



**CONTRACT NO. 9500684**

**AOA Gate Replacement**





**TECHNICAL SPECIFICATIONS**

**Issued For Bid**

**September 12, 2019**

**Permit #A19-030B**

SECTION 00 01 07  
SEALS PAGE

<u>Discipline / Engineer of Record</u>	<u>Stamp</u>	<u>Signature</u>
<p>Civil Specifications</p> <p>David Akers TX PE #64899 WSP USA TBPE Firm No. 2262</p>		 07/31/2019
<p>Electrical Specifications</p> <p>Martin Torres TX PE # 97916 Campos Engineering, Inc. TBPE Firm No. F-001731</p>		 07/25/2019

END OF SECTION

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

Any Section marked as "Applicable" below is hereby incorporated into the Project Manual by reference. Any Section revised or a new Section to be added to supersede the above published document are as indicated and dated below and are hereby included in the Project Manual.

Any Section included in the published book that are not included in the table below are not included in the Project Manual. Dallas-Fort Worth International Airport

Section	Description	Applicable	Revised	Added
<b>DIVISION 00</b>	<b>PROCUREMENT AND CONTRACTING REQUIREMENTS</b>			
00 01 01	Project Title Page	✓	07/31/19	
00 01 07	Seals Page	✓	07/25/19	
00 01 10	Table of Contents	✓	09/12/19	
<b>DIVISION 01</b>	<b>GENERAL REQUIREMENTS</b>			
01 10 01	Abbreviations, Acronyms and Definitions	✓		
01 10 02	Reference Standards	✓		
01 11 00	Summary of Work	✓	07/31/19	
01 18 16	Protection of Existing Underground Utilities and Cables	✓		
01 18 16.13	Utility Location Sign-Off Sheet	✓		
01 18 16.14	Underground Utilities Damage Report	✓		
01 21 00	Standby Time Allowance	✓		
01 21 00.01	Standby Time Work Report	✓		
01 25 13	Product Substitution Procedures	✓		
01 25 13.01	Product Substitution Form	✓		
01 26 13	Request for Information	✓		
01 29 00	Payment Procedures	✓		
01 29 73	Schedule of Values	✓		
01 29 85	Wage Rate Requirements	✓	07/30/19	
01 29 85.01	Request for Authorization of Additional Classification and Rate	✓		
01 30 00	Allowances	✓	09/12/19	
01 31 19	Project Meetings	✓		
01 32 16	Schedules	✓		
01 33 23	Shop Drawings, Product Data, and Samples	✓		
01 33 29.06.01	Contaminated Media Management Plan	✓		
01 35 13.13	Minimum Standards for Construction and Maintenance on the AOA	✓		
01 35 13.13.01	Minimum Standards for Construction and Maintenance on the AOA — Forms and Instructions	✓		
01 35 23	Hot Work Operations and Control	✓		
01 35 24	Asbestos Operations and Control	✓		
01 41 26.10	Construction Air Permitting	✓		
01 41 26.13	Concrete Batch Plant and Hot Mix Asphalt Plant Permitting			
01 45 16.13	Contractor Quality Control	✓		
01 45 20	Non-Conformance Report	✓		
01 45 29	Owners Testing Laboratory	✓		
01 50 00	Temporary Facilities and Controls	✓		
01 50 00.01	Temporary Facilities and Controls — Water Request Form	✓		

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<b>Section</b>	<b>Description</b>	<b>Applicable</b>	<b>Revised</b>	<b>Added</b>
01 50 13	Owner's Field Office	✓		
01 52 00.01	Construction Signage	✓		
01 52 13	Dust Control	✓		
01 52 16	Haul Road	✓		
01 55 20	Contractor Use of the Parking Revenue Area	✓		
01 55 20.01	Contractor Use of the Parking Revenue Area — Instructions and Forms	✓		
01 55 29	Staging Areas	✓		
01 57 13	Temporary Erosion and Sediment Control	✓		
01 57 19	Spill Prevention Control and Countermeasure	✓		
01 57 19.13	Spill Response	✓		
01 57 19.13.01	Spill Response Plan Form	✓		
01 66 00	Product Storage and Handling Requirements	✓		
01 71 13	Mobilization	✓		
01 71 14	Land Use Requirements	✓		
01 71 14.01	Land Use Requirements — Application Procedures	✓		
01 73 29	Cutting And Patching	✓		
01 74 13	Progress Cleaning	✓		
01 74 18	Concrete Waste	✓		
01 74 19	Construction Waste	✓		
01 74 23	Final Cleaning	✓		
01 76 00	Protecting Installed Construction	✓		
01 76 50	Punch List	✓		
01 77 00	Closeout Procedures	✓		
01 77 00.01	Closeout Procedures — System Acceptance	✓		
01 78 23	Operation and Maintenance Data	✓		
01 78 33.36	Bonds and Warranties	✓		
01 78 39	Project Record Documents	✓		
01 78 46	Extra Stock Materials	✓		
01 79 00	Demonstration and Training	✓		
01 81 13	Sustainable Design Requirements	✓		
01 91 00	Commissioning	✓		
<b>DIVISION 03</b>				
32 92 19	Seeding and Sodding	✓		

**SPECIAL SPECIFICATIONS**

<b>Section</b>	<b>Description</b>	<b>Applicable</b>	<b>Revised</b>	<b>Added</b>
01 35 35.14	Security Usage	✓	06/13/19	✓
26 05 05	Selective Demolition for Electrical	✓	06/13/19	✓
26 05 19	Low-Voltage Electrical Power Conductors and Cables	✓	06/13/19	✓
26 05 26	Grounding and Bonding for Electrical Systems	✓	06/13/19	✓
26 05 29	Hangars and Supports for Electrical Systems	✓	06/13/19	✓
26 05 33.13	Conduit for Electrical Systems	✓	06/13/19	✓
26 05 33.16	Boxes for Electrical Systems	✓	06/13/19	✓
26 05 53	Identification for Electrical Systems	✓	06/13/19	✓
26 24 16	Panel Boards	✓	06/13/19	✓
26 28 13	Fuses	✓	06/13/19	✓
26 28 16.16	Enclosed Switches	✓	06/13/19	✓
27 01 00	General Telecommunications Systems Requirements	✓	06/13/19	✓

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27 05 26	Grounding and Bonding for Communications	✓	06/13/19	✓
33 71 19	Electrical Underground Ducts, Ductbanks, and Manholes	✓	06/13/19	✓
SS-1	V-Track Sliding Gates	✓	06/13/19	✓
SS-2	Linear Crash Gate System	✓	06/13/19	✓
SS-3	Crash Barrier Arm	✓	07/31/19	✓
F-162	Chain-Link Fences	✓	06/13/19	✓
F-164	Slide Gate Operators	✓	07/31/19	✓

**APPLICABLE 2014 TXDOT STANDARD SPECIFICATIONS<sup>1</sup>**

<b>Section</b>	<b>Description</b>	<b>Applicable</b>	<b>Revised</b>	<b>Added</b>
TxDOT 104	Removing Concrete	✓		
TxDOT 105	Removing Treated and Untreated Base and Asphalt Pavement	✓		
TxDOT 310	Prime Coat	✓		
TxDOT 360	Concrete Pavement	✓		
TxDOT 400	Excavation and Backfill for Structures	✓		
TxDOT 421	Hydraulic Cement Concrete	✓		
TxDOT 427	Surface Finishes for Concrete	✓		
TxDOT 440	Reinforcement for Concrete	✓		
TxDOT 496	Removing Structures	✓		06/13/19
TxDOT 529	Concrete Curb, Gutter and Combined Curb and Gutter	✓		

<sup>1</sup>Texas Department of Transportation's Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Adopted November 2014.

**END OF SECTION**

SECTION 01 11 00  
SUMMARY OF WORK

**PART 1 — GENERAL**

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of this Contract comprises AOAGate and Operator Replacement. The opening and closing mechanisms on twenty-two (22) AOA gates shall be replaced with a new mechanism. The old mechanisms are obsolete, have ongoing issues which require frequent maintenance, and can cause security risks around the perimeter of the AOA. These gates are located at:
- Terminal C South Gates 444 & 445
  - Terminal C North Gate 238
  - Terminal D North Gate 155
  - Terminal D South Gates 311, 312, 313
  - ~~S.E. Perimeter Taxiway Gate 412~~ N.I.C.
  - DPS Station Gate 446
  - DPS Station 6 Gate 431
  - DPS Station 3 Gate 236
  - NE DPS Gate 111
  - ~~Cargo Road West Gates 148, 149~~ N.I.C.
  - DPS Station 2 Gate 163
  - AA Hanger Gate 143
  - DPS Station 4 Gate 349
  - Fire Training Gate 348
  - SW Freight Gates 300, 301
  - SW AOA Mail Gate 327, 328
- B. Gates 312, 149, and 328 will be permanently removed and replaced with AOA fencing.
- C. All new gates will use a sliding configuration with the bottom centered along an above ground “v-track”. When in motion, the gate is supported at a minimum of three points; the top and bottom gate tube with the fence end post, and the bottom guide wheels with the v-track connected to the pavement.
- D. New pavement will also be placed along the gate entrance width, centered along the v-track and 5 ft to either side. This pavement is being replaced in order to support the continued loading of these heavily trafficked areas.
- E. Crash barriers shall be installed or replaced at 18 of these gates. The crash barriers at B-North Gates 160,161 are being replaced.

Construction will be inside the Airport's Air Operations Area (AOA). The Contractor shall be responsible for reviewing all existing conditions associated with the Work prior to commencement of work activities.

## 1.2 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. [240] consecutive Calendar Days for Substantial Completion, from the date set forth in the Notice to Proceed (NTP).
  - 2. 60 consecutive Calendar Days for Final Completion, from the date set forth for Substantial Completion.
  - 3. Total Contract Time = [300] 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.
  - 1. 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.

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. Airfield Blackout Dates:
    - 1) No airfield closures or lighting circuit lockouts should be scheduled beginning at 2200 hours on Friday night, November 22, 2019, until 2200 hours on Monday night, December 2, 2019.
    - 2) No airfield closures or lighting circuit lockouts should be scheduled beginning at 2200 hours on Friday night, December 20, 2019, until 2200 hours on Monday night January 6, 2020.
  - b. Landside Blackout Dates  

The following 2019-2020 dates have been established as construction blackout dates in the landside and customer service areas. During the noted landside Holiday blackout dates any work that impacts ramp level operations, roadways, guests inside the terminals and non-emergency utility outage requests, will normally not be approved. Work and utility outages that do not impact stakeholder operations or have limited impact will be evaluated on a case by case basis during the blackout periods. The dates listed are the primary dates and others may follow:

    - 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
    - Spring Break – Thursday, March 5 at 00:00 am through 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.



**SUMMARY OF WORK**  
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- 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
- c. For all utility outages, a Utility Outage Request form must be submitted seven days in advance to [Poweroutage@dfwairport.com](mailto: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](mailto:PowerOutage@dfwairport.com).

**PART 2 - PRODUCTS**

Not Used.

**PART 3 — EXECUTION**

Not Used.

**PART 4 — MEASUREMENT AND PAYMENT**

Not Used.

**END OF SECTION**

## WAGE RATE REQUIREMENTS

### Section: 01 29 85

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#### 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.pov/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 Owner's Authorized Representative (OAR).
- 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 OAR. The Contractor must complete Items 3 through 15 and submit the request to the OAR prior to issuance of the Notice to Proceed (NTP) or as soon as the need for the additional classification or rate is identified, if the work has been authorized to begin.

#### PART 2 - PRODUCTS

Not Used.

#### PART 3 — EXECUTION

Not Used.

#### PART 4 — MEASUREMENT AND PAYMENT

Not Used.

**END OF SECTION**

## WAGE RATES REQUIREMENTS

Section: 01 29 85

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General Decision Number: TX190025 01/04/2019 TX25

Superseded General Decision Number: TX20180035

State: Texas

Construction Type: Highway

Counties: Archer, Callahan, Clay, Collin, Dallas, Delta, Denton, Ellis, Grayson, Hunt, Johnson, Jones, Kaufman, Parker, Rockwall, Tarrant and Wise Counties in Texas.

HIGHWAY CONSTRUCTION PROJECTS (excluding tunnels, building structures in rest area projects & railroad construction; bascule, suspension & spandrel arch bridges designed for commercial navigation, bridges involving marine construction; and other major bridges).

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](http://www.dol.gov/whd/govcontracts).

