the authority having jurisdiction between the Telecommunications Grounding Busbar and the EIA bus bar within the rack using two-hole compression lugs to connect the bonding conductor to each busbar. The installer will provide the EIA bus bar, antioxidant compound, the bonding conductor and other necessary hardware required to make the connections between the rack and the Telecommunications Grounding Busbar.

F. Vertical Cable Managers

1. When more than one cable manager is used on a rack/frame or group of racks/frames, use the same make, style and size of vertical cable manager on the rack/frame or in between racks/frames.

2. The color of the rack(s)/frame(s) and cable manager(s) must match.

3. Attach vertical cable managers to the side of the rack/frame using the manufacturer’s installation instructions and included hardware.

4. When a single vertical cable manager is used in between two racks/frames, attach the vertical cable manager to both racks/frames.

5. Dress cables through the openings in between the T-shaped guides on the manager so that cables make gradual bends as they exit or enter the cable manager into the rack-mount space (U). Do not twist, coil or make sharp bends in cables.

6. Doors shall be attached to the cable manager and in the closed position after cabling is complete.

G. Horizontal Cable Managers

1. When more than one horizontal cable manager is used on a rack/frame or group of racks/frames, use the same make and style of cable manager on the rack/frame or racks/frames.

2. The color of the rack(s)/frame(s) and cable manager(s) must match.

3. Attach horizontal cable managers to the rack/frame with four screws according to the manufacturer’s installation instructions. Each cable manager shall be centered within the allocated rack-mount space (U).

4. Horizontal managers shall be located so that the number of ports (cables) that each manager supports shall not exceed each cable manager’s cable fill capacity.

5. Dress cables through the openings in between the T-shaped guides on the cable manager so that cables make gradual bends as they exit or enter the cable manager into the rack-mount space (U). Do not twist, coil or make sharp bends in cables.

6. Covers shall be attached to the cable manager and in the closed position after cabling is complete.

H. Ladder Rack
1. Provide all components of the ladder rack system (ladder rack, turns, splices, supports, and accessories) from a single manufacturer.

2. Ladder rack shall be installed with side stringers facing down so that the ladder forms an inverted U-shape and so that welds between the stringers (sides) and cross members (middle) face away from cables.

3. Ladder rack shall be secured to the structural ceiling, building truss system, wall, and the tops of equipment racks and/or cabinets using the manufacturer's recommended supports and appropriate installation hardware and methods as defined by local code or the authority having jurisdiction (AHJ).

4. Ladder rack splices will be made in mid-span, not over a support, with the manufacturer's recommended splice hardware.

5. Ladder rack shall be supported every 5' or less in accordance with TIA-569-B. Ladder rack shall be supported within 2' of every splice and within 2' on both/all sides of every intersection. Support ladder rack within 2' on both sides of every change in elevation. Support ladder rack every 2' when attached vertically to a wall.

6. Heavy-duty splices are recommended for ladder rack in excess of 18" width (18" wide ladder rack). Heavy-duty splices are required for any splice formed in the vertical orientation including changes in elevation formed using vertical-to-horizontal 90° turns or horizontal-to-vertical 90° turns. Use heavy-duty splices to secure all overhead turns to the overhead horizontal pathway(s).

7. When the pathway is overhead, ladder rack shall be installed with a minimum clearance of 12" above the ladder rack. Leave a minimum of 12" in between ladder rack and ceiling/building truss structure. Leave a minimum of 3" in between ladder rack and the tops of equipment racks and/or cabinets. Multiple tiers of ladder rack shall be installed with a minimum clearance of 12" in between each tier of ladder rack. When located above an acoustical drop ceiling, leave a minimum of 3" clearance between the top of the drop ceiling tiles and the bottom of the ladder rack.

8. When installed under a raised floor, ladder rack shall be installed with a minimum 3" clearance between the top of the ladder rack and the bottom of the floor tiles or floor system stringers, whichever is lower in elevation. Maintain a 3" clearance between ladder racks wherever ladder racks cross.

9. Within each telecommunications room, ladder rack should be bonded together, electrically continuous, and bonded to the TGB, unless otherwise noted in the specifications and contract documents. Ladder rack and turns shall be bonded across each splice with a bonding kit. Ladder rack shall be bonded to the Telecommunications Grounding Busbar (TGB) using an approved ground lug on the ladder rack and a minimum #6 grounding wire or as recommended by the AHJ. Remove paint from the ladder rack where bonding/ground lugs contact the ladder rack so that the lug will contact bare metal. Use antioxidant joint compound in between the bare metal on the ladder rack and ground lug. Use antioxidant joint compound in between the bus bar and the ground lug. Verify continuity through the bonds at splices and intersections between individual ladder rack sections and turns and through the bond to the TGB.

10. The quantity of cables within the ladder rack will not exceed a whole number value equal to 50% of the interior area of the ladder rack divided by the cross-sectional area of the cable. The interior area of ladder rack will be considered to be the width of the ladder rack multiplied by a height of 2", unless cable retaining posts are added to the ladder rack. The interior area of ladder rack equipped with cable retaining posts will be considered to be the width of the ladder rack multiplied by a height of 6". Actual cable fill for ladder rack that is not equipped with cable retaining posts will not exceed 2" in height. Actual cable fill for ladder rack equipped with cable retaining posts will not exceed 6" in height.
The combined weight of cables within the ladder rack will not exceed the stated load capacity of the ladder rack as stated in the manufacturer’s product specifications or load/design tables.

Cables (cable bundles) will be secured to the cross members of ladder rack with ¾” wide reusable straps. Straps are not required when ladder rack is equipped with cable retaining posts.

Add 8” high cable retaining posts to the open sides of ladder rack when cable fill exceeds 2” in height or when cable bundles cannot be secured directly to the ladder rack cross members with a strap. Cable fill within any ladder rack should not exceed 6” in height.

When a single ladder rack supports different types of cable media, the cable media will be separated within the pathway by cable spools that attach to the cross members on the ladder rack. Treat each type of cable media and divided area of the ladder rack separately when determining cable fill limits.

Use a radius drop to guide cables wherever cable exits overhead ladder rack to access a rack, frame, cabinet or wall-mounted rack, cabinet or termination field. If necessary, provide a moveable cross member also to attach and align the radius drop in between the welded cross members of a ladder rack.

Cover the exposed ends of cable runway that do not terminate against a wall, the floor or the ceiling with end caps or an end closing kit.

Use auxiliary support brackets that attach to the side stringer of the ladder rack to support interconnect cabling (patch cords, equipment cords, jumper cords) that is routed between racks using the ladder rack. Auxiliary support brackets can be used to support other conductors that should be physically separated from cables within the ladder rack as defined by local code or the authority having jurisdiction (AHJ).

Whenever possible, maintain a 2’ separation between ladder rack used for communications cables and pathways for other utilities or building services.

The installer will provide touch-up paint color-matched to the finish on the ladder rack and will correct any minor cosmetic damage (chips, small scratches, etc.) resulting from normal handling during the installation process prior to delivery to the owner. If a component is cosmetically damaged to the extent that correction in the field is obvious against the factory finish, the component will be replaced with a new component finished from the factory. If a component is physically damaged due to mishandling or modification during the installation process, it shall not be used as part of the ladder rack system.

I. Fiber Runner

1. Provide all components of the fiber runner system (channel, covers, couplers, supports, and accessories) from a single manufacturer.

2. Fiber runner shall be installed to the side stringers of the ladder rack so that the fiber runner is at the front of the cabinet.

3. Fiber runner couplers will be made in mid-span, not over a support, with the manufacturer’s recommended coupler hardware.

4. Fiber runner shall be supported every 5’ or less in accordance with manufacturers installation guide. Fiber runner shall be supported within 2’ of every splice and within 2’ on both/all sides of every intersection.

5. Leave a minimum of 3” in between fiber runner and the tops of equipment racks and/or cabinets. Multiple tiers of fiber runner shall be installed with a minimum clearance of 12” in between each tier of fiber runner.

6. The quantity of cables within the fiber runner will not exceed a whole number value equal to 50% of the interior area of the fiber runner divided by the cross-sectional area of the cable. The interior area of fiber runner will be considered to be the width of the fiber runner multiplied by a height of the fiber runner.
7. The combined weight of cables within the fiber runner will not exceed the stated load capacity of the fiber runner as stated in the manufacturer's product specifications or load/design tables.

8. Cover the exposed ends of fiber runner with end caps.

9. If a component is cosmetically damaged to the extent that correction in the field is obvious against the factory finish, the component will be replaced with a new component finished from the factory. If a component is physically damaged due to mishandling or modification during the installation process, it shall not be used as part of the fiber runner system.

3.2 AC POWER AND GROUNDING

A. Coordinate and verify final connection of related electrical power, TMGB and TMB Grounding Busbar and ground conductors.


C. Ground equipment chassis not having a three-wire power cord, other metal enclosures, and equipment rack frames in the ER and IDF room(s) to the ground bus bar in that room using #6 AWG insulated conductor and bonding with 10/32 nuts, bolts and lock-washers.

D. Remove any finish and make-bare any metallic surface at the point where grounding wire is connected to and or terminated on equipment frames, racks or devices.

END OF SECTION
SECTION: 27 13 00

COMMUNICATIONS BACKBONE 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 backbone cabling between Telecommunications Rooms.

C. Included in this section are the minimum composition requirements and installation methods for the following:

1. Multi-pair Category 3 UTP Cable
2. UTP Termination Hardware
3. Conventional Fiber Optic Cabling
4. Air Blown Fiber Optic Cabling
5. Innerduct
6. Fiber Optic Splicing and Termination Hardware
7. Fiber Enclosures, Adapter Panels and Splice Trays
8. Fiber Optic Patch Cords

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. CMR Communications Riser Cable
4. CMP Communications Plenum Cable
5. DCM Design Criteria Manual
6. DFW Dallas/Fort Worth International Airport
7. EIA Electronics Industries Association
8. FOCIS Fiber Optic Connector Intermateability Standards
9. ICEA Insulated Cable Engineers Association
10. IDC Insulation Displacement Connector
11. IEEE Institute of Electrical and Electronics Engineers
12. MCR Main Communications Room
13. MER Main Equipment Room
14. NECA National Electrical Contractors Association
15. NEMA National Electric Manufacturers Association
16. NFPA National Fire Protection Association
17. OAR Owner's Authorized Representative
18. OLTS Optical Loss Test Set
19. OFNR Optical Fiber Nonconductive Riser
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 BICSI, EIA and TIA recommended installation practices when installing communications backbone 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, 2010
3. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises, 2009
5. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard, 2009
8. EIA/TIA TSB-36 – Additional Cable Specifications for Unshielded Twisted Pair
9. EIA/TIA TSB-40 – Additional Transmission Specifications for Unshielded Twisted Pair
10. EIA/TIA TSB-67 – Transmission Performance Specifications for Field-testing of Unshielded Twisted Pair Cabling Systems
13. ANSI/TIA/EIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces, 2004
16. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers, 2005
18. UL 13 – Standard for Safety for Power-Limited Circuit Cables
19. UL 444 – Standard for Safety for Communications Cables
21. IEEE 802 – Local Area Network Standard
22. DFW Airport Design Criteria Manual
23. American Airlines Facilities Design Guidelines
24. 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 and pay for all necessary permits and fees 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 backbone 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.

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 copper cabling and optical fiber, indicating minimum bend radius and maximum pull tension.
   4. Outline of administration labeling scheme for voice and data communications cabling and termination locations per ANSI/EIA/TIA-606 and the DFW DCM.
   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 all pathway systems to include cable tray, conduits (horizontal and vertical), and non-contiguous support.
   6. As built documentation of MCR/MER/TR modifications and associated cabinet elevations.
   7. Laminated as-built drawing sheet of TR service area, with a scale of not less than 1/8", mounted in the wall of each TR.