Modification Number	Publication Date
0	01/04/2019

\* SUTX2011-007 08/03/2011

# WAGE RATES REQUIREMENTS

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	Rates	Fringes
CONCRETE FINISHER (Paving and Structures).....	\$ 14.12	
ELECTRICIAN.....	\$ 19.80	
FORM BUILDER/FORM SETTER		
Paving & Curb.....	\$ 13.16	
Structures.....	\$ 13.84	
LABORER		
Asphalt Raker.....	\$ 12.69	
Flagger.....	\$ 10.06	
Laborer, Common.....	\$ 10.72	
Laborer, Utility.....	\$ 12.32	
Pipelayer.....	\$ 13.24	
Work Zone Barricade Servicer.....	\$ 11.68	
POWER EQUIPMENT OPERATOR:		
Asphalt Distributor.....	\$ 15.32	
Asphalt Paving Machine.....	\$ 13.99	
Broom or Sweeper.....	\$ 11.74	
Concrete Pavement Finishing Machine.....	\$ 16.05	
Concrete Saw.....	\$ 14.48	
Crane Operator, Lattice Boom 80 Tons or Less.....	\$ 17.27	
Crane Operator, Lattice Boom over 80 Tons.....	\$ 20.52	
Crane, Hydraulic 80 Tons or Less.....	\$ 18.12	
Crawler Tractor.....	\$ 14.07	
Excavator, 50,000 pounds or less.....	\$ 17.19	
Excavator, over 50,000 pounds.....	\$ 16.99	
Foundation Drill , Truck Mounted.....	\$ 21.07	
Foundation Drill, Crawler Mounted.....	\$ 17.99	
Front End Loader 3 CY or Less.....	\$ 13.69	
Front End Loader, over 3 CY.....	\$ 14.72	
Loader/Backhoe.....	\$ 15.18	
Mechanic.....	\$ 17.68	
Milling Machine.....	\$ 14.32	
Motor Grader, Fine Grade.....	\$ 17.19	
Motor Grader, Rough.....	\$ 16.02	
Pavement Marking Machine.....	\$ 13.63	
Reclaimer/Pulverizer.....	\$ 11.01	

**WAGE RATES REQUIREMENTS**

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Roller, Asphalt.....	\$ 13.08
Roller, Other.....	\$ 11.51
Scraper.....	\$ 12.96
Small Slipform Machine.....	\$ 15.96
Spreader Box.....	\$ 14.73
 Servicer.....	\$ 14.58
 Steel Worker (Reinforcing).....	\$ 16.18
 TRUCK DRIVER	
Lowboy-Float.....	\$ 16.24
Off Road Hauler.....	\$ 12.25
Single Axle.....	\$ 12.31
Single or Tandem Axle Dump Truck.....	\$ 12.62
Tandem Axle Tractor with Semi Trailer.....	\$ 12.86
Transit-Mix.....	\$ 14.14
 WELDER.....	\$ 14.84

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.  
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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](http://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)).

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## WAGE RATES REQUIREMENTS

### Section: 01 29 85

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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

## WAGE RATES REQUIREMENTS

Section: 01 29 85

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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.

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### 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 RATES REQUIREMENTS**

**Section: 01 29 85**

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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.

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END OF GENERAL DECISION

**PART 2 - PRODUCTS**

Not Used.

**PART 3 - EXECUTION**

Not Used.

**END OF SECTION**



**ALLOWANCES**  
**Section: 01 30 00**

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. This Section covers the requirements and procedures if Allowances are included in the Contract.
- B. Allowances are not included in the Lump Sum Base Bid for a Lump Sum contract.
- C. Allowances have been set aside to complete elements of the Work that are within the general scope of work, but are not shown on the Plans or specified in the Specifications. Any and all unused portions of the stipulated Allowances will not be paid to the Contractor and shall be deducted from the Contract Amount at the Final Completion of the Project.
- D. Use of any funds allotted to Allowances is only for the Work of the Project. while Allowances are 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. Differing Site Conditions: This Allowance establishes means to compensate the Contractor for changes in the various work areas/phases or Scope of Work as directed by the OAR to mitigate differing or unforeseen field conditions. The scope and associated compensation under this Allowance includes, but is not limited to:
  - 1. Additional demolition, relocation, or construction of necessary infrastructure to mitigate miscellaneous unforeseen conditions.
  - 2. Discovery of abandoned utilities from prior permanent or temporary Federal Aviation Administration (FAA) facilities, drainage structures abandoned in place, direct buried cabling, and similar items.

**ALLOWANCES**  
**Section: 01 30 00**

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3. Additional compensation to maintain and remove existing erosion control devices from previous projects and not included in the Contract Documents.

B. Utility Investigation/Relocation: This Allowance establishes means to compensate the Contractor for Level A Potholing and modification in various work areas of the Project as directed by the OAR. The scope of this Allowance includes, but is not limited to:

1. Additional exploratory investigation and relocation of utilities.
2. Other additional miscellaneous utilities requirements not included in the Scope of Work.

Investigation of utilities shown on the Plans to confirm location and depth will not be considered part of this Allowance but is included within the Contract Amount.

**PART 2 – PRODUCTS**

Not Used.

**PART 3 – EXECUTION**

Not Used.

**PART 4 – MEASUREMENT AND PAYMENT**

4.1 MEASUREMENT

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

4.2 PAYMENT

Payment will be made under:

Pay Item 01 30 00-2	Unforeseen Field Conditions
Pay Item 01 30 00-3	Utility Investigation/Relocation

**END OF SECTION**

**SECTION 01 35 35.14**  
**SECURITY USAGE**

**PART 1 - GENERAL**

1.1 SUMMARY

- A. The following specification describes the procedure involved to staff a previously unused AOA gate for the exclusive use as a project construction gate. All required items must be in place for the duration the permanent gate is temporarily closed.
- B. Related sections:
  - 1. 01 35 13.13 Minimum Standards for Construction and Maintenance on the AOA

1.2 SUBMITTALS

- 1. Product data for components and accessories for temporary guard house or trailer, including heating and/or AC unit, generator, portable toilet, fire extinguisher.
- 2. Shop drawings showing layout, dimensions, spacing of components, and installation details for temporary guard house or trailer.
- 3. Request for security staffing forms submitted weekly on Monday. All staffing requests must contain contact information for the Superintendent of the project who can be reached at all times.
- 4. 3 copies of keys to guard post lock. Two copies to DFW ASD Security Compliance and one to the contractor.

**PART 2 - PRODUCTS**

2.1 ACCEPTABLE MANUFACTURERS

Products from qualified manufacturers will be acceptable by the Owner as equal, if approved in writing, ten days prior to bidding, and if they meet all the following specifications for design and fabrication.

2.2 MATERIALS

- 1. Metal booth, actual guard house, cargo container, modular type office or small trailer. Minimum dimensions 10 ft x 8 ft.
- 2. Dual vertical heat and A/C unit for inside the guard booth.

3. Generator 120/240-volt single phase to power the guard booth, supplied by diesel fuel.
4. Outdoor tower lighting.
5. Portable toilet facility.
6. Concrete Traffic Barriers
7. Fire Extinguisher

### **PART 3 – CONSTRUCTION**

#### **3.1 PREPARATION**

- A. *Prior* to construction, field verify required dimensions.
- B. Guard post area must include space for the Officer's parked vehicle.

#### **3.2 INSTALLATION**

- A. Install guard posts/trailer in accordance with manufacturer's instructions.
- B. Install tower lighting. The lighting must illuminate entire outdoor sign-in and screening area to the AOA, during early morning and evening working hours.
- C. Install concrete traffic barriers (CTB) surrounding the booth from traffic side to provide a safety curtain for the officers working the post.

### **PART 4 - MEASUREMENT AND PAYMENT**

- 4.1 Security Usage will be measured by the total hours the temporary guard post is staffed by an officer during closure for construction of the associated gate. Payment will be made at the Contract unit price of the hourly rate for the officer. Cost for construction of the temporary guard post, installation of all components, labor, tools, and incidentals, also including bi-weekly service to portable toilet, shall be considered subsidiary to this item.

**END OF SECTION**

**SECTION 26 05 05**  
**SELECTIVE DEMOLITION FOR ELECTRICAL**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Electrical demolition.

**PART 2 PRODUCTS**

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual sections.

**PART 3 EXECUTION**

3.01 EXAMINATION

- A. Verify that abandoned wiring and equipment serve only abandoned facilities.
- B. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

- A. Disconnect electrical systems serving existing gates and barrier systems to be removed.
- B. The contractor is responsible for tracing out of wiring to be removed as part of this contract.
- C. Coordinate utility service outages with utility company.
- D. Removed equipment is to be returned to the owner.
- E. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- F. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
  - 1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
  - 2. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Remove abandoned wiring to source of supply.
- B. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

**SELECTIVE DEMOLITION FOR ELECTRICAL**  
**Section 26 05 05**

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- C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- D. Disconnect and remove abandoned panelboards and distribution equipment.
- E. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- F. Repair adjacent construction and finishes damaged during demolition and extension work.
- G. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- H. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

**3.04 CLEANING AND REPAIR**

- A. Clean and repair existing materials and equipment that remain or that are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

**END OF SECTION**

**SECTION 26 05 19**  
**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Single conductor building wire.
- B. Underground feeder and branch-circuit cable.
- C. Power and control tray cable.
- D. Wiring connectors.
- E. Electrical tape.
- F. Heat shrink tubing.
- G. Oxide inhibiting compound.
- H. Wire pulling lubricant.

**1.02 REFERENCE STANDARDS**

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011 (Reapproved 2017).
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).
- E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.
- F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- G. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); 2012.
- H. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF); 2007.
- I. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2009.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- L. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- M. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- N. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- O. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.
- P. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.
- Q. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
- R. UL 1277 - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members; Current Edition, Including All Revisions.

# LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

## Section 26 05 19

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### 1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.

### 1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

### 1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

## PART 2 PRODUCTS

### 2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

### 2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.
- H. Conductor Material:
  - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
  - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
  - 3. Tinned Copper Conductors: Comply with ASTM B33.
- I. Conductor Color Coding:
  - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
  - 2. Color Coding Method: Integrally colored insulation.
  - 3. Color Code:



## LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

### Section 26 05 19

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- a. 480Y/277 V, 3 Phase, 4 Wire System:
  - 1) Phase A: Brown.
  - 2) Phase B: Orange.
  - 3) Phase C: Yellow.
  - 4) Neutral/Grounded: Gray.
- b. 208Y/120 V, 3 Phase, 4 Wire System:
  - 1) Phase A: Black.
  - 2) Phase B: Red.
  - 3) Phase C: Blue.
  - 4) Neutral/Grounded: White.
- c. 240/120 V, 1 Phase, 3 Wire System:
  - 1) Phase A: Black.
  - 2) Phase B: Red.
  - 3) Neutral/Grounded: White.
- d. Equipment Ground, All Systems: Green.

#### 2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
  - 1. Copper Building Wire:
    - a. Cerro Wire LLC: [www.cerrowire.com/#sle](http://www.cerrowire.com/#sle).
    - b. Encore Wire Corporation: [www.encorewire.com/#sle](http://www.encorewire.com/#sle).
    - c. General Cable Technologies Corporation; : [www.generalcable.com/#sle](http://www.generalcable.com/#sle).
    - d. Southwire Company: [www.southwire.com/#sle](http://www.southwire.com/#sle).
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
  - 1. Feeders and Branch Circuits:
    - a. Size 10 AWG and Smaller: Solid.
    - b. Size 8 AWG and Larger: Stranded.
  - 2. Control Circuits: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
  - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
    - a. Size 4 AWG and Larger: Type XHHW-2.
    - b. Installed Underground: Type XHHW-2.

#### 2.04 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE

- A. Manufacturers:
  - 1. Cerro Wire LLC: [www.cerrowire.com/#sle](http://www.cerrowire.com/#sle).
  - 2. Encore Wire Corporation: [www.encorewire.com/#sle](http://www.encorewire.com/#sle).
  - 3. Southwire Company: [www.southwire.com/#sle](http://www.southwire.com/#sle).
- B. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.
- C. Provide equipment grounding conductor unless otherwise indicated.
- D. Conductor Stranding:
  - 1. Size 10 AWG and Smaller: Solid.
  - 2. Size 8 AWG and Larger: Stranded.
- E. Insulation Voltage Rating: 600 V.

#### 2.05 POWER AND CONTROL TRAY CABLE

- A. Description: NFPA 70, Type TC cable listed and labeled as complying with UL 1277.
- B. Conductor Stranding: Stranded.

## LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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- C. Insulation Voltage Rating: 600 V.
- D. Insulation: Type XHHW or XHHW-2.
- E. Jacket: PVC or Chlorinated Polyethylene (CPE).

#### 2.06 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Wiring Connectors for Splices and Taps:
  - 1. Copper Conductors Size 8 AWG and Smaller: Use compression connectors.
  - 2. Copper Conductors Size 6 AWG and Larger: Use compression connectors.
- C. Wiring Connectors for Terminations:
  - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
  - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
  - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
  - 4. Copper Conductors Size 8 AWG and Larger: Use compression connectors where connectors are required.
- D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- E. Compression Connectors: Provide circumferential type or hex type crimp configuration.
  - 1. Manufacturers:
    - a. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - b. IlSCO: [www.ilSCO.com/#sle](http://www.ilSCO.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).

#### 2.07 WIRING ACCESSORIES

- A. Electrical Tape:
  - 1. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
  - 1. Manufacturers:
    - a. 3M: [www.3m.com/#sle](http://www.3m.com/#sle).
    - b. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
- C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
  - 1. Manufacturers:
    - a. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - b. Ideal Industries, Inc: [www.idealindustries.com/#sle](http://www.idealindustries.com/#sle).
    - c. IlSCO: [www.ilSCO.com/#sle](http://www.ilSCO.com/#sle).
- D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

# LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

## Section 26 05 19

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### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that work likely to damage wire and cable has been completed.
- B. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- C. Verify that field measurements are as indicated.
- D. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

#### 3.03 INSTALLATION

- A. Circuiting Requirements:
  - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
  - 2. When circuit destination is indicated without specific routing, determine exact routing required.
  - 3. Arrange circuiting to minimize splices.
  - 4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
  - 5. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install underground feeder and branch-circuit cable (Type UF-B) in accordance with NECA 121.
- E. Installation in Raceway:
  - 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
  - 2. Pull all conductors and cables together into raceway at same time.
  - 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
  - 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
- G. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.
- H. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- I. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- J. Make wiring connections using specified wiring connectors.
  - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
  - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.

## **LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

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3. Do not remove conductor strands to facilitate insertion into connector.
  4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
  5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- K. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
- L. Insulate ends of spare conductors using vinyl insulating electrical tape.
- M. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system

**END OF SECTION**

**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground rod electrodes.

1.02 RELATED REQUIREMENTS

- A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2007.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

**PART 2 PRODUCTS**

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

- D. Grounding System Resistance:
  - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- E. Grounding Electrode System:
  - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
    - a. Provide continuous grounding electrode conductors without splice or joint.
    - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
  - 2. Ground Rod Electrode(s):
    - a. Provide single electrode unless otherwise indicated or required for gate and barrier arm systems. Refer to equipment installation manuals for additional requirements.

## 2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
  - 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
  - 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
  - 1. Use insulated copper conductors unless otherwise indicated.
    - a. Exceptions:
      - 1) Use bare copper conductors where installed underground in direct contact with earth.
      - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
  - 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
  - 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
    - a. Exceptions:
      - 1) Use mechanical connectors for connections to electrodes at ground access wells.
  - 3. Unless otherwise indicated, use mechanical connectors or compression connectors for accessible connections.

- D. Ground Rod Electrodes:
  - 1. Comply with NEMA GR 1.
  - 2. Material: Stainless steel.
  - 3. Size: 3/4 inch (19 mm) diameter by 10 length, unless otherwise indicated.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### **3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
- D. Make grounding and bonding connections using specified connectors.
  - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
  - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
  - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
  - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 26 0553.

**END OF SECTION**

**SECTION 26 05 29**  
**HANGARS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.
- D. MFMA-4 - Metal Framing Standards Publication; 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
  - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
  - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
  - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems and post-installed concrete and masonry anchors.

1.05 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with DFW Airport Requirements.



1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

**PART 2 PRODUCTS**

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

- 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
- 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
- 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
- 4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- 5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
  - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
  - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
  - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
  - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.

- 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
- 2. Conduit Clamps: Bolted type unless otherwise indicated.
- 3. Manufacturers:
  - a. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
  - b. Erico International Corporation: [www.erico.com/#sle](http://www.erico.com/#sle).
  - c. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com/#sle](http://www.emerson.com/#sle).
  - d. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

- 1. Manufacturers:

- a. Cooper Crouse-Hinds, a division of Eaton Corporation:  
[www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
  - b. Erico International Corporation: [www.erico.com/#sle](http://www.erico.com/#sle).
  - c. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com/#sle](http://www.emerson.com/#sle).
  - d. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
- D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.
  2. Channel Material:
    - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
    - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
  3. Manufacturers:
    - a. Cooper B-Line, a division of Eaton Corporation:  
[www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
    - b. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - c. Unistrut, a brand of Atkore International Inc: [www.unistrut.com/#sle](http://www.unistrut.com/#sle).
- E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
- F. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
  2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
  3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
  4. Steel: Use beam clamps, machine bolts, or welded threaded studs.
  5. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    - a. Comply with MFMA-4.
    - b. Channel Material: Use galvanized steel.
    - c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).

- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems. Do not support from ceiling support system or ceiling grid.
- D. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- E. Equipment Support and Attachment:
  - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
  - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- F. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- G. Secure fasteners according to manufacturer's recommended torque settings.
- H. Remove temporary supports.

### 3.02 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

**END OF SECTION**

**SECTION 26 05 33.13**  
**CONDUIT FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Aluminum rigid metal conduit (RMC).
- C. Intermediate metal conduit (IMC).
- D. PVC-coated galvanized steel rigid metal conduit (RMC).
- E. Liquidtight flexible metal conduit (LFMC).
- F. Rigid polyvinyl chloride (PVC) conduit.
- G. Conduit fittings.

1.02 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2015.
- B. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A); 2015.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
- F. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.
- G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.
- H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; 2005 (Reaffirmed 2013).
- J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.
- K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2016.
- L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- N. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.
- O. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
- P. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- Q. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

- R. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

### 1.03 ADMINISTRATIVE REQUIREMENTS

#### A. Coordination:

1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Verify the vertical and horizontal location of any existing underground utilities prior to beginning construction work.

#### B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

### 1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

### 1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

## **PART 2 PRODUCTS**

### 2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized rigid steel above grade and schedule 40 PVC encased in concrete below grade..
- C. Underground:
  1. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
  2. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.

3. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches (100 mm) on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.
- D. Exposed, Exterior: Use galvanized steel rigid metal conduit or PVC-coated galvanized steel rigid metal conduit.
- E. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit, aluminum rigid metal conduit, or reinforced thermosetting resin conduit (RTRC).
- F. Hazardous (Classified) Locations: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), aluminum rigid metal conduit, or PVC-coated galvanized steel rigid metal conduit.
- G. Connections to Vibrating Equipment:
  1. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
  2. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.

## 2.02 CONDUIT REQUIREMENTS

- A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.
- B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

## 2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
  1. Allied Tube & Conduit: [www.alliedeg.com/#sle](http://www.alliedeg.com/#sle).
  2. Republic Conduit: [www.republic-conduit.com/#sle](http://www.republic-conduit.com/#sle).
  3. Wheatland Tube Company: [www.wheatland.com/#sle](http://www.wheatland.com/#sle).
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
  1. Manufacturers:
    - a. Bridgeport Fittings Inc: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
    - b. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com/#sle](http://www.emerson.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
  2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  3. Material: Use steel or malleable iron.

4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

#### 2.04 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Allied Tube & Conduit: [www.alliedeg.com/#sle](http://www.alliedeg.com/#sle).
2. Republic Conduit: [www.republic-conduit.com/#sle](http://www.republic-conduit.com/#sle).
3. Wheatland Tube Company: [www.wheatland.com/#sle](http://www.wheatland.com/#sle).

B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.

C. Fittings:

1. Manufacturers:
  - a. Bridgeport Fittings Inc: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
  - b. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com/#sle](http://www.emerson.com/#sle).
  - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. Material: Use aluminum.
5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

#### 2.05 INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:

1. Allied Tube & Conduit: [www.alliedeg.com/#sle](http://www.alliedeg.com/#sle).
2. Republic Conduit: [www.republic-conduit.com/#sle](http://www.republic-conduit.com/#sle).
3. Wheatland Tube Company: [www.wheatland.com/#sle](http://www.wheatland.com/#sle).

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:

1. Manufacturers:
  - a. Bridgeport Fittings Inc: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
  - b. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com/#sle](http://www.emerson.com/#sle).
  - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

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3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. Material: Use steel or malleable iron.
5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

#### 2.06 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
  1. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
  2. Robroy Industries: [www.robroy.com/#sle](http://www.robroy.com/#sle).
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil (1.02 mm).
- D. PVC-Coated Fittings:
  1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
  2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
  3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
  4. Material: Use steel or malleable iron.
  5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil (1.02 mm).
- E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil (0.38 mm).

#### 2.07 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers:
  1. AFC Cable Systems, Inc: [www.afcweb.com/#sle](http://www.afcweb.com/#sle).
  2. Electri-Flex Company: [www.electriflex.com/#sle](http://www.electriflex.com/#sle).
  3. International Metal Hose: [www.metalhose.com/#sle](http://www.metalhose.com/#sle).
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
  1. Manufacturers:
    - a. Bridgeport Fittings Inc: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
    - b. O-Z/Gedney, a brand of Emerson Electric Co: [www.emerson.com/#sle](http://www.emerson.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).



2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.

## 2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

### A. Manufacturers:

1. Cantex Inc: [www.cantexinc.com/#sle](http://www.cantexinc.com/#sle).
2. Carlon, a brand of Thomas & Betts Corporation: [www.carlon.com/#sle](http://www.carlon.com/#sle).
3. JM Eagle: [www.jmeagle.com/#sle](http://www.jmeagle.com/#sle).

### B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

### C. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

## **PART 3 EXECUTION**

### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
- E. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
- G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- H. Conduit Routing:
  1. Unless dimensioned, conduit routing indicated is diagrammatic.
  2. When conduit destination is indicated without specific routing, determine exact routing required.
- I. Conduit Support:

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1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
  2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- J. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
  2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
  3. Use suitable adapters where required to transition from one type of conduit to another.
  4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
  5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
  6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
  7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- K. Underground Installation:
1. Minimum Cover, Unless Otherwise Indicated or Required:
    - a. Underground, Exterior: 24 inches (610 mm).
  2. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length.
- L. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.
- M. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
  2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
  3. Where conduits are subject to earth movement by settlement or frost.
- N. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.

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- 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- O. Provide grounding and bonding in accordance with Section 26 0526.
- P. Identify conduits in accordance with Section 26 0553.

#### **3.03 FIELD QUALITY CONTROL**

- A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- B. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- C. Correct deficiencies and replace damaged or defective conduits.

#### **3.04 CLEANING**

- A. Clean interior of conduits to remove moisture and foreign matter.

#### **3.05 PROTECTION**

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

**END OF SECTION**

**SECTION 26 05 33.16**  
**BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).
- C. Underground boxes/enclosures.

**1.02 REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. SCTE 77 - Specification for Underground Enclosure Integrity; 2017.
- H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 508A - Industrial Control Panels; 2013.
- K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

**1.03 SUBMITTALS**

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures and underground boxes/enclosures.

**1.04 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.

**PART 2 PRODUCTS**

**2.01 BOXES**

- A. General Requirements:

## BOXES FOR ELECTRICAL SYSTEMS

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1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
  2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
  3. Provide products listed, classified, and labeled as suitable for the purpose intended.
  4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
  5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
  2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
  3. Use suitable concrete type boxes where flush-mounted in concrete.
  4. Use raised covers suitable for the type of wall construction and device configuration where required.
  5. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
  6. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
  2. NEMA 250 Environment Type, Unless Otherwise Indicated:
  3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
    - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
- D. Underground Boxes/Enclosures:
1. Description: In-ground, solid bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
  2. Underground boxes shall be traffic rated with H-20 AASHTO load rating.
  3. Size: As indicated on drawings.
  4. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches (300 mm).
  5. Provide logo on cover to indicate type of service.

6. Applications:
  - a. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
7. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
  - a. Manufacturers:
    - 1) Hubbell Incorporated; Quazite Products;  
www.hubbellpowersystems.com/#sle.
    - 2) Oldcastle Precast, Inc; www.oldcastleprecast.com/#sle.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### **3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Box Locations:
  1. Unless dimensioned, box locations indicated are approximate.
- E. Box Supports:
  1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
- F. Install boxes plumb and level.
- G. Flush-Mounted Boxes:
  1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
  2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
  3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.
- H. Install boxes as required to preserve insulation integrity.
- I. Underground Boxes/Enclosures:

## **BOXES FOR ELECTRICAL SYSTEMS**

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1. Install enclosure on gravel base, minimum 6 inches (150 mm) deep.
  2. Mount enclosures located in landscaped areas with top at 1 inch (25 mm) above finished grade.
  3. Provide cast-in-place concrete collar around enclosures that are not located in concrete areas.
  4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.
  5. Provide sump at bottom of closed bottom boxes.
- J. Close unused box openings.
- K. Provide grounding and bonding in accordance with Section 26 0526.

#### **3.03 CLEANING**

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

#### **3.04 PROTECTION**

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

**END OF SECTION**

**SECTION 26 05 53**  
**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Warning signs and labels.

1.02 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.
- C. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

**PART 2 PRODUCTS**

2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
  - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
    - a. Panelboards:
      - 1) Identify ampere rating.
      - 2) Identify voltage and phase.
      - 3) Identify power source and circuit number. Include location.
      - 4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
      - 5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces.
      - 6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device.
    - b. Enclosed switches:
      - 1) Identify voltage and phase.



## IDENTIFICATION FOR ELECTRICAL SYSTEMS

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- 2) Identify power source and circuit number. Include location when not within sight of equipment.
  - 3) Identify load(s) served. Include location when not within sight of equipment.
- B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
  2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
- C. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
  2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.

## 2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
1. Manufacturers:
    - a. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
    - b. Kolbi Pipe Marker Co: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).
    - c. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
  2. Materials:
    - a. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
  3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/8 inch (3 mm); engraved text.
  4. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.
- B. Identification Labels:
1. Manufacturers:
    - a. Brady Corporation; [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
    - b. Brother International Corporation: [www.brother-usa.com/#sle](http://www.brother-usa.com/#sle).
    - c. Panduit Corp: [www.panduit.com/#sle](http://www.panduit.com/#sle).
  2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
  3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

## IDENTIFICATION FOR ELECTRICAL SYSTEMS

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- C. Format for Equipment Identification:
  - 1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
  - 2. Legend:
    - a. Equipment designation or other approved description.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height:
    - a. Equipment Designation: 1/2 inch (13 mm).
  - 5. Color:
    - a. Normal Power System: White text on black background.
- D. Format for General Information and Operating Instructions:
  - 1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
  - 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height: 1/4 inch (6 mm).
  - 5. Color: Black text on white background unless otherwise indicated.