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.

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 through authorized Panduit, Corning and Sumitomo Electric product distributors.
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. General Cable Technologies Corp.
   b. Superior Essex Inc.
   c. Owner Approved Equivalent

2. Cable, Fiber Optic
   a. Corning
   b. Sumitomo Electric
   c. Owner Approved Equivalent

3. Termination Components
   a. Corning
   b. 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 are to be approved by Owner.

2.4 UTP PRODUCTS

A. UTP Cable
   1. Provide multi-pair Category 3 cabling for all copper backbone connectivity.
   2. Conductors shall be 24 AWG solid annealed copper.
   3. Pairs shall be formed into 25-pair binder groups.
   4. The jacket shall be constructed of flame retardant PVC.
   5. Comply with ICEA S-90-661 for mechanical properties.
   7. Provide plenum-rated cable for all plenum environments and riser-rated cable for all non-plenum environments.
   8. Approved products:
      a. General Cable Category 3 Plenum
      b. General Cable Category 3 Non-Plenum
      c. Superior Essex Category 3 CMR/CMP
      d. Owner approved equivalent.

B. UTP Cable Terminating Hardware
   1. Terminate each end of copper backbone cables with rack mount 110 style field termination kits.
   2. Hardware to exceed the TIA/EIA-568-B.2 Category 3 standard.
   3. Hardware to be field terminable.
4. Include required quantity of bases and connecting blocks, label holders and labels.
5. Kit shall include jumper troughs.
6. Connecting blocks shall be of the 5-pair variety.
7. Acceptable products:
   a. Panduit P110B1005R4WJY 110 Punchdown Kit with Bases, 5 Pair Connector Blocks, Jumper Troughs
   b. Owner approved equivalent.

2.5 FIBER OPTIC PRODUCTS (DFW AIRPORT)

A. Multimode Fiber
   1. Provide air-blown multimode fiber optic backbone cabling, as indicated in the drawing set.
   2. Optical fibers shall be 50/125-micron and OM3 compliant.
   3. Maximum attenuation coefficient shall be:
      a. 3.0 dB/km at 850 nm
      b. 1.0 dB/km at 1300 nm
   4. Refer to the drawing set for exact fiber counts.
   5. Approved products:
      a. Sumitomo FutureFLEX FBxxG53
         1) Where xx equals fiber strand count.
      b. Owner approved equivalent.

B. Singlemode Fiber
   1. Provide air-blown singlemode fiber optic backbone cabling, as indicated in the drawing set.
   2. Optical fibers shall be minimum OS1 compliant.
   3. Maximum attenuation coefficient shall be
      a. 0.65 dB/km at 1310 nm
      b. 0.65 dB/km at 1383 nm
      c. 0.65 dB/km at 1550 nm
   4. Refer to the drawing set for exact fiber counts.
   5. Approved products:
      a. Sumitomo FutureFLEX FBxxSX
         1) Where xx equals fiber strand count
      b. Owner approved equivalent.

C. Innerduct
1. Provide plenum-rated for all plenum environments and riser-rated for all non-plenum environments.
2. Jacket shall be riser rated, nonconductive, type OFNR, complying with UL 1666.
3. Jacket shall be plenum rated, nonconductive, type OFNP, complying with NFPA 262.
4. Jacket shall be OSP rated, nonconductive, UV resistant.
   a. High performance black polyethylene tubes with low friction liners.
   b. Fiber reinforced plastic central strength member for extra pulling strength.
   c. Water blocking tape.
   d. Polyethylene outer jacket and ripcord.
5. Refer to the drawing set for the number of tubes.
   a. Sumitomo FutureFLEX TCxxTR3 Riser Rated Tube Cable
   b. Sumitomo FutureFLEX TCxxTP2 Plenum Rated Tube Cable
   c. Sumitomo FutureFLEX TCxxMTX OSP Rated Tube Cable
   d. Where xx equals cell count.
   e. Owner approved equivalent.

D. Fiber Optic Connectors
1. Provide LC pigtail connectors to fusion splice to each fiber.
2. Quick-connect, simplex or duplex, type LC connectors.
3. Connector to comply with FOCIS specifications of TIA-604-10A.
4. Insertion loss of not more than 0.75 dB.
5. Acceptable Products:
   a. Panduit FXB10-NM1Y LC To Pigtail, MM, 10 GbE 50μm, 1m
   b. Panduit F9B10-NM1Y LC To Pigtail PC, Singlemode, 9μm Simple Buffered, 1m
   c. Owner approved equivalent

E. Fiber Enclosures
1. Provide rack mount modular fiber enclosures.
2. Enclosures shall accept splice modules and fiber adapter modules.
3. Populate unused fiber adapter panel openings with blank filler plates.
4. Refer to the drawing set to determine exact size and configuration.
5. Acceptable Products:
   a. Panduit FRME1U Rack Mount Fiber Enclosure 1RU
   b. Panduit FRME2U Rack Mount Fiber Enclosure 2RU
   c. Panduit FCE4U Rack Mount Fiber Enclosure 4RU
   d. Owner approved equivalent

F. Fiber Optic Splice Module
1. Provide fusion splice modules for DFW Airport fiber enclosures
2. Modules shall accept up to 24 fusion splices.
3. Modules shall be designed to install in rack mount fiber enclosures.
4. Provide a quantity of modules to accommodate every splice within each enclosure.
5. Acceptable products:
a. Panduit FOSMH4U Fiber Optic Splice Module  
b. Panduit FOSMF Fiber Optic Splice Module for 24 Fusion Splices  
c. Owner approved equivalent

G. Fiber Adapter Panel

1. Provide LC duplex fiber adapter panels for fiber enclosures
2. Modules shall 12 duplex LC fibers.
3. Modules shall be designed to install in rack mount fiber enclosures.
4. Provide a quantity to accommodate every fiber within each enclosure
5. Acceptable products:
   a. Panduit FAP12WAQDLCZ Fiber Adapter Panel, 12 duplex MM LC
   b. Panduit FAP12WBUDLCZ Fiber Adapter Panel, 12 duplex SM LC
   c. Panduit FAPB Blank Fiber Adapter Panel
   d. Owner approved equivalent

H. Fiber Optic Patch Cords

1. Provide factory-made, duplex fiber jumpers.
2. Multimode jumpers shall be constructed of laser optimized 50/125μm (OM3) fiber.
3. Singlemode jumpers shall be constructed of 9/125μm (OS1) fiber.
4. Allow for one patch cord for every four (4) strands of fiber in each closet, but coordinate the exact quantity of patch cords, their lengths and connector types, with the OAR.
5. Acceptable Products:
   a. Panduit FXE10-10MxY LC to LC Fiber Jumper, Duplex, 10 GbE Multimode
   b. Panduit F9E10-10MxY LC to LC Fiber Jumper, Duplex, 10 GbE Singlemode
   c. Panduit FXE3-10MxY SC to LC Fiber Jumper, Duplex, 10 GbE Multimode
   d. Panduit F9E3-10MxY SC to LC Fiber Jumper, Duplex, 10 GbE Singlemode
   e. Owner Approved Equivalent

2.6 FIBER OPTIC PRODUCTS (American Airlines and TSA)

A. Multimode Fiber (American Airlines Only)

1. Provide multimode fiber optic backbone cabling, as indicated in the drawing set.
2. Optical fibers shall be 50/125-micron and OM3 compliant.
3. Maximum attenuation coefficient shall be:
   a. 3.0 dB/km at 850 nm
   b. 1.0 dB/km at 1300 nm
4. Provide plenum-rated cable for all plenum environments and riser-rated cable for all non-plenum environments.
5. Jacket to be aqua in color.
6. Jacket to be imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.
7. Refer to the drawing set for exact fiber counts.
8. Approved products:
   a. Corning MIC® Interlocking Armored Plenum Cable
      1) xxxT88-31180-A3 (2-24 fibers)
      2) xxxT88-61180-A3 (36-48 fibers)
      3) xxxT88-T3180-A3 (60-144 fibers)
      4) Where xxx equals fiber strand count.
   b. Owner approved equivalent.

B. Singlemode Fiber
1. Provide singlemode fiber optic backbone cabling, as indicated in the drawing set.
2. Optical fibers shall be minimum OS1 compliant.
3. Maximum attenuation coefficient shall be:
   a. 0.65 dB/km at 1310 nm
   b. 0.65 dB/km at 1383 nm
   c. 0.65 dB/km at 1550 nm.
4. Provide plenum-rated cable for all plenum environments and riser-rated cable for all non-plenum environments.
5. Jacket to be yellow in color.
6. Jacket to be imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.
7. Refer to the drawing set for exact fiber counts.
8. Approved products:
   a. Corning MIC® Interlocking Armored Plenum Cable
      1) xxxE88-31131-A3 (2-24 fibers)
      2) xxxE88-61131-A3 (36-48 fibers)
      3) xxxE88-T3131-A3 (60-144 fibers)
      4) Where xxx equals fiber strand count.
   b. Owner approved equivalent.

C. Innerduct
1. Provide innerduct in all conduits carrying fiber optic and copper backbone cabling.
2. Innerduct to be constructed of flexible fabric ducts sewn together into groups.
3. The tensile strength of the innerduct shall exceed 2500 lbs.
4. The melting point for the innerduct shall be no less than 480° F.
5. Innerduct shall be unaffected by mud, silt or debris after placement of cable.
6. Each duct shall contain a color-coded pull tape.
7. Each group of ducts shall come with a unique color code.
8. Acceptable products:
   a. Maxcell Innerduct
1) MXC4003 Standard 4" 3-Cell Fabric Innerduct  
2) MXC3456 Standard 3" 3-Cell Fabric Innerduct  
3) MXC2003 Standard 2" 3-Cell Fabric Innerduct

b. Owner approved equivalent.

D. Fiber Optic Connectors (American Airlines)

1. Provide field terminated SC connectors for each fiber.
2. Quick-connect, simplex or duplex, type SC connectors.
3. Connector to comply with FOCIS specifications of TIA-604-3A.
4. Insertion loss not more than 0.75 dB.
5. Acceptable Products:
   a. Corning 95-051-41-SP-X SC Field Terminated Laser Optimized MM Connector, Anaerobic Cure
   b. Corning 95-050-41-X SC Field Terminated Laser Optimized MM Connector, Unicam
   c. Corning 95-201-41-SP SC Field Terminated, Singlemode Connector, Anaerobic Cure
   d. Corning 95-200-41 SC Field Terminated, Singlemode Connector, Unicam
   e. Corning 95-200-44 SC Field Terminated, Singlemode APC Connector, Unicam
   f. Owner approved equivalent

E. Fiber Optic Connectors (TSA)

1. Provide field terminated LC connectors for each fiber.
2. Quick-connect, simplex or duplex, type LC connectors.
3. Connector to be TIA/EIA-604-10A FOCIS-10 compatible that exceed TIA/EIA-568-B.3 requirements.
4. Insertion loss not more than 0.75 dB.
5. Acceptable Products:
   a. Corning 95-051-98-SP-X LC Field Terminated Laser Optimized MM Connector, Anaerobic Cure
   b. Corning 95-050-99-X LC Field Terminated Laser Optimized MM Connector, Unicam
   c. Corning 95-201-98-SP LC Field Terminated, Singlemode Connector, Anaerobic Cure
   d. Corning 95-200-99 LC Field Terminated, Singlemode Connector, Unicam
   e. Owner approved equivalent

F. Fiber Enclosures

1. Provide rack mount modular fiber enclosures.
2. Enclosures shall accept splice modules and fiber adapter modules.
3. Populate unused fiber adapter panel openings with blank filler plates.
4. Refer to the drawing set to determine exact size and configuration.
5. Acceptable Products:
   a. Corning CCH-02U Rack Mount Fiber Enclosure 2RU
   b. Corning CCH-03U Rack Mount Fiber Enclosure 3RU
   c. Corning CCH-04U Rack Mount Fiber Enclosure 4RU
G. Fiber Adapter Panel (American Airlines)