#### 2.03 WIRE AND CABLE MARKERS

- A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- C. Legend: Power source and circuit number or other designation indicated.
- D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- E. Minimum Text Height: 1/8 inch (3 mm).
- F. Color: Black text on white background unless otherwise indicated.

#### 2.04 VOLTAGE MARKERS

- A. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- B. Minimum Size:
  - 1. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches (29 by 110 mm).
  - 2. Markers for Junction Boxes: 1/2 by 2 1/4 inches (13 by 57 mm).
- C. Legend:
  - 1. Markers for Voltage Identification: Highest voltage present.

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- D. Color: Black text on orange background unless otherwise indicated.

### 2.05 UNDERGROUND WARNING TAPE

- A. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- B. Foil-backed Detectable Type Tape: 3 inches (76 mm) wide, with minimum thickness of 5 mil (0.1 mm), unless otherwise required for proper detection.
- C. Legend: Type of service, continuously repeated over full length of tape.
- D. Color:

### 2.06 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
  - 1. Materials:
  - 2. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.
- C. Warning Labels:
  - 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
  - 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
  - 3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
  - 1. Surface-Mounted Equipment: Enclosure front.
  - 2. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
  - 3. Elevated Equipment: Legible from the floor or working platform.
  - 4. Branch Devices: Adjacent to device.
  - 5. Interior Components: Legible from the point of access.
  - 6. Boxes: Outside face of cover.
  - 7. Conductors and Cables: Legible from the point of access.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

## **IDENTIFICATION FOR ELECTRICAL SYSTEMS**

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- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches (75 mm) below finished grade.
- G. Mark all handwritten text, where permitted, to be neat and legible.

**END OF SECTION**

**SECTION 26 24 16**  
**PANELBOARDS**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Overcurrent protective devices for panelboards.

1.02 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e (Amended 2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- E. NEMA PB 1 - Panelboards; 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.
- G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- K. UL 67 - Panelboards; Current Edition, Including All Revisions.
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

#### 1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

#### 1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

#### 1.07 FIELD CONDITIONS

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
  - 1. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

### **PART 2 PRODUCTS**

#### 2.01 MANUFACTURERS

- A. ABB/GE: [www.geindustrial.com/#sle](http://www.geindustrial.com/#sle).
- B. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).
- D. Siemens Industry, Inc: [www.usa.siemens.com/#sle](http://www.usa.siemens.com/#sle).
- E. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

## 2.02 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet (2,000 m).
  - 2. Ambient Temperature:
    - a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
- C. Short Circuit Current Rating:
  - 1. Provide panelboards with listed short circuit current rating as indicated on the drawings.
- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
  - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
  - 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Outdoor Locations: Type 3R.
  - 2. Boxes: Galvanized steel unless otherwise indicated.
    - a. Provide wiring gutters sized to accommodate the conductors to be installed.
  - 3. Fronts:
    - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
  - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

## 2.03 POWER DISTRIBUTION PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:

1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
  1. Phase and Neutral Bus Material: Aluminum.
  2. Ground Bus Material: Aluminum.
- D. Circuit Breakers:
  1. Provide bolt-on type.
- E. Enclosures:
  1. Provide surface-mounted enclosures unless otherwise indicated.

#### 2.04 OVERCURRENT PROTECTIVE DEVICES

- A. Molded Case Circuit Breakers:
  1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
  2. Interrupting Capacity:
    - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      - 2) 14,000 rms symmetrical amperes at 480 VAC.
  3. Conductor Terminations:
    - a. Lug Material: Copper, suitable for terminating copper conductors only.
  4. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

#### 2.05 SOURCE QUALITY CONTROL

- A. Factory test panelboards according to NEMA PB 1.

### **PART 3 EXECUTION**

#### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).



**PANELBOARDS**  
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- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required supports in accordance with Section 26 0529.
- F. Install panelboards plumb.
- G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.
- H. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad.
- I. Provide grounding and bonding in accordance with Section 26 0526.
- J. Install all field-installed branch devices, components, and accessories.
- K. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- L. Provide filler plates to cover unused spaces in panelboards.

**3.03 FIELD QUALITY CONTROL**

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Correct deficiencies and replace damaged or defective panelboards or associated components.

**3.04 ADJUSTING**

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.

**3.05 CLEANING**

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

**END OF SECTION**

**SECTION 26 28 13**  
**FUSES**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Fuses.

1.02 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.
- B. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.
- C. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

**PART 2 PRODUCTS**

2.01 MANUFACTURERS

- A. Bussmann, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).

2.02 APPLICATIONS

- A. General Purpose Branch Circuits: Class RK1, time-delay.
- B. Individual Motor Branch Circuits: Class RK1, time-delay.

2.03 FUSES

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.

**PART 3 EXECUTION**

3.01 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

**END OF SECTION**

**SECTION 26 28 16.16**  
**ENCLOSED SWITCHES**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- G. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

**PART 2 PRODUCTS**

2.01 MANUFACTURERS

- A. ABB/GE: [www.geindustrial.com/#sle](http://www.geindustrial.com/#sle).
- B. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).
- D. Siemens Industry, Inc: [www.usa.siemens.com/#sle](http://www.usa.siemens.com/#sle).

## 2.02 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet (2,000 m).
  - 2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
  - 1. Minimum Ratings:
    - a. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 50,000 rms symmetrical amperes.
- G. Provide with switch blade contact position that is visible when the cover is open.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Outdoor Locations: Type 3R.
  - 2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
- K. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- L. Heavy Duty Switches:
  - 1. Comply with NEMA KS 1.
  - 2. Conductor Terminations:
    - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  - 3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required supports in accordance with Section 26 0529.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 26 0526.

**END OF SECTION**

**SECTION 27 01 00**

**GENERAL TELECOMMUNICATIONS SYSTEMS REQUIREMENTS**

**PART 1 - GENERAL**

1.1 SUMMARY

- A. Section 27 01 00 includes the general information common to the special system Sections listed in "Related Sections" article in this Section.
- B. Related Requirements
  - 1. Related Sections:
    - a. TXDOT Item No. 402 "Trench Excavation Protection"
    - b. TXDOT Item No. 403 "Temporary Special Shoring"
    - c. 27 05 26 "Grounding and Bonding for Communications Systems"
    - d. 27 05 43 "Underground Ducts and Raceways for Communications Systems"
    - e. 27 05 53 "Identification for Communications Systems"

1.2 REFERENCES

- A. Abbreviations and Acronyms:
  - 1. AED: Automated External Defibrillator
  - 2. AWG: American Wire Gauge
  - 3. C: Conduit
  - 4. CAT: Category
  - 5. COMM: Communications
  - 6. CPU: Central Processing Unit
  - 7. CRT: Cathode Ray Tube
  - 8. EMT: Electrical Metallic Tubing
  - 9. EQ: Equalizer
  - 10. FA: Fire Alarm
  - 11. FAR: Federal Aviation Regulation
  - 12. FIS: Federal Inspection Service
  - 13. FO: Fiber Optic
  - 14. GRD: Ground
  - 15. IDF: Intermediate Distribution Frame
  - 16. IR: Infrared
  - 17. LAN: Local Area Network

## GENERAL TELECOMMUNICATIONS SYSTEMS REQUIREMENTS

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18. LCD: Liquid Crystal Display
  19. MATV: Master Antenna Television
  20. MCR: Main Communications Room
  21. MDF: Main DistributionFrame
  22. MMFO: Multimode FiberOptic
  23. MNS: Mass Notification System
  24. OTS: Off The Shelf
  25. PA: PublicAddress
  26. PC: Personal Computer
  27. PP: Patch Panel
  28. PVC: Polyvinyl Chloride Conduit
  29. RGS: Rigid Galvanized Steel
  30. RU: Rack Unit
  31. SHLD: Shielded (Cable)
  32. SIDA: Secure Identification Display Area
  33. SMFO: Singlemode Fiber Optic
  34. TV: Television
  35. UPS: Uninterruptible Power Supply
  36. USCS: United Customs Service
  37. VE: Voice Evacuation
  38. XMTR: Transmitter
- B. Definitions: See individual system Sections for system description.
- C. Reference Standards
1. Specific reference in to codes, rules, regulations, standards, manufacturer's instructions or requirements of regulatory agencies shall mean the latest printed edition of each in effect at date of Contract unless the Document is shown dated.
  2. Comply with all local codes and requirements of authorities having jurisdiction.
  3. Conflicts:
    - a. Between Drawings and Specifications, between different specifications, or between different drawings: Comply with the one establishing the more stringent requirement.
    - b. Between referenced requirements or between industry standards: Comply with the one establishing the more stringent requirements.
    - c. Between referenced requirements and Contract documents: Comply with the one establishing the more stringent requirements.



## GENERAL TELECOMMUNICATIONS SYSTEMS REQUIREMENTS

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4. References (as applicable per system):
  - a. American National Standards Institute (ANSI).
    - 1) ANSI C2 (1993); National Electrical Safety Code.
  - b. American Society for Testing Materials (ASTM) International.
  - c. Building Industry Consulting Services International (BICSI).
  - d. Code of Federal Regulations (CFR).
    - 1) CFR 47 Part 15; Radio Frequency Devices.
  - e. Dallas-Fort Worth International Airport Construction and Fire Prevention Standards Resolution and Amendments to the Codes
  - f. Dallas/Fort Worth International Airport Guidelines including the Design Criteria Manual
  - g. Factory Mutual (FM).
  - h. Institute of Electrical and Electronic Engineers (IEEE).
  - i. International Code Council
    - 1) International Building Code (IBC) 2009.
    - 2) International Fire Code (IFC)
  - j. International Organization for Standardization (ISO) including:
    - 1) International Organization for Standardization (ISO) 9001; Quality Assurance in Design/Development, Production, Installations, and Servicing
    - 2) ISO 9003; Quality Assurance in Final Inspection and Test
    - 3) ISO 9004; Quality Management and Quality System Elements Guidelines
  - k. Internet Engineering Task Force (IETF).
  - l. National Electrical Manufacturers Association (NEMA).
  - m. National Fire Protection Association (NFPA).
    - 1) NFPA 70 (2008 National Electrical Code (NEC).
    - 2) NFPA 11 Standard on Stored Electrical Energy Emergency and Standby Power Systems.
  - n. Occupational Safety and Health Agency (OSHA).
  - o. Underwriters Laboratory (UL)
  - p. Local, county, state and federal regulations and codes in effect as of date of Final Completion.

## GENERAL TELECOMMUNICATIONS SYSTEMS REQUIREMENTS

### Section: 27 01 00

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#### 1.3 ACTION SUBMITTALS

- A. The Contractor shall not perform any portion of the Work requiring submittal in "Action Submittals" article until the Construction Manager, Engineer, and the DFW Board have approved the respective submittal(s). All Work shall be in accordance with approved submittals.
- B. Product Data: The Contractor shall submit catalogue cut-sheets that include manufacturer, trade name, and complete model number for each product specified.
  - 1. Model number shall be handwritten and/or clouded/circled to indicate exact selection. Identify applicable Section reference for each product. Product data sheets shall be bound in a three (3) ring binder and shall include a product index listing the model number and description of product.
  - 2. Submit manufacturer's data on system components including, but not limited to, Electrical specifications, Mechanical specifications, physical dimensions and weights, rough in diagrams, and instructions for installation, operation and maintenance, suitable for inclusion in maintenance manuals.
  - 3. Provide complete parts lists and breakdowns that identify each component (to the lowest repairable unit) as well as ordering information. The characteristics of each component shall also be shown, where applicable, to aid in obtaining substitute parts.
- C. Shop Drawings
  - 1. Provide Shop Drawings showing equipment/locations, and arrangements. Dimensioned locations of outlet boxes, cables, and cable terminations shall be fully documented in as-built drawings.
  - 2. Provide an assembly Drawing of every equipment rack and card cage enclosure with location and dimensions shown.
  - 3. Provide wiring diagrams showing all field connected wiring.
- D. Test and Evaluation Reports: Prepare and submit Test Plans, Test Procedures and Test Reports as indicated for each system. The Test Plans, Procedures, and Reports shall be submitted to the DFW Board and Engineer for approval.
- E. Special Procedure Submittals: Provide a schedule for proposed installation and implementation, including dates and milestones within thirty (30) days of Contract award. Schedule shall include, at a minimum, the proposed Shop Drawing submission dates, the ordering and manufacture time, the installation schedule, the programming of the system, and the testing time. The schedule shall indicate any dependencies upon other systems as required to complete operation. Updates shall be submitted on a bi-weekly basis.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data

Intent: The intent is to require complete documentation of each System for the purpose of system operation and maintenance during and after the

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warranty period. It is intended that the Operation and Maintenance Manuals be exhaustive in the coverage of the system to the extent that they may be used as the sole guide to the troubleshooting, identification, and repair of defective parts.