1. Provide SC duplex fiber adapter panels for fiber enclosures.
2. Modules shall be SC duplex for either 6 or 12 fibers.
3. Modules shall be designed to install in rack mount fiber enclosures.
4. Provide a quantity to accommodate every fiber within each enclosure
5. Acceptable products:
   a. Corning CCH-CP12-E7 Multimode Fiber Adapter Panel, 6 duplex SC
   b. Corning CCH-CP12-59 Singlemode Fiber Adapter Panel, 6 duplex UPC SC
   c. Corning CCH-CP06-59 Singlemode Fiber Adapter Panel, 3 duplex UPC SC
   d. Corning CCH-CP06-D9 Singlemode Fiber Adapter Panel, 3 duplex APC SC
   e. Owner approved equivalent

H. Fiber Adapter Panel (TSA)

1. Provide LC duplex fiber adapter panels for fiber enclosures
2. Modules shall 12 duplex LC fibers.
3. Modules shall be designed to install in rack mount fiber enclosures.
4. Provide a quantity to accommodate every fiber within each enclosure
5. Acceptable products:
   a. Corning CCH-CP12-E4 Multimode Fiber Adapter Panel, 12 duplex LC
   b. Corning CCH-CP12-A9 Singlemode Fiber Adapter Panel, 6 duplex LC
   c. Owner approved equivalent

I. Fiber Optic Patch Cords

1. Provide factory-made, duplex fiber jumpers.
2. Multimode jumpers shall be constructed of laser optimized 50/125μm (OM3) fiber.
3. Singlemode jumpers shall be constructed of 9/125μm (OS1 minimum) fiber.
4. Provide a variety of lengths (1M, 2M and 3M), as needed, based on the rack elevations in the drawing set.
5. Refer to the fiber usage schedules to determine patch cord quantities for each closet. Provide an additional 20% for spares.
6. Acceptable Products:
   a. Corning 5757-02-T5120-***-M SC to SC Fiber Jumper, Duplex, 10 GbE Multimode
   b. Corning 7272-02-R5120-***-M SC to SC Fiber Jumper, Duplex, Singlemode
   c. Corning 5705-02-T5120-***-M SC to LC Fiber Jumper, Duplex, 10 GbE Multimode
   d. Corning 7204-02-R5120-***-M SC to LC Fiber Jumper, Duplex, Singlemode
   e. Corning 0505-02-T5120-***-M LC to LC Fiber Jumper, Duplex, Singlemode
   f. Corning 0404-02-R5120-***-M LC to LC Fiber Jumper, Duplex, Singlemode
PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Install cables in conduits, raceways and cable trays.

B. Install plenum cable in environmental air spaces where cabling will be exposed, including plenum ceilings.

C. Bundle, lace, and train cables within racks and enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and wiring troughs, as required.

3.3 INSTALLATION OF CABLES

A. General Requirements for Cabling:

1. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
2. Install 110-style IDC termination hardware unless otherwise indicated.
3. Terminate all conductors; no cable shall contain unterminated elements.
4. UTP Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and no more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Verify that installed cable's minimum bend radius does not exceed the installed conduit’s bend radius at any point. Coordinate any conduit bend radius conflicts with Installing/General Contractor prior to installation of cable.

B. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 6 feet long no less than 12 inches in diameter below each feed point.

C. Special Requirement for American Airlines Singlemode Fiber Optic Cable:
1. American Airlines singlemode Fiber Optic cables between the MER and each TR shall have six fibers terminated as APC connectors mounted on a 6-port APC Adapter Panel.
   
a. This means the 18 fibers not APC will be UPC type connectors mounted on one each 12-port and 6-port Adapter Panels.

3.4 POST-INSTALLATION TESTING

A. Contractor shall test each pair or strand of every cable prior to acceptance. (100% PASS)

B. Contractor shall supply all of the required test equipment used to conduct acceptance tests.

C. Contractor shall submit acceptance documentation as defined below. No cabling installation is considered complete until test results have been completed, submitted and approved.

D. Standards Compliance and Test Requirements:

1. Copper backbone shall exceed ANSI/TIA-568-C.2 Backbone Cabling requirements and meet the manufacturer’s specifications for the installed product.

2. Optical fiber shall exceed ANSI/TIA-568-C.3 Optical Fiber Cabling Components Standard requirements and meet the manufacturer’s specifications for the installed product.


E. Cable Test Documentation:

1. Optical Fiber: Testing shall be performed on all fibers in the completed end-to-end system.

   a. Power Meter and Source Loss Reports: Testing shall consist of a bi-directional, dual wave length end to end test. The system loss measurements shall be provided at 850 and 1300 nanometers for multi-mode fibers and 1310 and 1550 for single mode fibers.

   b. Optical Time Domain Reflectometer (OTDR) Reports: Testing shall consist of a bi-directional end to end OTDR trace performed per TIA/EIA 455-61. Reflective events (connections) shall not exceed 0.75 dB.

   c. Non-reflective events (splices) shall not exceed 0.3 dB.

   d. Fibers shall be inspected at 250X or 400X magnification. 250X magnification is suitable for inspecting multimode and single mode fibers. 400X magnification may be used for detailed examination of single mode fibers.

   e. Testing shall be performed on each cabling segment (connector to connector).

   f. Testing of the cabling shall be performed using high-quality test cords of the same fiber type as the cabling under test. The test cords for optical loss test set (OLTS) testing shall be between one meter and five meters in length. The test cords for OTDR testing shall be approximately 100 meters for the launch cable and at least 25 meters for the receive cable.
Testing shall be performed on each cabling channel (equipment to equipment) that is planned for use per the owner’s instructions.

2. Test results saved within the field-test instrument shall be transferred into a Windows™ based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., “as saved in the field-test instrument”. The file format, CSV (comma separated value), does not provide adequate protection of these records and shall not be used.

3. The detailed test results documentation data is to be provided in an electronic database for each tested optical fiber and shall contain the following information:
   a. The identification of the customer site as specified by the end-user.
   b. The name of the test limit selected to execute the stored test results.
   c. The name of the personnel performing the test.
   d. The date and time the test results were saved.
   e. The manufacturer, model and serial number of the test instrument.
   f. The version of the test software and the version of the test limit database held within the test instrument.
   g. The fiber identification number.
   h. The length for each optical fiber.
   i. The index of refraction used for length calculation when using a length capable OLTS.
   j. Test results to include OLTS attenuation link and channel measurements at the appropriate wavelength(s) and the margin (difference between the measured attenuation and the test limit value).
   k. Test results to include OTDR link and channel traces and event tables at the appropriate wavelength(s).
   l. The length for each optical fiber as calculated by the OTDR.
   m. Overall Pass/Fail evaluation of the link-under-test for OLTS and OTDR measurements.
   n. Circuit IDs reported by the test instrument should match the specified label ID.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections in accordance with project specifications. Provide minimum 24 hours notice to OAR prior to testing. All testing shall be witnessed by OAR, at OAR’s discretion.

B. Tests and Inspections:

1. Furnish proposed test procedures, recording forms, list of testing personnel and test equipment to OAR for review prior to commencement of testing.
2. Follow recommended procedures for testing as published by test equipment manufacturer.

C. Copper Cable Testing:

1. Testing of all copper wiring shall be performed prior to system cutover. 100% of riser wiring pairs shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage.
2. Category 3 riser cables shall be tested for conformance to TIA 568C.
3. OAR shall randomly perform unannounced, onsite reviews during installation. OAR shall perform final inspection and a complete review of test results before installation is accepted.

D. Optical Fiber Testing with OTDR

1. The Contractor shall test all optical fiber cable prior to installation. The Contractor shall assume all liability for the replacement of the cable should it be found defective at a later date.
2. All fiber testing shall be performed on all fibers in the completed system. Bidirectional end-to-end OTDR testing shall be performed in accordance with TIA 455-78-B. The system loss measurement shall be provided at 850 and 1310 nanometers for multimode fibers and 1310 and 1550 for single mode fibers.
3. Fiber links shall have a maximum loss of (allowable cable loss per km) (km of fiber in the link) + (.4dB)(number of mated connectors) = maximum allowable loss.
4. Documentation shall be provided in both hard copy and CD format to the OAR.

E. Optical Fiber Testing with Power Meter

1. Multimode Horizontal Link Segments should be tested in both directions at 850-nm and 1300-nm wavelengths.
2. Multimode backbone and composite link segments should be tested in both directions at both 850-nm and 1300-nm wavelengths.
3. Singlemode horizontal link segments shall be tested in both directions at 1300-nm and 1550-nm wavelengths.
4. Singlemode backbone and composite link segments should be tested in both direction at both 1310-nm and 1550-nm wavelengths.

F. Testing documentation shall be submitted in accordance with TIA/EIA 526-14-A “Optical Power Loss Measurement in Installed Multimode Fiber Cable Plant” and TIA/EIA 526-7 “Measurement of Optical Power Loss of Installed Singlemode Fiber Cable Plant”. At minimum, the following information shall be documented during testing:

1. Names of personnel conducting the test.
2. Type of test equipment used (manufacturer, model, serial number).
3. Date test is being performed.
5. End point locations.
6. Test direction.
7. Reference power measurement (when not using a power meter with a relative power measurement mode).
8. Measured attenuation of the link segment.
10. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

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 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 6 & 6A Cable
   2. Fiber Optic Cabling
   3. Faceplates, Jacks, and Modules
   4. Patch Panels
   5. Patch Cords
   6. 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. CMR Communications Riser Cable
   5. CMP Communications Plenum Cable
   6. DCM Design Criteria Manual
   7. DFW Dallas/Fort Worth International Airport
   8. EIA Electronics Industries Association
   9. FEP Fluorinated Ethylene Propylene
   10. IDC Insulation Displacement Connector
   11. IEC International Electrotechnical Commission
   12. IEEE Institute of Electrical and Electronics Engineers
   13. ISO International Standards Organization
   14. MCR Main Communications Room
   15. MER Main Equipment Room
   16. NEMA National Electric Manufacturers Association
   17. NEXT Near End Crosstalk
   18. NFPA National Fire Protection Association
   19. OAR Owner’s Authorized Representative
   20. PCI Panduit Certified Installer
   21. RCDD Registered Communications Distribution Designer
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 BICSI, EIA and TIA 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, 2010
3. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises, 2009
4. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard, 2009
5. ANSI/TIA-568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards, 2009
6. EIA/TIA TSB-36 – Additional Cable Specifications for Unshielded Twisted Pair
7. EIA/TIA TSB-40 – Additional Transmission Specifications for Unshielded Twisted Pair
8. EIA/TIA TSB-67 – Transmission Performance Specifications for Field-testing of Unshielded Twisted Pair Cabling Systems
13. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers, 2005
15. UL 13 – Standard for Safety for Power-Limited Circuit Cables
16. UL 444– Standard for Safety for Communications Cables
18. IEEE 802 – Local Area Network Standard
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 and pay for all necessary permits and fees 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.
4. Outline of administration labeling scheme for voice and data communications cabling and termination locations per ANSI/EIA/TIA-606 and DFW/DCM.
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 IDF/TR modifications and associated cabinet elevations.
6. Laminated as-built drawing sheet of TR service area representing each level, with a scale of not less than 1/8”, mounted on the wall of each TR.

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, or for a period of 1 year from date of final completion, whichever is longer. 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 6 copper links originating from patch panels shall be warranted against the link performance minimum expected results defined in the ANSI/TIA/EIA Telecommunications Systems Bulletin (TSB-67), now incorporated into TIA/EIA 568-B, for Category 6 performance requirements. Category 6 copper links originating from wall mounted 110-style termination blocks shall be warranted against link performance minimum expected results for Category 6 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 (DFW AIRPORT MCR AND COMPUTER ROOMS ONLY)

A. UTP Cable

1. Provide Category 6A cabling for all cabinet-to-cabinet interconnects within MERs and computer rooms.
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 copper conductors shall be twisted in pairs, separated by internal dividers to improve NEXT performance, and shall be covered by a low smoke, flame retardant (CMP) jacket.
5. The jacket color shall be blue.
6. Approved products:
   a. Panduit PUP6A04BU-UG TX6™ 10Gig™ Category 6A UTP Copper Cable, Blue, Plenum
   b. Owner approved equivalent

B. 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.
6. Approved products:
   a. Panduit CJ6X88TGBU Mini-Com® TX6™ 10Gig™ UTP Jack Module, Blue
   b. Owner approved equivalent

C. Copper Patch Cords
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/EIA 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.

2.5 CATEGORY 6 PRODUCTS
A. UTP Cable (Voice/Data)
1. Provide Category 6 cabling for all voice and data work area outlet locations.
2. Cable shall far exceed ANSI/TIA/EIA-568-B.2-1 and ISO/IEC 11801 Class E standards.
3. The conductors shall be 23 AWG construction with FEP (CMP) or polyolefin (CMR) insulation.
4. The copper conductors shall be twisted in pairs, separated by an integrated pair divider and shall be covered by a low smoke, flame retardant (CMP) jacket or a flame retardant (CMR) jacket.
5. Provide plenum-rated cable for all plenum environments and riser-rated cable for all non-plenum environments.
6. The jacket color for DFW Airport cables shall be blue.
7. The jacket color for Tenant Airlines shall be white.
8. The jacket color for TSA cables shall be yellow.
9. Approved products:
   a. Panduit PUP6504BU-U1 Y TX6500™ Category 6 UTP Copper Cable, Blue, Plenum
   b. Panduit PUP6504WH-U1 Y TX6500™ Category 6 UTP Copper Cable, White, Plenum
   c. Panduit PUP6504YL-U1 Y TX6500™ Category 6 UTP Copper Cable, Yellow, Plenum
   d. Panduit PUR6504BU-U1 Y TX6500™ Category 6 UTP Copper Cable, Blue, Non-Plenum
   e. Panduit PUR6504WH-U1 Y TX6500™ Category 6 UTP Copper Cable, White, Non-Plenum
   f. Panduit PUR6504YL-U1 Y TX6500™ Category 6 UTP Copper Cable, Yellow, Non-Plenum
   g. Owner approved equivalent

B. UTP Jack Modules
   1. Provide Category 6 jack modules to terminate both ends of each 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. Modules at DFW Airport work area outlet locations shall be blue in color.
   6. Modules at TSA work area outlet locations shall be yellow in color.
   7. Modules at Tenant Airline work area outlet locations shall be black in color.
   8. Modules in DFW Airport MCR/CR patch panels shall be blue in color.
   9. Modules in Tenant Airlines patch panels shall be black in color.
  10. Modules in TSA TR patch panels shall be black in color.
  11. Approved products:
      a. Panduit CJ688TGBU Mini-Com® TX6™ PLUS UTP Jack Module, Blue
      b. Panduit CJ688TGYL Mini-Com® TX6™ PLUS UTP Jack Module, Yellow
      c. Panduit CJ688TGBL Mini-Com® TX6™ PLUS UTP Jack Module, Black
      d. Owner approved equivalent

C. Category 6 Patch Cords for IT Spaces (CR/TR/IT Rooms)
   1. Provide Category 6 small diameter patch cords for voice and data ports within these locations.
   3. Shall meet requirements of IEEE 802.af and IEEE 802.3at for PoE applications in bundle sizes of no more than 40 patch cords.
   4. Each patch cord shall be 100% performance tested and wired T568B.
5. Patch cord shall be constructed of Category 6, 28 AWG UTP stranded cable and TX6™ PLUS Modular Plugs; plug contacts plated with 50 micro-inches of gold for superior performance.
6. Patch cord plugs shall meet all applicable ANSI/TIA/EIA-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/EIA component range, ensuring interoperability and excellent 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 for CR/TR/IT Room locations. Include a quantity necessary to patch 50% of each 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. Coordinate patch cord colors with the various OARs.
12. Approved products:
    a. Panduit UTP28SP5* Category 6 Small Diameter Copper Patch Cord, 5’
    b. Panduit UTP28SP7* Category 6 Small Diameter Copper Patch Cord, 7’
    c. Panduit UTP28SP10* Category 6 Small Diameter Copper Patch Cord, 10’
    d. Owner approved equivalent

D. Category 6 Patch Cords (Work Area Outlet)
1. Provide Category 6 patch cords for voice and data work area outlets.
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 Category 6, 24 AWG UTP stranded cable and TX6™ PLUS Modular Plugs; plug contacts plated with 50 micro-inches of gold for superior performance.
6. Patch cord plugs shall meet all applicable ANSI/TIA/EIA-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/EIA component range, ensuring interoperability and excellent performance.
9. Patch cord shall be labeled with an identification of performance level, length, and a quality control number.
10. Provide a quantity of 10’ length patch cords for 50% of each available port on every work area outlet.
11. Provide plenum rated patch cords for work area outlets installed above the ceiling and not patched inside of a raceway (i.e. the patch cord is exposed inside the plenum). These scenarios include, but are not limited to:
    a. Wireless access points
    b. Non-DFW CCTV cameras
12. Coordinate patch cord colors with the various OARs.
13. Approved products:
   a. Panduit UTPSP10‘Y Category 6 Copper Patch Cord, 10’
   b. Panduit UAPPBU10 Category 6 Plenum Rated Copper Patch Cord, 10’
   c. Owner approved equivalent

E. 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

2.6 FIBER OPTIC PRODUCTS
A. Fiber Optic Cable
1. Provide fiber optic drops to the locations shown in the drawing set.
2. Optical fibers shall be minimum OS1 compliant.
3. Maximum attenuation coefficient shall be:
   a. 0.65 dB/km at 1310 nm
   b. 0.65 dB/km at 1383 nm
   c. 0.65 dB/km at 1550 nm.
4. Provide plenum-rated cable for all plenum environments and riser-rated cable for all non-plenum environments.
5. Jacket to be yellow in color.
6. Jacket to be imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.
7. Refer to the drawing set for exact fiber counts.
8. Approved products:
   a. Corning MIC® Interlocking Armored Plenum Cable
      1) 002E81-31131-A1, 2-Strand, OFCR
      2) 002E88-31131-A3, 2-Strand, OFCP
      3) 006E81-31131-A1, 6-Strand, OFCR
      4) 006E88-31131-A3, 6-Strand, OFCP
9. Owner approved equivalent.

Fiber Optic Terminations

1. Terminate each end of horizontal fiber optic cable with LC connectors.
2. Connector to be TIA/EIA-604-10A FOCIS-10 compatible that exceed TIA/EIA-568-B.3 requirements.
3. Connector performance shall match or exceed the performance of the cable.
4. Connector to be field polish termination, with anaerobic adhesive
5. Approved products:
   a. Panduit FLCSSBUY
   b. Owner approved equivalent.

B. Fiber Optic Jack Modules

1. Provide fiber optic bulkhead modules at work area outlet locations.
2. Module shall be TIA/EIA-604 FOCIS-10 compatible that exceed TIA/EIA-568-B.3 requirements.
3. Module shall be compatible with Mini-Com® products for complete modularity.
4. Module performance shall match or exceed the performance of the cable.
5. Approved products:
   a. Panduit CMDSLCZBU
   b. Owner approved equivalent

2.7 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. Wallphone Plates

1. Provide faceplates for wallphone locations.
2. Faceplate shall be of stainless steel construction.
3. Faceplate shall include mounting studs on plate which are positioned to mount standard wall mount telephones with keystone adaptation flush to wall surface.
4. Include a Category 6 TX PLUS keystone jack module.
5. Approved products:
   a. Panduit KWP6PY Keystone Phone Plate, Cat 6 TX Plus
   b. Owner approved equivalent.

C. 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.

D. 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 CBXS6AW-AY Surface Mount Box, 6 Port
   e. Owner approved equivalent.

E. Tamper Resistant Faceplate

1. Provide tamper resistant faceplates for voice and data work area outlets.
2. Faceplate shall accept four (4) 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. Include label/label covers for easy port identification.
5. Sloped design improves bend radius control.
6. Two-piece hinged design.
7. Mount to single gang opening.
8. Faceplate shall be off white in color.
9. Approved products:
   b. Owner approved equivalent.
F. 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 CFPF*4BL Furniture Faceplate, 4 Port
   b. Owner approved equivalent.

G. 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 patch panel color.
4. Approved products:
   a. Panduit CMBW-X Mini-Com® Blank Module, White
   b. Panduit CMBBL-X Mini-Com® Blank Module, Black
   c. Owner approved equivalent.

H. Patch Panels

1. Provide modular patch panels in MCR/MER/TR 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 faceplate 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 48-port patch panels in TSA TR locations.
6. Use either 24-port or 48-port patch panels in DFW Airport CR and Tenant TR locations.
7. Approved products:
   a. Panduit UICMP24BLY Patch Panel, 24 Port, Ultimate ID, Black
   b. Panduit UICMP48BLY Patch Panel, 48 Port, Ultimate ID, Black
   c. Panduit UICPP2L4BL Patch Panel Faceplate, Ultimate ID, Black
   d. Owner approved equivalent.

I. Structured Media Enclosures

1. Provide a structured media enclosure in each concession space.
2. Enclosure to be a minimum 24" H.
3. Enclosure shall be equipped with a locking metal cover.
4. Provide a Media Distribution Mini-Com Modular Patch Panel (8-port).
5. Acceptable manufacturers:
   a. Panduit
   b. Legrand
   c. Owner approved equivalent.
   d.
J. Jet Bridge Interface Box

1. Provide a jet bridge cabling interface where indicated on the drawing set.
2. The enclosure shall be meet NEMA 4X requirements, with a foam-in-place gasket and a door with a continuous hinge.
3. Enclosure to be 24" H x 24" W x 8" D.
4. Include a mounting surface inside the enclosure.
5. Enclosure mounted outside are to be equipped with a solar shield.
6. Include a locking wing-nut with 2 keys.
7. Enclosure shall be equipped with a locking metal cover.
8. Acceptable products:
   a. Hoffman COMLINE Wall-Mount Enclosure System:
      1) ECL606020 Enclosure
      2) EP6060AL Mounting Surface
      3) DL36 Locking Wing Nut
      4) ESSH6020 Solar Shield
   b. Owner approved equivalent.

K. Jet Bridge Interface Box (In-Ceiling Enclosure)

1. Provide ceiling enclosures for all new quads added to the airport CCTV system.
2. The enclosure shall accommodate a minimum of 2RU of active electronics and 3RU, or more, of passive connectivity.
3. The enclosure shall be designed to accommodate an electrical receptacle.
4. The enclosure shall include airflow and heat dissipation features, allowing for proper thermal management.
5. The enclosure shall be designed to mount in a conventional 2' x 2', or 2' x 4' drop tile ceiling.
6. The door shall have a 50 lb. weight capacity.
7. Include door plate, equipment mounting bracket, horizontal cable management, a low decibel fan assembly, air dam and electrical junction box.
8. Provide a grounding and bonding kit.
9. Acceptable products assembly:
   a. Panduit
      1) Panduit PZICEA Active In-Ceiling Enclosure
      2) Panduit PZICGK Grounding & Bonding Kit
   b. Owner approved equivalent.

2.8 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:
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 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 TR(s) and ITR(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 MCR/MER/TR 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 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/EIA 568-A 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 6 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 40 patch cords.