2. Scope: The Contractor shall provide the Integrator with two (2) hardcopy complete drawing books and maintenance and operation manuals on the completed system and six (6) copies of the drawing books and maintenance and operations manuals in PDF format on CD-ROM format. These manuals shall include basic wiring diagrams, schematics, and functional details such that any component, wire, or piece of equipment in the system may be easily identified by going to the actual equipment and making reference to this manual. It is required that everything in the system be neatly labeled and easily identifiable. Every terminal, wire, component, or piece of equipment, relay, and other such items shall have a plain English language descriptor identifying the zone and/or function. All of these identification characteristics shall be included in the maintenance and operation manuals. The Contractor shall verify the accuracy and completeness of the drawing books and maintenance and operations manuals and then the Integrator will compile all of the drawing books and maintenance and operations manuals for delivery to the DFW Board.
3. Maintenance Manual: The Maintenance Manual requirement is in addition to shop drawing requirements. Maintenance Manuals and drawing sets shall be compiled after system fabrication and testing, and shall incorporate any changes made after shop drawing submittal. The Maintenance Manuals and drawing books shall be permanently bound in hard plastic covers.
4. Maintenance Manuals, Manufacturer's Literature: Provide manufacturer's standard literature, covering all equipment included in the system. The maintenance manuals shall contain specifications, adjustment procedures, circuit schematics, component location diagrams, and replacement parts identification. All references to equipment not supplied on this Project shall be crossed out.
5. Pulling/Terminating operation Record and CMS (Cable Management System): As-Built required cable data to be provided to the project manager no less than thirty (30) calendar days from completion of pulling and /or terminating operation. Electronic record shall be in an Excel spreadsheet format and supported by Microstation/AutoCAD drawings in DFW Board's standard Microstation/AutoCAD format only. Contractor shall be responsible for any delays due to improper documentation or failing to submit within the prescribed time frame.
6. Drawing Books: All drawings developed specifically for this Project shall be reduced to 11" X 17", folded and bound with hard plastic covers. The 11" X 17" Drawings provided shall be easily readable after printing, even if this requires breaking large drawings into several parts. Text shall be no smaller than 1/16-inch. The Drawing book documents shall be produced with Microstation/AutoCAD and the electronic files shall be provided to the DFW Board at the completion of the Project on CR-ROM. Provide component identification and cross reference on the Drawings to allow the DFWITS

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Life Safety personnel to understand the function of each item (the block diagram), find the room where the device is mounted (Contract document plans), find its location in a rack (arrangement drawings), find how it is wired (wiring diagrams), and its detailed specifications (vendor data sheets), and how to repair it (spare part lists). Include the following drawings as a minimum.

- a. Functional Block Diagram: Provide overall Block Diagrams showing the major interconnections between subsystems. Drawings shall depict the final System overview, including equipment types, location, and any special information.
- b. System Riser Diagram(s): Drawings shall show all System components, wire numbers, color codes, pin numbers, component locations and connections, depicting the "as-built", final configuration.
- c. Rack Elevation and Wiring Diagram(s): Elevation diagrams shall depict the front views of the equipment racks identifying all equipment installed within. Complete wiring diagrams of the racks shall also be included.
- d. Floor plans of the communications rooms showing the location of all equipment affected as a part of this contract within the communications rooms.
- e. Elevation drawings of all wall mounted equipment showing the location of each component on the wall. Components on the walls shall be identified as in the functional block diagrams.
- f. Arrangement Drawings: Provide Drawings showing the physical arrangement of all major system components. This shall include:
  - 1) Elevation Drawings of all equipment racks showing the location of each component in the racks. Components in the racks shall be identified as in the functional block diagrams.
  - 2) Wiring Diagrams: Provide wiring diagrams showing all field installed interconnecting wiring. Wire identification on the diagrams shall agree with the wire markers installed on the equipment.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Spare Parts: Provide spare parts as described in the individual Sections. Submit cost lists of proposed manufacturers recommended spare parts to maintain the complete system with a minimum of downtime. This list shall include partnames, part numbers, and source for additional purchase. The part list shall be cross-referenced to the functional block diagrams and the product data.
- B. Tools:
  1. Special Tools List: Submit a list of special tools required to maintain the systems. Include on the list the name, part number, and source for all special tools.
  2. Special Test Equipment: Submit a list of special test equipment required to prove that all system components are functioning per the Specifications.

1.6 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer: Equipment and materials shall be a standard product of manufacturers regularly engaged in the manufacture and installation of that type of equipment and shall be the manufacturer's latest standard design. Items of the same classification shall be by the same manufacturer and shall be the same series and model. This requirement includes equipment, modules, assemblies, parts, and components.
2. Suppliers: Equipment and materials shall be a standard product of suppliers regularly engaged in the supply of that type of equipment and shall be the manufacturer's latest standard design. Items of the same classification shall be supplied by the same manufacturer. This requirement includes equipment, modules, assemblies, parts, and components.
3. Fabricators: Equipment and materials shall be a typical product of fabricators regularly engaged in the fabrication of that type of equipment.
4. Contractor: The Contractor must have been in the business of selling and installing similar systems for a minimum of three (3) years. The Contractor shall have been actively engaged in installing, maintaining and operating similar systems and services as outlined in the Specifications. The Contractor shall have a minimum of three (3) sites that are actively using the same system with the same version of the software, and each of those sites, must be currently in operation, and have been in operation for at least the proceeding twelve (12) months. The Contractor shall submit information regarding a minimum of three (3) reference sites that are actively using the system proposed by Contractor.
5. Installers: 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.

- B. Certifications: UL Compliance and Labeling: Provide system components, which are UL listed and labeled.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements: Deliver system components properly packaged in factory fabricated type containers. Enclose an operating impact sensor in each container that is holding sensitive electronic equipment. The impact sensor shall be capable of recording a 5G rating.

B. Storage and Handling Requirements:

1. Handle equipment and components carefully to avoid breakage, impact, denting and scoring finishes. Do not install damaged equipment. Replace and return damaged units to equipment manufacturer.
2. Equipment delivered to the job site shall be opened and inspected immediately upon arriving and compared to the approved Shop Drawing submittal and checked for defects. If the equipment is not correct, the equipment shall be returned to the manufacturer immediately and a new order for the approved equipment shall be placed at no cost to the Owner.

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3. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other contaminants. Equipment damaged prior to Final Completion shall be replaced at no cost to the Owner.

#### 1.8 FIELD CONDITIONS

##### A. Ambient Conditions

1. Radio/Television Interference
2. FCC Compliance: All equipment that uses radio frequency energy shall be certified to comply with 47 CFR Part 15 of Federal Communication Commission rules.
3. Expected Radio Frequency Environment: The Contractor shall be familiar with background RF levels at the site and protect the systems from interference with other systems and prevent interference with other systems.

#### 1.9 WARRANTY

- A. Manufacturer Warranty: Provide the manufacturer's standard maintenance and support services for all hardware and software associated with this system at no additional charge for a period of not less than one (1) year. Replacement of equipment shall be included in the Contractor's System Warranty.
- B. Special Warranty: The Contractor shall guarantee all labor, workmanship, and materials for a period of one (1) year from the date of Final Completion unless noted otherwise for specific systems. Should a failure occur within the Warranty period to the system, the Contractor shall provide all labor and materials necessary to restore the system to the condition required for the final test and Final Completion for this Contract, at no cost to the Owner.
  1. When spare equipment is used to provide system fixes, the Contractor shall replace spare equipment used in order to maintain a constant on-site spare parts inventory. Warranty work shall include preventative and routine maintenance work in addition to emergency warranty work.
  2. Emergency Warranty work shall include the repair or replacement of components which fail during the warranty period excluding equipment damaged or rendered unserviceable due to apparent and provable misuse, abuse, vandalism or negligence by DFW Board employees or the public. Apparent and provable as used herein shall mean that the physical evidence indicates what and who caused the damage, e.g., lightning strike, vehicular damage, someone other than the Contractor's technician, etc.
  3. Tie-ins: During the Warranty period, additional components may be connected and their use entered in the database. New devices will be connected in the same manner as shown on the Drawings for this Contract and the existence of the new connections shall not void this guarantee.
  4. Response Times: Repairs shall be made as expeditiously as possible to minimize the time in which components are inoperable. For the Warranty Period, Extended Warranty Periods as applicable, and for the Operations Maintenance Service Agreement durations, the following response times shall be maintained:

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- a. The initial call to the Contractor shall require the type of call to be classified as critical or non-critical. The nature of the problem and the effect on DFW Board operations will be the deciding factor in classifying the problem. For the purpose of defining the priority of the call, the Contractor shall have factory trained and certified personnel accessible to the DFW Board operator personnel via phone call-back within one (1) hour of initial call.
  - b. Critical Items: These are defined as failures or problems which affect the overall safety, security, or operation of the DFW Board and their tenants. For example, the failure of a primary server, the loss of an access control panel which controls multiple portals, or the loss of a voice evacuation zone would be examples of critical items requiring immediate remedy.
    - 1) Critical Items require the Contractor to respond with all due speed, including the possible response outside of normal business hours.
    - 2) The Contractor shall be able diagnose software problems on the system within two (2) hours of the initial call. Diagnosis can include the use of remote dial-in function as allowed by the DFW Board.
    - 3) The Contractor shall be able to respond to on-site calls within six (6) hours of the initial call.
  - c. Non-critical Items: These are defined as failures or problems which do not affect the overall safety, security, or operation of the DFW Board and their tenants. For example, the failure of a non-critical redundant piece of equipment or the loss of a single camera would usually be considered non-critical.
    - 1) The Contractor shall diagnose and remedy the problem during normal working hours no later than the next working day. The initial response shall be the morning of the next day if received before noon or by the noon the next day if received before close of business. Normal business hours are defined as 8 AM to 5 PM Monday through Friday.
5. Warranty and Maintenance Log: The Contractor shall maintain a bound warranty and maintenance log of all services performed during the Warranty period. The log shall be in an DFW Board approved format and shall be kept in the Security Dispatch area of the DFW Board Operations Center. The log shall be kept on a component by component basis, with separate volumes and/or sections as appropriate for each component. The log shall itemize the history the history of preventative and corrective/repair activities, stating the character, duration, cause, cure of all malfunctions and the individual's name who completed the repair. The log shall record all software and hardware updates.
6. The Contractor shall include fifty (50) hours of onsite assistance (Including all travel cost) to be used after the Final Completion of the system. This assistance time is in addition to Warranty services and shall be performed on an on-call basis at the DFW Board's request.
- C. Extended Correction Period: Contractor shall provide a price for an extended Warranty and Operations Maintenance Services Agreement for all of the Systems as a whole.

D. Tube Cell Warranty:

1. Contractor shall be required to submit at project closeout, a signed and registered Sumitomoo Warranty consisting of extended product warranty and applications assurance in accordance with the Sumitomoo Premium Warranty Program. The 25-year Premium Warranty warrants the Sumitomo products to be free of defects in material and workmanship for a period of twenty-five (25) years.
2. Contractor shall be required to submit the following list of required items that must be submitted for application of this warranty.
  - a. Complete the warranty registration form Sumitomo and submit.
  - b. Provide all Testing data for warranty certification. Contractor shall, at notice to proceed, submit the most current copy of the Sumitomoo certificate of registration and the warranty terms and conditions that apply to the Sumitomoo solution.
  - c. Contractor shall, at notice to proceed, submit a statement, of any Contractor warranties in addition to the manufacturers stated and supplied warranties.
  - d. Contractor shall, at close out, submit signed copies of the Contractor provided warranties that are in addition to manufacturers stated and supplied warranties.”

**PART 2 – PRODUCTS**

2.1 SYSTEM DESCRIPTION

- A. Refer to individual system Sections for system descriptions.

2.2 SOURCE QUALITY CONTROL

A. Intellectual Property

1. Patents: Should patented articles, methods, materials apparatus, etc., be used in this Work, the Contractor shall acquire the right to use same. The Contractor shall hold the DFW Board and his agents harmless for any delay, action, suit, or cost growing out of the patent rights for any device on this Project.
2. Copyrights: Should copyrighted software be used in this Work, the Contractor shall acquire the right to use same. The Contractor shall hold the DFW Board and his agents harmless for any delay, action, suit, or cost growing out of the copyrights for any software on this Project.
3. License to Use: All software required for the complete operation of the system as specified herein shall be delivered with either full Ownership transferred to the DFW Board or a non-time limited License to use on each machine it is installed on, including the right to make backup copies.
4. Software Master Source Code: The DFW Board shall be provided with the master source code for all proprietary manufacturer specific software, or the manufacturer shall enter into a master source code escrow agreement



whereby the source code shall be turned over to the DFW Board at no cost to the DFW Board in the event that the manufacturer should enter bankruptcy or discontinue support of the product. The source code shall be put into escrow along with the base operating system, all tools such as editors, compilers, linkers, etc., which are required to rebuild and operate the system, and any other documentation required. The operating system and utilities and programs can be licensed copies of same, not the source code. The intent is to provide everything required allowing the DFW Board to install, edit, and re-compile the program with any changes.

### **PART 3 – EXECUTION**

#### **3.1 EXAMINATION**

- A. The Owner assumes no responsibility or liability for transportation from country of origin, storage fees, drayage, import taxes, duty taxes, or other costs associated with the delivery and storage of system components.
- B. The Contractor shall be responsible for any and all loss or damage in the shipment and delivery of all material until transfer of title to the Owner.
- C. The Contractor shall store products in accordance with manufacturer's instructions, within Contractor's staging area and with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.
- D. All data and low voltage conduit shall be provided with orange labels with black lettering unless otherwise noted.
- E. The Contractor shall provide coverings to protect products from damage from traffic and construction operations, remove when no longer needed.
- F. The Contractor shall ensure that all work performed is in accordance with the requirements and standards defined and referenced herein. Any work performed in deviation with these documents, any of the referenced material, or any applicable standards or requirements, shall immediately be corrected by the Contractor without additional charges, regardless of the stage of completion. The Contractor shall record all inspection observations. As a minimum, the record shall include the name(s) of personnel conducting the inspection, a brief description of the inspection and the observations. These records shall be available for the Owner to review at any time. Also, these records shall be delivered to the Owner before Final Completion.
- G. Installation Inspections: Installation inspections shall be undertaken through the performance of pre-installation, in-progress, and final inspections as follows:
  - 1. Pre-Installation Inspection: The Contractor shall make an inspection of all equipment and material to be used prior to installation. All items shall be verified for compliance with the requirements of these Specifications and all other applicable standards. All equipment, cable, and associated hardware identified for installation shall be inspected for damage and completeness utilizing standard practices to determine integrity and acceptability.

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2. In-Progress Inspection: At the Owner's discretion, the Contractor shall perform in-progress inspections that shall include visual inspections of equipment, wiring practices, cabling, placement of equipment, marking of cables and adherence to safety procedures. In addition, the Owner, or his representative, may conduct additional inspections any time.
3. Final Inspection: The Contractor shall conduct a final inspection that encompasses all portions of the installation. This inspection shall be performed to ensure that all aspects of the installation have been performed in accordance with these Specifications, standard industry practices and the publications referenced herein. All non-compliance items shall be noted by the Contractor during this inspection. The Owner shall witness this inspection.
4. Corrective Action and Verification Inspection: The Contractor shall perform all corrective actions to ensure that all non-compliance items identified during the final inspection have been corrected.

### 3.2 INSTALLATION

- A. Standards: All installation activities shall be performed in a neat and professional manner in accordance with all applicable local and national codes. Additionally, the Contractor and all subsequent Sub-Contractors employed to satisfy the requirements of these specifications shall obtain, or satisfy, the following prior to installation:
  1. All licenses and permits
  2. All insurance and bonding as required
  3. All other standards or requirements specified in this document
- B. The Contractor shall install and inspect all hardware required in this specification in accordance with the manufacturer's installation instructions.
- C. The Contractor shall adhere to the following during installation of the system:
  1. Underwriter's Laboratories (UL) listing for restricted access installations in business and customer premises applications. This listing is required by the National Electric Code for customer premise installations.
  2. Fire resistance requirements specified by Underwriter's Laboratories in UL 1459, 2nd edition.
- D. System installation and construction methods shall conform to the requirements of the Dallas / Fort Worth International Airport.
- E. Where undefined by codes and standards, the Contractor shall apply a safety factor of at least two (2) times the rated load to all fastenings and supports of system components.
- F. The Contractor shall install all system components including furnished equipment, and appurtenances in accordance with the manufacturer's instructions, and shall furnish all cables, connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.

- G Rack Mounted Equipment:
  - 1. As a general practice, the Contractor shall run power cables, control cables, and high level cables on the left side of an equipment rack as viewed from the rear.
  - 2. The Contractor shall run other cables on the right side of an equipment rack, as viewed from the rear.
  - 3. For equipment mounted in drawers or on slides, provide the rack accessories as well as interconnecting cables with a service loop of not less than three feet and ensure that the cable is long enough to allow full extension of drawer or slide.
- H. Final hardware selected and installation of hardware shall be submitted for review by the Owner. Additionally, the Contractor shall review the cabinets and equipment room to ensure ventilation requirements are met or recommend modifications.
- I. The Contractor shall place materials only in those locations that have been previously authorized. Any other locations shall be authorized, in writing, by the Owner.
- J. The Contractor shall provide all tools, applications and test equipment required to install, verify, and test the installation and to determine that it meets the specifications. The Contractor shall furnish all necessary materials required to implement and to achieve the required work performance.

### 3.3 FIELD QUALITY CONTROL

- A. General: Provide field quality control to ensure system components are installed in accordance to the contract documents prior to system startup.
- B. Project Testing: The system installation shall not be considered complete until On-Site Testing is completed. The purpose is to test the complete system and demonstrate that all specified features and performance criteria are met. All requirements of the specification shall be tested, including:
  - 1. Functionality, including reporting and response
  - 2. System capacity
  - 3. Hardware
  - 4. Failure Recovery
- C. Test Plan/Procedure: The Contractor shall provide six (6) copies of the proposed test plan/procedures for each testing phase for review by the Owner. The test plan for each phase of testing shall detail the objectives of all tests. The tests shall clearly demonstrate that the system and its components fully comply with the requirements specified herein. The submission of Test Plans shall adhere to the following:
  - 1. A draft test plan shall be presented to the Owner at least forty-five (45) days prior to the scheduled start of each test.
  - 2. A workshop for reviewing comments shall be conducted with the Owner at least thirty (30) days prior to the scheduled start of each test.
  - 3. The Contractor shall revise the draft test plan in response to Owner comments.

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4. A final test plan shall be submitted to the Owner at least fourteen (14) days prior to the scheduled start of each test
- D. Test plans shall contain at a minimum:
1. Functional procedures including use of any test or sample data.
  2. Test equipment is to be identified by manufacturer and model.
  3. Interconnection of test equipment and steps of operation shall be defined.
  4. Expected results required to comply with specifications.
  5. Traceability matrix referencing Specification requirements with specific test procedures.
  6. Record of test results with witness initials or signature and date performed.
  7. Pass or fail evaluation with comments.
- E. The test procedures shall provide conformity to all Specification requirements. Satisfactory completion of the test procedure is necessary as a condition of Final Completion.
- F. All Test plans must be reviewed by the Owner. To successfully complete a test, the test document must be signed and dated by both the Contractor and the Owner.
- G. The Owner will review, witness and validate the execution of all formal test procedures prepared by the Contractor and deliverable under the contract to assure the tests cover all requirements and that there is a conformity between the conducted test, the test results and Specification requirements.
- H. Documentation verification both interconnects and operationally, shall be part of the test. Where documentation is not in accordance with the installed system interconnect and operating procedures, the system shall not be considered accepted until the system and documentation correlate.
- I. The Contractor shall provide the Owner or Owner representative the opportunity(s) to participate in any or all of tests.
- J. Test Reports: The Contractor shall prepare, for each test, a test report document that shall certify successful completion of that test. Six (6) copies of the test report shall be submitted to the Owner representative for review and acceptance within seven (7) days following each test. The test report shall contain, at a minimum:
1. Commentary on test results.
  2. A listing and discussion of all discrepancies between expected and actual results and of all failures encountered during the test and their resolution.
  3. Complete copy of test procedures and test data sheets with annotations showing dates, times, initials, and any other annotations entered during execution of the test.
  4. Signatures of persons who performed and witnessed the test.
- K. Test Resolution: Any discrepancies or problems as a result of the system installation discovered during these tests shall be corrected by the Contractor at no cost to Owner. The problems identified in each phase shall be corrected and

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the percentage of the entire system re-tested determined by the Owner before any subsequent testing phase is performed.

- L. Factory Acceptance Testing: The purpose of this test is to validate that the individual system components function as standalone equipment and all specified features are met.
1. The Contractor shall ensure that development of the system is complete, required approvals of submittals have been obtained, and sufficient equipment has been procured to completely demonstrate and test the system.
  2. Factory Acceptance testing shall be completed at an Owner authorized test site.
  3. Test Setup Equipment: Equipment shall be the actual products or identical models of products to those designated to be delivered and installed at the site. The following equipment shall be setup and used for conducting pre-delivery test:
    - a. Equipment associated with the system
    - b. Devices associated with the system
    - c. Software associated with the system
    - d. Administrative tools and equipment
    - e. Sufficient data to provide accurate simulation of all potential permutations of operational conditions as required by design
  4. Acceptance: Acceptance of system to perform sufficiently and provide specified functions shall be determined by the Owner. Testing may be witnessed by additional Owner authorized personnel.
  5. Acceptance Criteria: Performance of system shall equal or exceed criteria stated in individual Sections.
  6. If system does not perform satisfactorily, the Contractor shall make corrections and modifications and schedule new test with the Owner.
  7. Reporting:
    - a. Record all test procedures and results.
    - b. Submit report in accordance with reporting requirements in General Testing Requirements Section.
- M. Integration Testing:
1. The purpose of this test is to validate integration between the system and other interfaced subsystems or systems and to demonstrate that all specified features are met. All requirements of the System integration shall be tested including connectivity, interaction, interface, format, and data flow.
  2. Integration testing shall be completed at the systems integration laboratory or other authorized location on-site. Interfaces may be tested using simulated data to/from other systems.
  3. Field Testing: All cabling and connectors shall comply with and be tested to ANSI/TIA/EIA-568B.3 and as specified in Part 3.

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4. Test Setup Equipment: Equipment shall be actual products or identical models of products to those designated to be delivered and installed at the site. The following equipment shall be setup and used for conducting the test:
  - a. Equipment associated with the system
  - b. Devices associated with system
  - c. Software associated with system
  - d. Administrative tools and equipment
  - e. Sufficient data to provide accurate simulation of all potential permutations of operational conditions as required by design
5. Acceptance: Acceptance of system to perform sufficiently and provide specified functions shall be determined by the Owner. Testing may be witnessed by additional Owner personnel.
6. Acceptance Criteria: Performance of system shall equal or exceed criteria stated in Related Sections.
7. If system does not perform satisfactorily, the Contractor shall make corrections and modifications and schedule new test with the Owner.
8. Reporting:
  - a. Record all test procedures and results.
  - b. Submit report in accordance with reporting requirements in General Testing Requirements Section.

#### 3.4 CLOSEOUT ACTIVITIES

- A. Final Completion: The Contractor shall develop a Final Test and Completion (FTC) plan. The plan shall identify each component of the system, intent of test, method or methods of test and expected results. Each component listed in the plan shall include space for test party signatures, brief comments, time of test and pass/fail check boxes. The plan shall be submitted to DFW for approval or comment. When DFW Final Test and Completion comments are satisfied and the system is operational, the testing may begin. All components must be checked "pass", signed by all parties and agree with the transaction log to be complete.
- B. System warranty shall not start until Final Completion. Final Completion will be withheld until the following activities have been successfully completed:
  1. Acceptance of all submittals.
  2. Delivery of final documentation.
  3. Successful Final Test and Completion testing.
  4. Successful training and demonstration, including operation of system using the manuals and demonstration of fully functional system with interfaces.
  5. Purging of Contractor user privileges.

#### END OF SECTION

**SECTION 27 05 26**  
**GROUNDING AND BONDING FOR COMMUNICATIONS**

**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 telecommunications grounding systems in Telecommunications Rooms.
- C. Included in this section are the minimum composition requirements and installation methods for the following:
  - 1. Telecommunications Grounding Busbars
  - 2. Ground Blocks
  - 3. Compression Lugs

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. CR Communications Room
  - 5. DFW Dallas/Fort Worth International Airport
  - 6. EIA Electronics Industries Alliance
  - 7. NECA National Electrical Contractors Association
  - 8. NEMA National Electric Manufacturers Association
  - 9. NFPA National Fire Protection Association
  - 10. OAR Owner's Authorized Representative
  - 11. RCDD Registered Communications Distribution Designer
  - 12. RFP Request for Proposal
  - 13. STD Standard
  - 14. TGB Telecommunications Grounding Busbar
  - 15. TIA Telecommunications Industry Association
  - 16. TMGB Telecommunications Main Ground Bus Bar Underwriters Laboratories
  - 17. UL Telecommunications Main Ground Bus Bar 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 telecommunications grounding systems.
- 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
  - 2. ANSI/NECA/BICSI-568 — Standard for Installing Commercial Building Telecommunications Cabling, 2006



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-C— Commercial Building Standard for Telecommunications Pathways and Spaces, 2012
6. ANSI/TIA/EIA-606-A— Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 1993-2002
7. ANSI-J-STD-607-A— Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002
8. ANSI/TIA-942 — Telecommunications Infrastructure Standard for Data Centers, 2005
9. NFPA 70 — National Electrical Code, 2011
10. BICSI — Telecommunications Distribution Methods Manual, 13th Edition, 2014
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**

## GROUNDING AND BONDING FOR COMMUNICATIONS

### Section: 27 05 26

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- 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 43.
- C. Provide all submittal requirements under this section as a single package.
- D. Provide product data for the following:
  - 1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
  - 2. Proposed format of as-built documentation.

#### 1.9 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.

1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
2. Provide above closeout documentation as an electronic file in PDF format.

B. Warranty and Maintenance:

1. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.
- B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.
- C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- D. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- E. Contractor is responsible for on-site security of tools, test equipment and materials.
- F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

- A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.
- B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

1.12 WARRANTY

- A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01. Repair or replace defects occurring in labor or product within the Warranty period without charge.
- B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

**PART 2 — PRODUCTS**

2.1 GENERAL

- A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.
- B. The wall-mounted TGB will be provided by the electrical contractor under direction from the electrical design drawings and specifications.

## 2.2 TELECOMMUNICATIONS GROUNDING BUSBAR

- A. Telecommunications Grounding Busbars in the Communications Rooms are being done by the Division 26 contractor under direction of the Division 26 specification 26 05 26.
- B. Telecommunications Grounding Busbar and associated Earthing for the Communications Interface Manholes is to be done under this specification and associated drawing set.