3.5 LABELING

A. Comply with Section 270553 - Identification for Communications Systems.

3.6 TESTING

A. Copper Media Testing:

1. Contractor shall utilize personnel trained in the operation of the following Level II rated test equipment:

   a. Agilent WireScope Pro Series
   b. Fluke DTX-1800 Series
   c. Ideal LanTEK II
   d. 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 6 UTP cabling systems within the most current publication of TIA/EIA 568-B.

4. Provide equipment calibration reports with test results.

5. Provide 72 hours notice to the OAR prior to testing.
3.7 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.

3.8 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.

3.9 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
PART 1 - GENERAL

1.1 SUMMARY

A. Section 27 51 16 contains the technical specifications for the Public Address System (PA) for the Rent A Car Facility (RAC). The associated Drawing Set, including the General Notes, further specifies the system and is part of the technical specifications.

B. Scope of Work

1. Refer to Section 27 51 17 for portions of scope that shall be furnished and installed by the PA/VE Systems Integrator and by the Contractor. 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.

C. Related Requirements:

1. Related sections:

   a. 27 01 00 "General Telecommunications Systems Requirements."
   b. 27 51 17 "PA/VE System Package 2 Summary of Work."

2. Demolition: Demolition work is required for this system and includes deprogramming and carefully removing system components and devices. Demolition work will be performed in a phased manner.

D. Related Projects

1. The DFW Terminal PA/VE –Package 1 Project is extending the existing PA System in Terminal D to the remaining Terminals A, B, C, and E. The DFW Terminal PA/VE –Package 1 Project will not establish the PA system to be used for Voice Evacuation.

1.2 REFERENCES

A. Reference Standards

1. Refer to Section 27 01 00.

2. References:

   a. Refer to Section 27 01 00 for additional requirements.
   b. International Fire Code (IFC) 2009
   c. National Fire Protection Association (NFPA)


   d. Electronic Industry Alliance (EIA): standards as listed below.

   1) EIA-160: Sound Systems
2) EIA-299-A: Loudspeaker, Dynamic Magnetic Structures, and Impedance
3) EIA-310-D-2: Universal Network Equipment Rack and Cabinet
4) EIA SE-101-A: Amplifiers for Sound Equipment
5) EIA SE-103: Speakers for Sound Equipment
6) EIA SE-104: Engineering Specifications for Amplifiers for Sound Equipment
7) EIA SE-105: Microphones for Sound Equipment

1.3 ACTION SUBMITTALS
A. Refer to Section 27 01 00.

1.4 CLOSEOUT SUBMITTALS
A. Refer to Section 27 01 00.

1.5 MAINTENANCE MATERIAL SUBMITTALS
A. Refer to Section 27 01 00.
B. The Contractor is required to submit information regarding a minimum of three (3) reference sites that are actively using the same or similar systems. The sites should be similar in terms of number of equipment, devices throughput, and network operations. This reference information shall include the contact name, address, telephone number, and date of original installation for each reference site listed. Additionally, for each reference site detail the features that make it a qualified site (e.g., Final Test and Completion date, number of devices, etc.).

1.6 QUALITY ASSURANCE
A. Refer to Section 27 01 00.
B. The PA/VE system contractual agreement between the owner and PA/VE System Integrator stipulates that portions of this scope be performed by the PA/VE System Integrator. Coordinate sole source requirements with owner's representative prior to bidding.

1.7 DELIVERY, STORAGE, AND HANDLING:
A. Refer to Section 27 01 00.

1.8 FIELD CONDITIONS
A. Refer to Section 27 01 00.

1.9 WARRANTY
A. Refer to Section 27 01 00.
2.1 SYSTEM DESCRIPTION

A. The PA System shall be a public address paging system to collect, manage, and distribute high quality audible information to specific zones throughout the RAC. The PA System shall be specifically designed and focused on intelligibly reproducing live, prerecorded, or assembled voice messages. The PA System shall be a fully network based digital system and analyze the ambient sound level in specified zones to adjust the zone’s sound level accordingly.

B. Voice Evacuation: This project will establish the PA System as the audible portion of the Voice Evacuation (VE) System. Following the installation and successful testing, all occupied areas shall utilize the Public Address system for Voice Evacuation. Areas not renovated, such as mechanical rooms, shall continue to utilize the Fire Alarm system for all notification. Refer to TI series drawings for the PA/VE system limits.

C. Mass Notification System: Based on the Emergency Response Plan (ERP) requirements and perceived risks, DFW has chosen to proactively address the need for an Emergency Communication System by including requirements in their building standards. Therefore use of the PA/VE System shall include In-Building Mass Notification functionality as required by code.

D. Fire Alarm (FA) System: Provide the integration with the FA System listed below. Refer to ‘Fire Alarm System’ specification, Section 28 31 00 for additional requirements.

1. The FA System will initiate any general evacuation alarms; it will initiate FA system strobes and signal the PA system to distribute a prerecorded Voice Evacuation message. The PA system shall also mute speakers in areas where the FA will distribute all audible/visual notifications.
2. Any general evacuation alarms will be initiated manually by DPS from the FA System. At this time, there will be no automatic evacuation.
3. The initial operation of the RAC shall be for (manual) general evacuation alarms to be distributed building wide.
4. The PA System shall initiate any Mass Notification alarms; it shall signal the FA System to initiate strobes and distribute a recorded or live voice announcement through the PA System. The PA system shall also mute speakers in areas where the FA will distribute all audible/visual notifications.
5. Mass Notification will be initiated from any PA system microphone in the RAC Building.
6. The PA 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.
7. Provide voltage contact closure output interface for supervisory trouble signal to the Fire Alarm system.

E. Zoned System: The system shall be comprised of operational, voice evacuation, and mass notification zones. The Contractor shall program the PA System to provide paging to the various zones as described in the PA/VE schedule included in the drawings. Contractor shall coordinate VE programming with the FA System. For system coverage, refer to Public Address zones shown on the drawings.

F. Airline Flight Announcements: Provide an interface for importing flight information tables into the Public Address System for use by the existing IED Flight Announcement System to assemble airline boarding message announcements. Contractor shall coordinate specific airline flight information during system implementation.
G. Technology: This system shall utilize the latest in digital audio, video and networking technology. The entire system shall be digital and not utilize combinations of analog and digital circuits. At the first point of connection to the system, microphones and other program sources shall be digitized and remain in the digital domain until the final power amplifiers. Systems that use multiple stages of analog/digital quantization are not acceptable.

1. The system shall be entirely software driven. No analog controls may exist anywhere in the system that could allow unauthorized adjustments or users.
2. Microprocessors shall manage and control all system functions and hardware including microphone communication stations, announcement queuing, distribution of emergency announcements, local announcements, terminal announcements, background music distribution, announcement recording, and messaging.

H. System Architecture: The system shall feature distributed processing, with multiple Announcement Control System (ACS) software controllers. The ACS controller shall provide a network-centric architecture to minimize central head end equipment. This shall eliminate the possibility of complete system failure should catastrophic failure happen in any one room or area. This distributed topology shall also allow for local interface terminations with other systems, rather than the need to route connections to a centralized head-end location. Failed or abnormal performance of any active system component shall generate a fault to the fault reporting system.

I. Ethernet Network: The entire system shall operate on a single Ethernet network. The network shall be designed using a hierarchical star configuration with a Gigabit (minimum) backbone between all core, intermediate, and edge switches. The network shall be designed and installed using recognized industry practice and tested in accordance with ANSI/TIA/EIA 568B-1, 2, and 3.

J. Software: All system software for every system component shall be integrated into a single enterprise-class application utilizing a common database.

1. The entire system shall be programmed, controlled, and monitored by use of a single software application provided by the manufacturer of the system. Systems that require opening different applications provided by differing manufacturers to setup, control, or monitor system operations are not permitted.
2. Set up of announcement control, messaging, signal processing, and amplifier control functions shall utilize graphically oriented objects and a common tree-view for the entire system. When expanded completely, the left portion of the window shall show a tree view of the ACS nodes controlling each area of the facility (i.e. individual concourses, terminals, gates, etc or as applicable). Each expanded view shall include the functional setup parameters for each ACS, microphone communications station, and integrated digital power amplifier system. These include but are not limited to microphone communications station setup, zone & zone group setup, user and user group setup, permanent digital record and playback (PDRP) configuration, audio monitor and testing setup, zone equalization, ambient analysis setup and power amplifier control.

K. Password Security: System access to setup workstations, servers, and remote access shall require an authenticated user name and password. Access to microphone communications stations may require an optional user ID and PIN. Each user ID and PIN shall allow for up to 8 characters. The password server shall allow assignment of users to employer user groups for restricted access to appropriate functions and areas.

L. Announcement Distribution: The system shall provide for distribution of announcements and messages to each zone of the system. A zone is defined as the smallest addressable area of speaker coverage. The system shall prevent a single zone from receiving more than one announcement or message at a time. No announcement or
message shall be lost or discarded due to coordination or priority preemption unless configured as such through the business rules programming. For initial programming configure the systems as follows:

1. Program material sent to zones (i.e. Background Music) shall be ducked during any announcement or message.
2. A local or multi-local zone group announcement shall not delay a terminal announcement from playing, but if the local announcement has begun, the terminal message in that area shall be withheld.
3. Multiple emergency announcements may be made at one time if no zone conflicts for that class of announcement exist. Regardless of zone announcements, emergency announcements shall immediately suspend all other zone activity in the affected zones until the Emergency Responder logs off.

M. Priority Levels: Announcements and messages shall be processed and distributed based on defined levels of priority. A minimum of (256) priority levels shall be available. Initial priority levels shall be assigned as follows:

1. Not Assigned
2. Emergency Live Announcements
3. Emergency Messages
4. Not Assigned
5. Local Announcements and Messages
6. Not Assigned
7. Terminal Announcements and Messages
8. Not Assigned
9. Not Assigned
10. Program Material (Background Music)

N. Signal Routing: The system shall provide for simultaneous routing of the following traffic.

1. Each Announcement Control System (ACS) Instance or LAN segment shall route up to 240 paging stations, and 32 message channels to up 65,536 zone outputs. Routing shall be limited only by the number of CobraNet channels that are dynamically assigned. No announcements shall be routed through the servers unless being stored for delayed playback.
2. The system shall distribute a minimum of eight (8) program background music (BGM) channels assignable to any zone output.
3. The system shall distribute and monitor audio from any monitor point to the requested monitoring speaker station.
4. All routing of signals shall be on the digital audio network via the DFW LAN.
5. All switching shall be quiet with no audible switching transients, clicks or pops.

O. Announcement Properties: Each Announcement shall be configurable with announcement properties. These include:

1. Announcement Gain
2. Priority Level
3. Time to wait in a ready state.
4. Time to Warn for cutoff.
5. Maximum Length
6. Maximum Wait in busy queue
7. Activate with only partial resources.
8. Preempt All
9. Continue with some zones Preempted
10. Preemption Zone Kill
11. Recover Zones as available
12. Ducking
13. Zone Mute
14. **Emergency**

P. **Multi-Local Zone Groups:** The system shall have the ability to program multi-local zone groups for each microphone communications station. These zone groups shall be pre-established groups of relational zones that are commonly accessed from those stations. A single number entry (common to every station for that relationship) shall be used to access those zone groups.

Q. **User Groups:** The system shall provide for editable user group assignments that control user access. User groups are sets of zone assignments within the facility. Zone groups may be selected by user groups based on approved access. User groups shall be available to users at microphone communication stations based on their authenticated membership in a user group and password/PIN.

R. **Logging:** When a dedicated or virtual system server is included in the system topology, and the server has been loaded with Enterprise software, the Logging System portion of the software shall provide complete logging/archival for the following four (4) types of system activity:

1. **User Activity Log:** This feature shall record all log in and out activity by time and date and record event descriptions for each. This includes all changes made to the system setup configuration.
2. **ACS Announcement Log:** This feature shall record all events in the system including all announcements and messages that play. It shall include the user logged in, announcement type, time and date, originating station, destination zone(s) and length.
3. **Communications Station Security Log:** This feature logs the status of communications stations. It shall include the user, user's company (e.g. airline), station name and status.
4. **Fault Logger:** This feature shall log all system faults. It shall include type and location fault, time and date of fault, time and date of restoration, and applicable test data. Faults shall be assignable to fault classifications and configurable for prioritized delivery.

S. **System Capacity:** Each system shall provide for up to 32 ACS nodes. Each ACS node shall provide support for up to 240 microphone communications stations, 480 expansion microphone stations and over 65,000 zones. Any microphone communication station shall be able to be assigned to any combination of zones in the system.

T. **Audio Specifications:** The PA System shall meet the following audio specifications.

1. **Frequency Response:** +/- 0.5 dB 20Hz to 20kHz
2. **Total Harmonic Distortion (THD):** < 0.05% at rated amplifier output of 20Hz to 20kHz
3. **Noise Referenced to Input:** -120 dBu 20Hz to 20kHz
4. **Signal-to-Noise:** >90dB
5. **Maximum Latency from communications:** 11.9 ms station to power amps through (3) network switches

U. **Messaging Servers:** The messaging system (Digital Record and Playback (DRP)) shall be integral to the function of the ACS and be integral to an ACS controller or reside on the network as a message server appliance.

1. **(8) Channels of Recording and (8) Channels of Playback** shall be simultaneously available in each message server. Each channel shall provide a minimum of 130 seconds of recording. Times shall be configurable based on announcement type.
2. When a communications station or workstation initiates an announcement, the system shall dynamically assign a communications channel (CobraNet), and assign it to an open DRP channel. The announcement shall be played if the
microphone switch is released prior to the end of the record time. If the microphone switch is pressed and held during a 5 second (or as programmed) silence period, the announcement shall be cancelled. The announcement will playback automatically, to the selected zone group, in its assigned queue position.

3. Messages shall be stored in non-volatile memory and have a minimum capacity of 20,000 minutes.
4. The system shall support minimum of (8) languages.
5. Types of Messages

a. Standard Messages: These are standard single file (take) messages of following categories. Standard messages shall be capable of being assigned to any zone or zone group and shall be capable of being initiated by any assigned communications station or scheduled for play by the system clock.

1) Emergency announcements and instructions.
2) Public service announcements (no parking, no smoking, etc.)
3) Regulatory (do not leave bags unattended, etc.)
4) Other institutional messages.

b. Assembled Messages: Assembled messages shall allow audio message “takes” or phrases to be “assembled” in real time to create a complete message. Assembled messages shall allow dynamic information provided by the user or a database to be included within the message to provide for specific information or instructions. The user shall have the ability to “build announcements” using stored takes utilizing the built-in editing system. Takes shall be professionally recorded human voices and edited to allow assembly in any random order. Each message shall be up to 30 takes long. The following messages shall be assembled:

1) Flight boarding sequence announcements.
2) Flight arrival, bag claim, and delay announcements.
3) Gate changes or other gate operations.
4) Delayed flight or canceled announcements.
5) Provide message libraries for English, (add others if applicable)
6) Text-to-Speech Messages – Text-to-Speech Messages shall use a high-quality text to speech engine to create audio messages from text. Text-to-Speech messages shall be used only for courtesy announcements where announcements require dynamic messages and real voice takes cannot be anticipated or recorded. Provide message libraries for English, French, Spanish, German, Korean, Japanese and Chinese.

c. Text-to-Speech Messages: Text-to-Speech Messages shall use a high-quality text to speech engine to create audio messages from text. Text-to-Speech messages shall be used only for courtesy announcements where announcements require dynamic messages and real voice takes cannot be anticipated or recorded.

V. 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.

W. System Equalization: The system shall provide 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 nine (9) filters for each zone output.

X. Automatic Backup Amplifier Switching: The system shall include backup amplifier switching in the event of the failure of a power amplifier.
   1. The system shall automatically detect failure or abnormal operation of a power amplifier, and replace it with a spare amplifier without operator initiation.
   2. One spare power amplifier shall be installed in each amplifier mainframe.
   3. The spare amplifiers shall only be powered up when they are transferred into service. The system shall detect a failure, power up the spare amplifier, and complete the transfer for restored operation within two seconds of an amplifier failure.

Y. Monitoring System: Provide complete integrated aural and signal level monitoring of the system at designated monitor points. This capability shall be available for selection at each system workstation for level monitoring and at each monitor speaker location for aural monitoring. Audio routing shall be automatic from any monitor point to any listening point.
   1. Selection shall be instantaneous and not introduce pops or other audio noise.
   2. Provide monitor points for each direct digital input, local analog input, ambient channel output, equalizer output, amplifier input, amplifier output, and speaker zone.
   3. Provide capability to select an announcement or message in progress from the main activity screen and select monitor points for that activity during the announcement or message.
   4. Provide a dynamic multi-channel monitoring screen selectable for each amplifier mainframe. The screens shall include calibrated VU meter bars, channel status, signal preference, and fault status for each of the sixteen (16) channels. The screen shall also indicate status of the backup amplifier channels.

Z. Testing System: The system shall provide for self-diagnostics that operate in real time under software control.
   1. This self-testing shall include testing of any combination of communications stations, direct digital input, local analog input, ambient channel output, equalizer output, amplifier input, amplifier output, and speaker zones.
   2. The system shall be capable of testing to a resolution of 0.5 dB.
   3. Manual or programmed audible frequency self-testing shall be available as well as an inaudible (20 kHz) test designed to exceed the requirements of NFPA Standard 72F.
4. All testing must be capable of operating simultaneously with normal system operations including test setup. Systems that disrupt or play audible test tones to more than a single zone at a time are not acceptable.

5. Each speaker line shall be tested for Ground Fault Interruption (GFI) on both sides of the balanced speaker cabling. This testing shall be available without applying power to the amplifier to verify cabling integrity prior to powering.

6. All test results shall be reported to the fault reporting system.

2.2 MANUFACTURERS

A. Atlas/Soundolier
B. Elkay Industries
C. Lowell Manufacturing
D. Industrial Computer Source
E. Innovative Electronic Designs (IED)
F. Renkus Heinz
G. TOA
H. OWI

2.3 EQUIPMENT, COMPONENTS, ACCESSORIES

A. Type A, 4" Ceiling Speaker: Provide nominal UL listed 4" coaxial loudspeaker.
   1. Sensitivity: 92 dB at 1m with 1W input power.
   2. Frequency Response: 110Hz to 20kHz (+/- 5 dB)
   3. Dispersion: 120 degrees at 2kHz, -6dB
   4. Rated Power: 25 watts
   5. Transformer
      a. Primary Voltage: 70.7V
      b. Primary taps at: 1W, 2W, 4W, 8W
      c. Frequency Response: 60Hz – 12kHz +/- 1dBm
   6. Overall Assembly Diameter: 5"
   7. Enclosure:
      a. Enclosure shall be designed and manufactured specifically for the driver.
      b. Front-loading driver design.
      c. Provide tile bridge, or plaster ring as required for the ceiling conditions.
   8. Grille: Round flush mount. Contractor shall coordinate ceiling finishes with the architectural drawings and coordinate the final finish with the Architect.
      a. Standard white in acoustic tile.
      b. Standard white and/or standard black to match tech strips.
      c. Custom white and/or custom yellow in composite metal panels.

B. Type B, 4" Surface Mounted Speaker: Provide nominal UL listed 4" coaxial loudspeaker.
1. Sensitivity: 92 dB at 1m with 1W input power.
2. Frequency Response: 110Hz to 20kHz (+/- 5 dB)
3. Dispersion: 120 degrees at 2kHz, -6dB
4. Rated Power: 25 watts
5. Transformer
   a. Primary Voltage: 70.7V
   b. Primary taps at: 1W, 2W, 4W, 8W
   c. Frequency Response: 60Hz – 12kHz +/- 1dBm
6. Overall Assembly Diameter: 5”
7. Enclosure: Provide backbox enclosure suitable for surface mounting speaker. Provide all mounting brackets or other hardware required to safely mount the speaker. Contractor shall coordinate ceiling finishes with the architectural drawings and coordinate the final finish with the Architect.
   a. Standard white and/or standard black.

C. Type C, Outdoor Speaker: Provide weather resistant speaker UL listed for outdoor use.
   1. Sensitivity: 90 dB Average at 1m with 1W input power.
   2. Frequency Response: 85Hz to 20kHz (+/- 5 dB)
   3. Dispersion: 90 degrees x 90 degrees at 2kHz, -6dB
   4. Rated Power: 100 Watts RMS
   5. Transformer: 70.7V with taps at: 0.94W, 1.9W, 3.7W, 7.5W, 15W, 30W
   6. Overall Assembly Diameter: Nominal 10” x 7” x 6”
   7. Enclosure: Provide backbox enclosure with multi-position mounting bracket suitable for surface mounting speaker. Speaker shall be field adjusted on single axis mounting bracket for optimal sound coverage. Contractor shall coordinate final finish with the Architect. Provide all mounting brackets or other hardware required to safely mount the speaker.
   a. Standard white

D. Type D, Outdoor Back of House Speaker: Provide weather resistant speaker UL listed for outdoor use.
   1. Sensitivity: 90 dB Average at 1m with 1W input power.
   2. Frequency Response: 85Hz to 20kHz (+/- 5 dB)
   3. Dispersion: 90 degrees x 90 degrees at 2kHz, -6dB
   4. Rated Power: 100 Watts RMS
   5. Transformer: 70.7V with taps at: 0.94W, 1.9W, 3.7W, 7.5W, 15W, 30W
   6. Overall Assembly Diameter: Nominal 10” x 7” x 6”
   7. Enclosure: Provide backbox enclosure with multi-position mounting bracket suitable for surface mounting speaker. Speaker shall be field adjusted on single axis mounting bracket for optimal sound coverage. Contractor shall coordinate final finish with the Architect. Provide all mounting brackets or other hardware required to safely mount the speaker.
   a. Standard white

E. Type E, Wall Mounted Speaker: Provide nominal UL listed 8” coaxial loudspeaker.
   1. Sensitivity: 92 dB Average at 1m with 1W input power.
   2. Frequency Response: 85Hz to 20kHz (+/- 5 dB)
   3. Dispersion: 110 degrees at 2kHz, -6dB
   4. Rated Power: 25 Watts RMS
   5. Transformer: 70.7V with taps at: 0.25W, 0.5W, 1W, 2W, 4W
   6. Overall Assembly Diameter: Nominal 11” x 11” x 5”
7. Enclosure: Provide backbox enclosure suitable for surface mounting speaker. Provide all mounting brackets or other hardware required to safely mount the speaker. Contractor shall coordinate final finish with the Architect.

   a. Standard white and/or standard black.

F. Type F, Flush Wall Mounted Speaker: Provide nominal UL listed 4” coaxial loudspeaker.

   1. Sensitivity: 92 dB at 1m with 1W input power.
   2. Frequency Response: 110Hz to 20kHz (+/- 5 dB)
   3. Dispersion: 120 degrees at 2kHz, -6dB
   4. Rated Power: 25 watts
   5. Transformer

      a. Primary Voltage: 70.7V
      b. Primary taps at: 1W, 2W, 4W, 8W
      c. Frequency Response: 60Hz – 12kHz +/- 1dBm

6. Overall Assembly Diameter: 5”

7. Enclosure:

   a. Enclosure shall be designed and manufactured specifically for the driver.
   b. Rear-loading driver design.
   c. Provide backbox suitable for rear installation and mounting to vertically oriented surface.
   d. Grille: Round flush mount with custom white finish to match adjacent wall panels. Contractor shall coordinate final finish with the Architect.