## 2.3 BONDING ACCESSORIES

### A. Lay-In Ground Terminal Block

1. Ground terminal block shall be made of electroplated tin aluminum extrusion.
2. Ground terminal block shall accept conductors ranging from #14 AWG through 1/0.
3. The conductors shall be held in place by two stainless steel set screws.
4. Ground terminal block shall have two 1/4" (6.4 mm) holes spaced on 5/8" (15.8 mm) centers to allow secure two-bolt attachment to the rack or manhole.
5. Ground terminal block shall be UL Listed as a wire connector.
6. Acceptable products:
  - a. Chatsworth Products 40167-001
  - b. Owner Approved Equivalent

### B. Compression Lugs

1. Compression lugs shall be manufactured from electroplated tinned copper.
2. Compression lugs shall have two holes spaced on 5/8" (15.8 mm) or 1" (25.4 mm) centers, as stated below, to allow secure two bolt connections to busbars.
3. Compression lugs shall be sized to fit a specific size conductor, sizes #6 to 4/0, as stated below.
4. Compression lugs shall be UL Listed as wire connectors.
5. Acceptable products:
  - a. Panduit LCC Series
  - b. Chatsworth Products 40162
  - c. Owner Approved Equivalent

**PART 3 — EXECUTION**

**3.1 INSTALLATION**

**A. Telecommunications Grounding Busbar**

1. Every Communications Interface Manhole shall be bonded to a ten-foot ground rod placed within the general footprint of said manhole.
2. Minimum bonding connection to manholes shall be made with a rack-mount 2-hole ground terminal block sized to fit the conductor and installed according to manufacturer recommendations.
3. Bond metallic conduits at one end to proper ground.
4. Provide maximum 0.5 Ohm resistance at 0.05 volts at each ground bar.

**B. Ground Terminal Block**

1. Every rack and manhole shall be bonded to the TMGB or TGB.
2. Minimum bonding connection to racks and manholes shall be made with a rack-mount 2- hole ground terminal block sized to fit the conductor and rack and installed according to manufacturer recommendations.
3. Remove paint between rack/ manhole and terminal block, clean surface and use antioxidant between the rack and the terminal block to help prevent corrosion at the bond.

**C. Grounding Voice and Data Systems**

1. Provide an approved ground at all newly installed distribution frames and protector locations using proper bonding to any existing facility. Ensure ground continuity by properly bonding to any existing facility. Ensure ground continuity by properly bonding all appropriate cabling, closures, manholes, service boxes, and framework. All grounds shall consist of minimum #6 AWG copper wire and shall be supplied from the Telecommunications Main grounding Busbar or a Telecommunications Grounding Busbar.
2. Bond metallic conduits at one end to proper ground.
3. Provide maximum 0.5 Ohm resistance at 0.05 volts at each ground bar.
4. Ground electronic components, equipment manholes and racks, cable trays and cable racks.
5. Provide ground lead for copper cable in multiples of 25 or more.
6. For overall-shielded cable, bond shield to proper grounding sources at one end. Do not loop ground leads or share with conduit ground leads.

**3.2 TESTING**

- A.** The intent of the grounding design for the communication systems is to provide adequate safety grounding within the communications rooms and to provide a proper reference ground for reliable operation of the communication and data systems.

To this end, three tests will be performed:

1. Two Point Bonding Measurements — This test is intended to verify that the communication room bus bar is satisfactorily grounded to the ground loop

conductor which surrounds the garage structure. The resistance of this loop to remote ground has already been tested separately. Refer to electrical drawing, Electrical Grounding Riser Diagram for the general configuration of the grounding system.

Note that the power system grounds and the communication system grounds are intended to be kept separate except where they are connected together via the ground loop conductor. Since the power system grounding system is connected to the grounding loop, any nearby power system grounding component is a point that can be used for testing. The closest point is the ground (not neutral) bus bar in the power panel that is located in the communication room.

In order to perform this test, first visually verify that there is no direct grounding connection between the communication grounding bus bar and the power panel ground bus. Using an earth ground resistance tester, measure the resistance between the communication ground bus bar and the ground bus in the power panel. From the BICSI TDMM, the recommended maximum resistance from the communication ground bus bar to the ground loop is 0.1 ohms. (note that this test will include the resistance of the power system grounding riser, but the total is anticipated to be less than 0.1 ohms).

2. Spurious Ground Test — This test is intended to evaluate the degree to which the communication grounding bus bar is isolated from paths to ground other than the intended ground. To perform this test, disconnect the ground conductor which connects “downward” toward the grounding loop from the communication grounding bus bar. Using an earth ground resistance tester, measure the resistance between the communication ground bus bar and the ground bus in the power panel. The resistance should be 1000 Ohms or greater.
3. Root Mean Square Current Testing — These tests are to reveal the presence of unwanted AC or DC current flow on the bonding conductor. To perform this test, disconnect the ground conductor which connects “downward” toward the grounding loop from the communication grounding bus bar. Then connect the “downward” conductor in series through a ammeter to the communication bus bar. Measure both AC and DC current. Per the BICSI TDMM, the DC current should be less than 0.5 amps and the AC current should be less than 1.0 amp.

### 3.3 COMMISSIONING

- A. Upon approval or the Contractor’s test report, and at the time set by the Consultant, demonstrate that the final system adjustments and tests meet the specified requirements. Provide all labor, materials, tools and measurement equipment for these tests and adjustments.
- B. The Contractor is responsible for all costs incurred to satisfy criteria requirements.
- C. Deliver “Operation and Maintenance” manuals and “Instruction Guides” to Owner.

### **END OF SECTION**

**SECTION 33 71 19**  
**ELECTRICAL UNDERGROUND DUCTS, DUCTBANKS, AND MANHOLES**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Conduit and duct:
  - 1. Galvanized steel rigid metal conduit (RMC).
  - 2. Rigid polyvinyl chloride (PVC) conduit.

1.02 RELATED REQUIREMENTS

- A. TxDOT 421 Hydraulic Cement Concrete.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2015.
- B. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- C. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.
- D. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2016.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- G. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- H. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Product Data: Provide for metallic conduit and nonmetallic conduit.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

**PART 2 PRODUCTS**

2.01 CONDUIT AND DUCT

- A. Galvanized Steel Rigid Metal Conduit (RMC): NFPA 70, Type RMC; comply with ANSI C80.1 and list and label as complying with UL 6.

1. Fittings: Comply with NEMA FB 1 and list and label as complying with UL 514B; steel or malleable iron, threaded type.
- B. Rigid Polyvinyl Chloride (PVC) Conduit: NFPA 70, Type PVC; comply with NEMA TC 2 and list and label as complying with UL 651; Schedule 40 unless otherwise indicated; rated for use with conductors rated 90 degrees C.
  1. Fittings: Comply with NEMA TC 3 and list and label as complying with UL 651.
    - a. Manufacturer: Same as manufacturer of conduit to be connected.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify routing and termination locations of duct bank prior to excavation for rough-in.
- B. Ductbank routing is shown in approximate locations unless dimensions are indicated. Route as required to complete duct system.

#### **3.02 DUCT BANK INSTALLATION**

- A. Install duct to locate top of ductbank at depths as indicated on drawings.
- B. Install power and communications duct to locate top of ductbank minimum 24 inches below finished grade in areas not subject to deliberate traffic and 30 inches in deliberate traffic paths.
- C. Support duct on duct spacers with duct size, duct spacing, and outdoor temperature.
- D. Spacer installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
- E. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct or duct groups.
- F. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
- G. Concreting Sequence: Pour each run between termination points in one continuous operation.
- H. Pouring Concrete: Provide concrete encasement material in accordance with TXDOT Item 421, "Hydraulic Cement Concrete", Class A. Where conduit bends



**ELECTRICAL UNDERGROUND DUCTS, DUCTBANKS, AND MANHOLES**  
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are less than 80-foot radii, encase in concrete. Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application

- I. Install duct with minimum slope of 4 inches per 100 feet (100 mm per 25.4 m) (0.33 percent). Slope duct away from building entrances.
- J. Cut duct square using saw or pipe cutter; de-burr cut ends.
- K. Insert duct to shoulder of fittings; fasten securely.
- L. Install no more than equivalent of three 90-degree bends between pull points.
- M. Provide suitable fittings to accommodate expansion and deflection where required.
- N. Stagger duct joints vertically in concrete encasement 6 inches minimum.
- O. Provide minimum 3 inch concrete cover at bottom, top, and sides of ductbank.
- P. Provide two No. 4 steel reinforcing bars in top of bank under paved areas.
- Q. Connect to existing concrete encasement using dowels.
- R. Provide suitable pull string in each empty duct except sleeves and nipples.
- S. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.

**END OF SECTION**

**SECTION SS-1  
V-TRACK SLIDING GATES**

**PART 1 - GENERAL**

1.1 SUMMARY

- A. Section includes: Chain-link V-track security gate with galvanized steel round rods welded into modular panels, including steel fence posts and guide track.
- B. Related sections:
  - 1. TxDOT 421 Hydraulic Cement Concrete
  - 2. Section F-164 Gate Operators.
  - 3. Section F-162 Chain Link Fences

1.2 REFERENCES

- A. ASTM International(ASTM):
  - 1. ASTM A36 – Carbon Structural Steel.
  - 2. ASTM A121 – Metallic-Coated Carbon Steel Barbed Wire.
  - 3. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 4. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
  - 5. ASTM D822 - Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
  - 6. ASTM D2794 - Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

1.3 SUBMITTALS

- 1. Product data for components and accessories.
- 2. Shop drawings showing layout, dimensions, spacing of components, and installation details.

1.4 WARRANTY

Provide manufacturer's standard limited warranty covering cantilever slide gate and truck assembly against failure resulting 'from normal use for period of 5 years from date of purchase. Failure is defined as any defect in manufacturing that prevents the gate from operating in a normal manner.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

Products from qualified manufacturers having a minimum of 5 years' experience manufacturing steel slide gate will be acceptable by the Owner as equal, if approved in writing, ten days prior to bidding, and if they meet all of the following specifications for design, size gauge of metal parts and fabrication.

Obtain chain link fences and gates, including accessories, fittings, and fastenings, from a single source.

**2.2 MATERIALS**

A. Steel bar stock: ASTM A36.

B. Steel tubing: ASTM A500, Grade B.

C. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, and water-reducing and plasticizing additives.

D. Fence Frame:

1. ASTM F 1043 for framing and ASTM F 1083 for Group IC round pipe.
2. Fence Height shall be as shown on the drawings and the Standard Details.
3. Strength Requirement shall be as required for light industrial according to ASTM F 1043.
4. Horizontal Slide Gate Posts shall be Class 2 and shall meet the requirements of ASTM F 1184.
5. Bracing shall be provided by diagonal adjustable length truss rods of 3/8" galvanized steel, in each panel of gate frames.
6. Finish shall match the fence.

E. Gate Type: V-wheeled rolling gates.

1. Welded frame fabricated from 2" by 2" [51 mm by 51 mm] steel tubing to match fencing material. Frame configuration shall be as indicated on Drawings and approved shop drawings.
2. Rolling mechanism: Steel wheels with V-shaped edge groove and 4 inches [102 mm] diameter, mounted to gate frame and riding on ground set V-track. Assembly braced at top by adjustable guide wheels mounted with brackets to support posts.

F. Gate In-fill / Fabric: 9 gauge, 2 in. galvanized steel chain link mesh.

G. Barbed wire: Three twisted strands of ASTM A121 galvanized 12 gage wire with

## V-TRACK SLIDING GATE

### Section: SS-1

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#12 gage four point round barbs at 5 inches. In addition, razor wire shall be looped and attached on top of the fence in 18 in. loops.

- H. Gate Signs. All AOA security fences and gates shall be equipped with security signage conforming to the Airport requirements. Sign specifications approved by the DPS can be obtained from the DFW Sign Shop.
- I. Coordinate provision of gate with electric operator specified in Section F-164 Gate Operators, to ensure size, weight, and design of gate is compatible with operator.

### 2.3 FACTORY FINISH

- A. Steel fence panels and posts shall be hot-dip galvanized to 1.25 ounces per square foot minimum zinc coating in accordance with ASTM A123. Standard size components shall receive polyester powder coating.
- B. Polyester powder coating: Electrostatically applied colored polyester powder coating heat cured to chemically bond finish to metal substrate.
  - 1. Minimum hardness measured in accordance with ASTM D3363: 2H.
  - 2. Direct impact resistance tested in accordance with ASTM D2794: Withstand 160 inch-pounds.
  - 3. Salt spray resistance tested in accordance with ASTM B117: No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95 degrees F and 95 percent relative humidity and after 1000 hours less than 3/16 inch [5 mm] undercutting.

## PART 3 – CONSTRUCTION

### 3.1 PREPARATION

- A. Prior to construction, field verify required dimensions.
- B. Coordinate fence and gate installation with provision of gate operator specified in Section F-164, Gate Operators to ensure proper power supply and that conduit and wiring are concealed.

### 3.2 INSTALLATION

- A. Install gateposts in accordance with manufacturer's instructions.
- B. Do not install bent, bowed, or otherwise damaged panels. Remove damaged components from site and replace.
- C. Drill holes in 'firm, undistributed or compacted soil. Holes shall have a diameter 4 times greater than outside dimension of post, and depths approximately 6" [152 mm] inches deeper than the post's bottom elevation or as shown on the Plans or accompanying drawings. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36" [914 mm] below surface when in firm, undisturbed soil.