G. Type G, Outdoor Speaker: Provide weather resistant speaker UL listed for outdoor use.

   1. Sensitivity: 88 dB Average at 1m with 1W input power.
   2. Frequency Response: 115Hz to 16kHz (+/- 5 dB)
   3. Dispersion: 90 degrees x 90 degrees at 2kHz, -6dB
   4. Rated Power: 30 Watts RMS
   5. Transformer: 70.7V with taps at: 2W, 4W, 8W, 16W
   6. Overall Assembly Diameter: Nominal 7” x 5” x 6”
   7. Enclosure: Provide backbox enclosure with multi-position mounting bracket suitable for surface mounting speaker. Speaker shall be field adjusted on single axis mounting bracket for optimal sound coverage. Contractor shall coordinate final finish with the Architect. Provide all mounting brackets or other hardware required to safely mount the speaker.

      a. Standard white

H. Announcement Control System (ACS): IED 1200ACS. The ACS shall be a network-based announcement controller designed to manage, distribute, and monitor audio to all digital PA system components including, but not limited to microphone paging stations, digital amplifiers, end of line filter modules, ambient analysis sensors, I/O collectors.

1. Announcement Control System: IED 1200ACS. Each announcement control system controller shall be designed and distributed to allow continued announcement and standard message operation in the event of failure of the system server, or communication to other ACS nodes. The announcement controller shall manage all primary operations of the ACS including paging communication stations, audio routing, message management, and Ethernet communications. It shall include an on-board hard drive as well as flash memory for fail safe emergency message playback.
2. The ACS shall provide an interface to the Fire Alarm system via input and output voltage signals. Upon failure of the primary ACS, the voltage signal interface shall automatically switch over to the failover location.

3. Provide each ACS with a license for 128 zones. Refer to the drawings for equipment provided in this project.

4. Provide each ACS with the ability to failover to the indicated location utilizing the IED LifeLine ACS software.

5. Each ACS shall be capable of providing eight playback and eight recording operations simultaneously. Live announcements shall be in addition to the quantity of playback and recording channels, and the quantity shall be limited only by the network.

6. Each ACS shall store and manage pre-recorded messages in English and Spanish.

7. The ACS shall be capable of managing up to 240 digital microphone stations. Refer to the drawings for equipment provided in this project.

8. Power Supply: IED 1112PS. Each unit shall power up to eight devices and have two 1112PSM power supply modules to provide redundancy. Power supply modules shall be hot swappable.

I. Software: IED Enterprise Software. Software programming or upgrade shall be provided for any adjustments to the system that require software modifications. Software affected shall include changes that impact the Enterprise Software, Courtesy Announcement System (TCAS), and Flight Announcement System (FAS).

J. Integrated Digital Power Amplifier System (IDPAS): IED T9160. Integrated power amplifier mainframes shall house, supply power to, and cool up to (8) eight amplifier cards and (1) backup amplifier cards for a total of (9) nine cards. The mainframe shall provide digital audio connections to the amplifier cards from the Announcement Control System (ACS) utilizing CobraNet type network audio.

1. Digital Audio Network Interface: The network interface shall receive (32) dynamic assigned audio channels from the ACS via the Ethernet Network. Control for the IDPAS and monitoring shall be included on the network. Dual Network connections shall be provided to support redundant networks.

2. Zone Manager: The IDPAS shall provide zone management for (16) channels as directed by the ACS. Channel management shall be structured to utilize the minimum channels necessary to support paging, messaging and background music activity for any combination of zones.

3. DSP Processing: The IDPAS shall include digital signal processing for (16) channels of audio. Each channel shall include (9) bands of parametric equalization, time delay, ambient analysis control, (7) monitoring points, and (7) testing points. Complete setup and control software shall be integrated within the Enterprise Software and available on the network for configuring, controlling, monitoring, and testing the DSP for each channel.

4. Ambient Analysis and Control: The Ambient Analysis System shall adjust signal levels in response to either ambient noise levels or computer commands. The system shall operate in real time and shall not be a "sample and hold" system. The system shall include an automatic calibration sequence. All setup, configuration, and monitoring controls shall be software based with the ability for multiple sensors averaged to control a single channel(s) or for a single sensor to control multiple channels. The sensors shall utilize control signaling and levels that allow co-locating with the speaker cable for cable routing efficiency. Three modes of operation shall be possible:

   a. Automatic: Changes attenuation levels in response to noise levels reported by remote sensors.
   b. Slaved: Changes attenuation levels based on remote sensors of an automatic channel.
   c. Fixed: Fixed attenuation as set by the computer and user.
5. Power Amplifier Cards: Each IDPAS mainframe shall be designed to accept (9) amplifier cards. Each card shall be removable and replaceable without disabling or interfering with the operation of the DSP or other power amplifier cards (hot swappable). The amplifier cards shall be available as dual 200-watt cards or single 400-watt cards, and shall be of a high efficiency design to maintain a minimum of 78% efficiency at 100% output. The mainframe shall support simultaneous use of (8) amplifier cards plus the hot spare card.

6. Automatic Backup Amplifier Switching: The ninth power amplifier slot shall be reserved for automatic backup amplifier switching. A matching amplifier card shall be installed as a hot spare amplifier in the event of failure of one of the primary amplifiers. The system shall detect a failure of an amplifier card and shall electronically replace that amplifier without loss of service. Switching shall result in no loss or change of source or destination routing. Detection and switching shall take place in less than two seconds. A failure shall be reported immediately to the fault logging system.

7. Internal Monitoring: Each IDPAS shall include an internal audio monitoring buss with software selected switching. This monitor shall allow selection of a monitor point from the control software to allow visual and audio monitoring of the channel network input, channel direct input, ambient channel output, EQ output, amplifier input, amplifier output, and speaker load monitor for each of the (16) channels. This feature shall operate simultaneously and independent of the automatic testing.

8. Automatic Testing: The automatic testing system shall locally test and process audio test signals through the IDPAS. These tests may be done manually on demand for any single test point as well as globally in the mainframe on a completely automated basis. The test points duplicate those of the monitoring points listed in the Internal Monitoring paragraph, with a testing resolution of 0.5 dB.

9. Local Inputs: The IDPAS shall include (16) analog inputs for local zone program sources or BGM. One channel shall be configurable as a backup emergency input usable in the event of a network failure.

10. Input Power: 120VAC (T9160L) utilizing (2) Belden/Volex 17250
    a. No power to amplifiers, quiescent: 83W
    b. (8) eight powered amplifiers, quiescent: 403W
    c. (8) eight powered amplifiers, speech/voice announcement input: 1000W

11. Audio Distribution: CobraNet based network audio
12. Maximum Number of Cards: Shall support up to (9) digital amplifier cards
13. Maximum Number of Paging Zones Assignable to Frame: 16 Zones
14. Maximum Number of Amplifier/Loudspeaker Outputs: 16 total zones, plug-in lugless compression-screw terminal blocks (2 outputs in 8 blocks)
15. Maximum Number of Local Program/BGM Inputs: 16 lugless compression-type screw terminal inputs
16. Rack Units: 6 RUs, 10.5" 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 122 degrees F

K. Digital Amplifier Cards: Provide amplifier cards as required based on the IED Models listed below. Class D switching mode amplifier used in the Digital Amplifier Mainframe.

1. Models:
   a. Dual 200W, 70V: IED Model T6472
2. Power: On/Off switch with power from the mainframe
3. Status Indication: Visual Indicator for power/output for the card and each channel
4. Operating Temperature Range: +32 degrees F to 122 degrees F
5. Efficiency:
   a. Dual 200W: 78% for 200W, 72% for 100W
   b. Single 400W: 78% for 400W, 72% for 200W

6. Clipping Level: 100 V peak
7. Frequency Response:
   a. Dual 200W: PO = 50W, 20Hz to 20 kHz, +/- 1dB
   b. Single 400W: PO = 100W, 20Hz to 20 kHz, +/- 1dB

8. Signal to Noise Ratio: 20Hz to 20 kHz, >85 dB
9. Total Harmonic Distortion:
   a. Dual 200W: PO = 200W, < 0.2% at 2kHz
   b. Single 400W: PO = 400W, < 0.2% at 2kHz

10. Overcurrent Protection: fused 5A, 2AG

L. Background Music Hub: IED T0516BGM. Interface to collect and condition audio from remote music sources. Remote units shall be capable of transporting balanced audio over copper category cabling up to 5,000 feet.

M. Ambient Noise Sensor Collector: IED T9032NS. The ambient analysis sensor collector shall accept inputs from the ambient analysis sensors, process their data, and transmit the data to the appropriate amplifier system.
   1. Connection to the system shall be via a 100BaseT Ethernet port.
   2. The collector shall be rack mounted in 1 RU and accept inputs from up to 32 ambient noise sensors.
   3. The collector shall be powered through a PoE Ethernet port.

N. 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

O. End of Line Filter Module: IED Model 596EOL. Provide module to monitor the integrity of a single continuous series-wired speaker circuit.

P. Microphone Paging Stations: IED Model 528. Provide digital, network based microphone paging station to initiate an audio message via the system. The station shall have a unique IP address coordinated with DFW ITS, and color graphical LCD screen. Microphone paging stations shall have a 12-button keypad for data entry and (8) soft function keys. The station shall be a network appliance with control and CobraNet audio communicating on the audio network. Connection to the system shall be 100BaseT with power provided by a PoE switch port. Each microphone shall utilize a magnetic mount and include a line amplifier in the microphone shell to eliminate microphone signal levels beyond the microphones. Each station shall support the connection of up to three remote expansion station (e.g. sidekick remote microphone station).
   1. Provide each Type based on the following mounting/models:
a. Type A, Desktop Station (Horizontal): IED Model 528HDT (Horizontal Desktop Microphone Station)
b. Type B, Counter Station (Vertical): IED Model 528VDT (Vertical Desktop Microphone Station)
c. Type C, Wall-Mounted Station (Vertical): IED Model 528VFM (Vertical Flush Mount Microphone Station)
d. Type D, Wall-Mounted Slave Station (Vertical): IED Model 528SK (Sidekick Remote Microphone Station)

2. Frequency Response: 22Hz to 22 kHz, Input Level = -20dBu, +0, -1.0dB
3. Total Harmonic Distortion: 22Hz to 22 kHz, Input Level = -20dBu, < 0.1% at 2kHz
4. Signal to Noise Ratio: 22Hz to 22 kHz, Input Level = -20dBu, >85 dB
5. Compressor:
   a. Compression Threshold: -15 dBu
   b. Ratio: 6:1
   c. Attack Time: 10 dB Step, 5 ms
   d. Release Time (40dB): 15 s
   e. Release Time (10dB): 3 s
6. Maximum Input: +6 dBu
7. Maximum Output: +7 dBu
8. Gain: 23 dB
9. Sample Rate: 48 kHz
10. Latency (two network hops): 5.7 ms
11. Connectivity: CAT5e of better for digital audio, power, and control
12. Operating Temperature Range: +32 degrees F to 104 degrees F
13. Standards Compliance: Full Duplex IEEE 802.3x, Fast Ethernet (100 Mbps) IEEE 802.3u, Data Terminal Equipment Power (POE) IEEE 802.3af
14. Input Power: Power Over Ethernet, 48VDC, <10W

Q. Rack Communications Station: IED 528RM2-H. Rack communications station shall have a 12-button keypad for data entry, (8) soft function keys, and a color graphical LCD. The stations shall be a network appliance with control and CobraNet audio communicating on the audio network. Connection to the system shall be 100BaseT with power provided by a PoE switch. Microphones shall be handheld and utilize a magnetic mount. It shall include a line amplifier in the microphone shell to eliminate microphone signal levels beyond the microphones. The station shall include a flush speaker for monitoring selected audio. The speaker shall be powered by an 8-watt power amplifier and include a panel volume control. The station shall be use no more than four standard rack units.

R. Speaker Cable: UL listed Article 725 (UL 444 for plenum applications) – minimum 12-gauge, tinned copper, PVC insulated, with PVC jacket. See one-line diagram for gauge.

S. 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.

T. UTP Cable: Refer to Section 27.15.00.

U. Homerun Conduits: Speaker circuit home run conduits from the zone tie box in the Communications Room 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 82dBA in bag make-up and mechanical spaces, and an ambient sound level of 62dBA 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 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 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 nodes and from microphone stations to PA 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. Digital Message Assembly: Standard or repetitive messages shall be studio-recorded voices capable of being assembled and distributed by the system. Assembled messages shall form complete phrases capable of distribution without real time operator input. The Public Address system shall be capable of recording, storing and playback of permanent
messages. Message “takes” shall be stored in non-volatile memory. Two types of permanent messages shall be provided; standard and assembled.

1. Standard messages shall include:
   a. Emergency evacuation announcements and instructions.
   b. Public service announcements.
   c. Regulatory announcements.
   d. Other institutional messages required by the DFW Board.

2. Standard messages shall be assignable to any zone or zones and may be initiated by any assigned paging station or scheduled for play by a system clock. The system clock shall be synchronized to the DFW Master Clock system.

3. Assembled messages allow words or phrases to be assembled in real time to create a complete message. Assembled messages shall provide dynamic information by the User or database to be included within the message to give specific information or instructions. Assembled messages shall include:
   a. Flight boarding announcements.
   b. Flight arrival and bag claim announcements.
   c. Gate change announcements.
   d. Delayed flight or cancelled flight announcements.

4. Digital Audio Library: A digital audio English and Spanish-based library shall be supplied with the system. Total message capacity shall be a minimum of 65,000 seconds. The digital message files shall be supplied and arranged in data tables as follows:
   a. Bag Claim look-up table: Shall contain CD quality minimum fixed and variable digitized message files prepared by a professional announcer (Fixed message files may be stand-alone, non-assembled messages such as security messages and parking warnings).
   b. Gate Room look-up table: Shall contain CD quality minimum fixed and variable digitized message files prepared by a professional announcer.

I. Microphone Paging: Coordinate and provide all microphone paging programming required by the DFW Board. A User ID input shall be required to activate a microphone station for live or recorded announcements. A User configurable time for keypad inactivity shall disable a microphone station. Announcements may be distributed live if the destination areas are not in use or, the page may be recorded and played back in queue when the destination areas are available. The microphone’s display will indicate busy when input resources are not available. Flight information for assembled messages shall be entered manually by paging party. A User ID shall be created for Emergency Responders that will allow authorized users to make announcements during emergency events from any microphone station. While a microphone station is activated by an Emergency Responder, other microphone stations shall be locked and have a visible indication as required by the Emergency Response Plan. Microphone stations shall be capable of paging to a zone, zone group and three (3) local page configurations as listed below. Live announcements shall be made only to the zone containing the microphone. Refer to the paging schedule on the drawings for additional information.

1. Local: Microphone shall page the local zone
2. Local Tie: Microphone shall page the local zone, and adjacent zone.
3. Extended Tie: Microphone shall page the local zone and adjacent concourse zone.

J. Remote System Control: Provide system controls to allow remote configuration and independent adjustment of signal processing of each system component (e.g., ambient noise compensation, equalization, gain management, etc.) from system workstations.
K. 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.

L. 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.

M. Monitor Test System Operation: The public address system shall provide for self-diagnostics that operate in real time under software control. This self-testing shall include testing of audio operation, power supplies, digital amplifiers, speaker circuits and network communications.

N. Software: All software which the operators interact with shall be User friendly, menu or graphical User interface driven and have the characteristics of an application program. All operating features specified here shall be available without requiring knowledge of the underlying programming language. All features shall be available by answering prompts and responding to menus. All menus shall be subdivided into logical groups. All operator input shall be checked to insure that no input error can render the system, or a portion thereof, inoperable.

O. Security: All software shall provide multiple levels of password protection. Initially three (3) levels of security will be established and specific rights to program areas shall be assigned by User:

1. Level 1: Shall allow User to configure the system, define graphical user screens, set system parameters and defaults, map alarm communications and features listed for Levels 2 and 3.
2. Level 2: Shall allow User to modify system parameters, enable modem, acknowledge alarms, and features listed in Level 3.
3. Level 3: Shall allow User to operate the system, view system settings and print current system configuration.

P. 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 01 00.

3.3 INSTALLATION AND APPLICATION

A. Refer to Section 27 01 00.

B. 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 01 00 3.5.A 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 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 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 speaker circuits 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.

C. Interface with Other Work: Refer to “System Description” in Part 2 for interface requirements.

D. Systems Integration: Refer to “System Description” in Part 2 for integration requirements.

E. Sequencing

1. Work shall be sequenced with general construction, structured cabling, and LAN schedules.

3.4 FIELD QUALITY CONTROL

A. Refer to Section 27 01 00.

B. Phases of Testing: Provide the phased testing in the sequence listed below.

1. Factory Acceptance Testing: Refer to testing requirements below.
2. Integration Testing: Refer to testing requirements below.
3. Final Test and Completion (FTC): Refer to testing requirements below.

C. Factory Acceptance Testing: Refer to Section 27 01 00.

D. Integration Testing: Refer to Section 27 01 00.

1. Flight Information. Demonstrate the process for importing flight information into the system and methods for using Flight Announcement System to assemble airline boarding message announcements.

2. Fire Alarm System. Demonstrate the Fire Alarm System receipt of supervisory signals from the PA System. In addition, demonstrate that the PA 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.

E. Final Test and Completion (FTC)

1. Testing and completion shall comply with NFPA 72, 2010 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.
8. Final Test and Completion shall be performed to demonstrate the system operates as specified.

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 01 00.
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.

G. Spare Parts: The Contractor shall furnish spare parts for the system. The intent of the spare parts is to allow the immediate replacement of failed or faulty components to the lowest level of field repair to maintain system operating integrity. Any spare parts used prior to Final Completion shall be furnished in addition to the spare parts required here. Furnish the following spare parts:

1. Paging Station Microphone and Flexible Cord: Minimum of 20% of each installed type.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

B. Video Surveillance Systems.
C. Grounding and Bonding.
D. Cable Pathways.
E. Cable Management.

1.2 RELATED WORK SPECIFIED UNDER OTHER DIVISIONS

A. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting.
B. Flashing of conduits into roofing and outside walls.
C. Heating, ventilating and air conditioning equipment.
D. Electrical service to equipment rooms.

1.3 RELATED WORK SPECIFIED UNDER THIS DIVISIONS

A. Pads required for equipment.
B. Cutting and patching for low voltage systems work, except for errors and omissions.

1.4 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 1. 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, and provide a list, of all types of quality control mechanisms they employ.

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:

   a. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
   c. ANSI/TIA/EIA Standards

      2) ANSI-J-STD-607-A – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002

D. 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.

b. Underwriters Laboratories, Inc. (UL): UL 1479 – Tests of Through-Penetration Firestop Systems
c. Americans with Disabilities Accessibility Guidelines
d. Code of Federal Regulations, Title 29, Chapter XVII, Part 1910 (OSHA)
e. Uniform Building Code (UBC)
f. International Building Code (IBC)
g. Texas Department of State Health Services (TDSHS)
h. Texas Department of Public Safety (TxDPS)
i. DFW Airport Design Criteria Manual

E. 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 Electronic safety and Security.

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, program, terminate or test communications cables and equipment 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 installation start date, completion of station cabling, completion of testing and labeling, cutover, completion of the final punch list, start of demolition, demolition completion and Owner acceptance.

1.9 SUBMITTALS

A. Comply with provisions of Division 01.

B. Provide all submittal requirements under this section as a single package.

1.10 ALTERNATES, SUBSTITUTIONS AND CHANGE ORDERS

A. If a proposed alternate material is equal to or exceeds specified requirements, the 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. 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 for 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 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.

1.12 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. 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 storage, handling or the course of construction.

1.13 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 systems (electronic file format and hard copy).
3. As-built door and device schedules.
4. As-built camera schedules.
5. As built documentation of all systems installed under this project.
6. As built documentation of TR modifications and associated cabinet and wall elevations.
B. Warranty and Maintenance:

1. Test Report binder(s)
2. Record Drawings

1.14 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 or 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. In some instances, where noted, salvaged equipment shall be used if 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 trades of any deviations or special conditions necessary for the installation of work. Interferences between work of various Contractors shall 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 the 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.

F. Coordinate with other trades to provide wall and ceiling access panels wherever required for access to communication and security equipment.

G. Intent:

1. These sections of specifications and drawings form a complete set of documents for the security 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 brackets, etc. provide same without additional cost to Owner.

3. Communication Equipment Room layouts indicted 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.

H. 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.

I. 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. The 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 the Owner.

3.4 PLYWOOD BACKBOARD AND WALL BACKING

A. General Contractor is to provide appropriate backing in walls as required for mounting brackets and other wall mounted equipment per manufacturer requirements.

3.5 FIRESTOPPING

A. Select appropriate type or types of through penetration firestop devices or systems appropriate for each type of communications/system 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 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 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 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. Turn in test results
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 component 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 INSPECTION FEES AND PERMITS

A. Obtain and pay for all necessary permits and inspection fees required for the security systems installation. 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 the 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 the 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
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 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 in the Technology Center, Communications Room, and adjacent Storage Space 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.
1.3 REFERENCES

A. All work shall be installed in accordance with all applicable codes and referenced design standards:

1. 2009 International Building Code with local amendments
2. 2009 International Fire Code with local amendments
3. 2009 International Mechanical Code with local amendments
4. 2010 NFPA 72, National Fire Alarm and Signaling Code
5. 2008 NFPA 70, National Electrical Code
6. 2010 NFPA 13, Sprinkler Systems
7. ADA - Americans with Disabilities Act

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 be 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.

1.8 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. Provide modifications to the addressable fire alarm control system in the Consolidated Rental Car (RAC) Facility.

B. Products for this project shall be of the latest design. Obsolete or discontinued models are not acceptable.

C. 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 XLS control panel will remain. Provide additional modular components as necessary to satisfy system capacity requirements and to accomplish all system functions.

B. Auxiliary Power Supplies

1. Provide each auxiliary power supply (APS) unit in an individual, single, self-contained, lockable cabinet. Input shall be 120 volt AC nominal with an output of regulated 24 volt DC. 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. Low Voltage Transient Voltage Surge Suppression Modules (TSM)

1. Provide transient voltage surge suppression modules consisting of silicon avalanche suppressor diode (SASD) technology. Modules shall be designed, manufactured and installed in accordance with UL 497B, the National Electrical Code, and the manufacturer's instructions.

2. Performance specifications shall include a Response Time of less than five (5) nanoseconds.
B. 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.

C. 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.

D. 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.

E. 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.

F. 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.

G. Conventional Heat Detectors

1. Provide conventional type heat detectors with the ability to be monitored by the control panel.
2. Provide conventional fixed temperature and rate-of-rise heat detectors. The fixed temperature rating shall be one hundred thirty-five (135) or one hundred ninety (190) degrees Fahrenheit. The rate-of-rise temperature detection shall be fifteen (15) degrees Fahrenheit per minute.
3. Provide a low profile design with a removable twist-lock base and screw mounting terminals.
4. The detector shall be designed with an external drop away heat collector for visual confirmation of activation.
5. 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.

H. 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.

I. 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.

J. 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 sealing 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.
K. 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.

L. 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.

M. 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.

N. 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.

O. 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/reflect 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.

P. 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.

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. Using existing raceway is unacceptable without prior written permission of the Engineer or Owner's Representative.

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 $\frac{1}{2}$ 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