## **V-TRACK SLIDING GATE**

### **Section: SS-1**

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- D. Place concrete around post in a continuous pour, tamp for consolidation. Trowel finish around post and slope to direct water away from posts. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.
  
- E. Gates:
  - 1. Install gates and adjust hardware for smooth operation.
  - 2. Provide concrete surface for length of operation of V-wheeled rolling gate. Anchor track to concrete with countersunk fasteners.
  - 3. Attach hardware by means, which will prevent unauthorized removal.
  - 4. After installation, test gate and operator. Open and close a minimum of five times. Correct deficiencies and adjust.

### **PART 4 - METHOD OF MEASUREMENT**

- 4.1 Chain-link sliding gate will be measured as a complete unit for each location and as per opening size indicated on the Plans and or in the "Proposal Form."
- 4.2 Signage for sliding gate shall not be measured separately but shall be considered subsidiary to the gate.

### **PART 5 - BASIS OF PAYMENT**

- 5.1 Payment for Chain-link sliding gate will be made at the Contract unit price per each gate at the specified size. The unit price for each gate shall include all products, installation and adjusting of the completed sliding gate. The price shall be full compensation for furnishing all materials, fabrication of gate components and fittings, installation of all major components and appurtenances as shown on the construction Plans all labor equipment, tools, and incidentals necessary to complete this Item.

**END OF SECTION**

**SECTION SS-2**  
**LINEAR CRASH GATE SYSTEM**

**PART 1 – GENERAL**

1.1 SCOPE

This specification defines the DELTA LINEAR CRASH GATE SYSTEM (ROLLING GATE), Model TT280, consisting of a crash rated linear gate; ground track; end support buttresses; rack and pinon drive operator and associated controls and safety equipment.

The gate shall be an above grade assembly consisting of a heavy steel structure capable of being opened and closed in a linear motion. When in the closed position it shall present a formidable obstacle to approaching vehicles. Upon impact, forces shall be first absorbed by the gate assembly and then transmitted to the end support buttresses and their foundations

1.2 RELATED WORK ITEMS

- A. F-164 Slide Gate Operators
- B. F-162 Chain Link Fence
- C. ASTM F1184 – Standard Specification for Industrial and Commercial Horizontal Slide Gates

1.3 SUBMITTALS

- A. Product data for components and accessories.
- B. Shop drawings showing layout, dimension, spacing of components, and installation details.

1.4 WARRANTY

The products shall be warranted by the manufacturer against manufacturing defects for a period of one year (365) days after delivery. The obligation under this warranty shall be to repair any defective product, without charge to Buyer.

**PART 2 – PRODUCTS**

2.1 LINEAR CRASH GATE

- A. The design of the gate system shall have been confirmed by the detailed examination of the structure with a finite structural analysis computer program. A print out of the analysis defining loads and moments at all nodes, connections and reaction points, the stresses in each element and quad plate shall be available with each system. Further, the design and performance of the Linear Crash Gate shall have been verified in a full-scale crash test and certified by an independent engineering laboratory.

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- B. The lower portion of the gate shall constitute a crash beam designed to withstand the vehicle impact defined herein. The superstructure of the gate shall provide a solid frame work to which bars, panels, grills, or decorative materials can be attached as defined by the architect.
- C. Gate Height. Height of the gate shall be a minimum of 72 inches (1.82 M) from the road surface to the top of the gate frame.
- D. Gate Length. Length shall be suitable to close and protect a 480 inch (12.19 M) clear opening.
- E. Finish. The gate and end support buttresses of the system shall be mechanically and chemically cleaned and painted with one coat of grey primer paint per manufacturers specification.

## 2.2 DRIVE SYSTEM

The linear crash gate shall be positioned and locked in place by an electro-mechanical linear gate operator. The specifications are further described in Section F-164, Slide Gate Operators.

### 2.2.1 OPERATOR SYSTEM CONFIGURATION

- A. Position Sensors. The control positions of the moving gate will be established by means of contacting sensors. These sensors which will interface with the system logic and control circuits will be sealed from the environment.
- B. Control and Logic Operating Voltage. All controls, sensors and sensor signals are to be 24 VAC (nominal). The low voltage is to be supplied from the control and logic module.
- C. Operator Access. The operator shall be available for servicing and repair by removing a cover. All components will be accessible when the cover is removed. The cover will be secured in place by means of hex head machine screws. (A lock and hasp for securing the cover can be specified as an option.)
- D. Operator Finish. The foundation base and all frame members of the operator shall be galvanized, electroplated or otherwise treated for corrosion resistance. The operator cover shall have a rust inhibiting enameled surface

### 2.2.2 CONTROL AND LOGIC CIRCUITS - The following circuits and control stations shall be furnished.

- A. Power consumption. The control circuit power consumption shall not exceed 2 amps' basic load.

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- B. Synchronization Signal. The system control and logic circuit shall have a separate output contact for operating or interfacing the gate with other security devices. This output will signal either an open or a full closed gate.

**PART 3 - EXECUTION**

**3.0 SITE INSPECTION**

- A. Examine final grades and installation conditions and do not begin work until all unsatisfactory conditions are corrected.

**3.1 INSTALLATION**

- A. Install crash gate in accordance with manufacturer's instructions.
- B. Contractor shall verify and be responsible for all dimensions and conditions at the job site.
- C. Foundation concrete may be placed directly into neat excavations, provided the sides of the excavation are stable. Where caving occurs, provide shoring, Type and method of shoring shall be at contractor's option.
- D. The excavation shall be kept dry at all times. Ground water, if encountered, shall be pumped from the excavation.
- E. Operator Construction. The operator shall be constructed in a manner to insure long trouble free operation and capable of operating in extreme environmental conditions. It will be constructed so that servicing and repair work when needed can be performed with standard readily available tools and components.
- F. Install grounding rods in accordance with Section 26 05 26.
- G. Power Off Operation. In the event of a power off condition the operator can be disengaged from the gate by releasing the brake mechanism mounted on the motor. The gate shall then be capable of being pushed either open or closed without damage to the drive components
- H. Handing of the Gate and Operator. The gate operator shall be left handed for Gate 327.

**4.0 PART 4 - PERFORMANCE AND VALIDATION**

**4.1 PERFORMANCE LINEAR CRASH GATE**

- A. EXPERIENCE. The Linear Gate and auxiliary equipment shall be of a proven design, supported by a detailed finite structural analysis utilizing advanced computer technology.
- B. QUALIFICATION TESTS. The Linear Gate shall have successfully passed full



## **CRASH GATE SYSTEM**

### **Section: SS-2**

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scale crash tests performed by an independent agency.

- C. Performance Evaluation. The barricade shall have a performance evaluation per D.O.S. Specification SD-SDT-02.01 (dated April 1985) of K12/L3.0 (15,000 pound vehicle @ 50 mph, less than 3 foot penetration for 12 ft opening).

#### **4.2 PERFORMANCE OPERATOR/GATE SYSTEM**

- A. GATE OPERATING SPEED (60 Hz local power). The operator system shall be capable of driving the gate at 36 feet per minute (FPM).
- B. CAPACITY. For a gate operating on a level track and with the wheel, bearings, and guides in good operating condition and no obstructions, the operator shall handle the gate without overheating the drive motor.

#### **4.3 QUALITY ASSURANCE PROVISIONS**

- A. TESTING. Upon completion, the system operator will be fully tested in the manufacturer's shop. In addition to testing to verify function, the following checks shall be made:
- Identification. A nameplate with manufacturer's name, model number, serial number and year built shall be located within the maintenance access area.
  - Workmanship. The gate/operator system shall have a neat and workmanlike appearance.
  - Dimensions. Principle dimensions shall be checked against drawings and ordering information.
  - Finish. Coatings shall be checked against ordering information and shall be workmanlike in appearance

#### **5.0 METHOD OF MEASUREMENT**

- 5.1 Linear Crash Gate will be measured as a complete unit for each location and as per opening size indicated on the Plans.
- 5.2 Signage for sliding gate shall not be measured separately but shall be considered subsidiary to the gate.

#### **6.0 BASIS OF PAYMENT**

- 6.1 Payment for Chain-link sliding gate will be made at the Contract unit price per each gate. The unit price for each gate shall include all products, installation and adjusting of the completed sliding gate. The price shall be full compensation for furnishing all materials, fabrication of gate components and fittings, installation of all major components and appurtenances as shown on the construction Plans all labor equipment, tools, and incidentals necessary to complete this Item.

**END OF SECTION**

**SECTION SS-3**  
**CRASH BARRIER ARM**

**PART 1 — GENERAL**

1.1. INCLUDED IN THIS SECTION

- A. Pre-wired drop arm vehicle barrier, including all selected attachments and accessory equipment. Complete with all pumps, valves, cylinders and electrical devices to move barrier arm and limit its travel in both directions.

1.2. RELATED WORK SPECIFIED ELSEWHERE

- A. Fencing: See Section F-162.
- B. Electrical service and connections: See Sections:
  - 26 05 19 Low-Voltage Electrical Power Conductors and Cables
  - 26 05 26 Grounding and Bonding for Electrical Systems
  - 26 05 33.13 Conduit for Electrical Systems
  - 26 05 33.16 Boxes for Electrical Systems
  - 26 05 53 Identification for Electrical Systems

1.3. SUBMITTALS

- A. Shop drawings: Submit drawings showing connections to adjacent construction, range of travel, and all electrical and mechanical connections to the barrier. All underground runs of electrical lines and inductive vehicle obstruction loop locations shall be indicated on drawings. Drawings shall also show the size and location of the concrete footings.
- B. Installation instructions: Submit two copies of manufacturer's installation instructions for this specific project.
- C. Submit manufacturer's completed warranty registration form to Project Manager.
- D. Project list: Submit list of product installations comparable to the subject job. Include date of product installation, installer, and owner's name and location of the project.
- E. Test reports:
  - 1. Submit affidavits from the manufacturer demonstrating that the barrier mechanism has been tested to 200,000 cycles without breakdown.
  - 2. Each operator shall bear a label indicating that the operator mechanism has been tested. Operator is tested for full power and pressure of all hydraulic components, full stress tests of all mechanical components and electrical tests of all overload devices.

1.4. QUALITY ASSURANCE

- A. Manufacturer: A company specializing in the manufacture of Anti-Ram barriers of the type specified, with a minimum of five years' experience manufacturing operators of this type and design.

- B. Installer: Must have a minimum of three years' experience installing similar equipment, or obtain other significant manufacturer endorsement of technical aptitude, if required, during the submittal process.
  - C. Distributor: All products proposed shall be within 150 miles of the Dallas Fort Worth International Airport. The distributor shall have sufficient parts in stock to repair equipment furnished. Organization shall have a minimum of five (5) years' experience and have furnished and installed equipment specified to at least five (5) similar installations.
- 1.5. **CODES AND REGULATORY REQUIREMENTS**
- A. Electrical Panels shall be built and labeled to UL508A standards. Complete all electrical work according to local codes and National Electrical Code. All fieldwork shall be performed in a neat and professional manner, completed to journeyman standards.
  - B. Vehicular barriers should never be used by pedestrians. A separate pedestrian entrance must always be provided when foot traffic is present.
- 1.6. **PRODUCT DELIVERY AND STORAGE**
- A. Store products upright in the original shipping containers, covered, ventilated and protected from all weather conditions.
- 1.7. **WARRANTY**
- A. Provide a warranty against all defects in materials or workmanship for five years or 500,000 gate cycles (whichever occurs first) after the date of installation. Defective materials shall be replaced at manufacturer's discretion with new or reconditioned materials furnished by the manufacturer, at no cost to the owner. Freight, labor and other incidental costs are not covered under the factory warranty, but may be covered by a separate service agreement between installing company and the owner.

## **PART 2 – PRODUCTS**

### **2.1 VEHICLE BARRIERS**

- A. HySecurity vehicle barrier model StrongArm™ M50, or other comparable barrier, as approved by the specifier. Substitute barriers that are approved will be published in an addendum, not less than ten days prior to bid opening. Requests for substitution will include the amount of savings to be passed on to the owner.

### **2.2 OPERATION**

- A. Operation shall be by means of dual acting hydraulic cylinder acting directly on the drop arm to move the arm through 90°. The arm travel time varies depending upon version ordered, see schedule below. Operation to the fully open and fully closed position shall be continuously monitored by an absolute position sensing device that accurately reads the position of the cylinder and arm. The system shall function normally without need for springs or weights to counterbalance the arm. Gears,

**CRASH BARRIER ARM**  
**Section: SS-3**

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sprockets, belts or pulleys shall not be incorporated in the operator. Arresting of vehicles shall be accomplished by polymeric straps suspended in the arm. All models include a variable speed motor drive and two brake valves to gradually stop and hold the arm without applying a shock load to the arm or barrier assembly. Barrier shall hydraulically lock in the closed position.

- B. The vehicle barrier shall be certified by a third party licensed engineer to be capable of withstanding a direct impact from a vehicle to the M50 level specified in ASTM F2656 for a minimum of one arm length between 12 ft to 24 ft. The vehicle barrier shall have successfully passed testing at an accredited test facility to ASTM F2656 as validation of the engineering certification.
- C. Safety Features shall include as a minimum:
  - 1. Lower barrier arm at a height of 18" from grade to prevent smaller vehicles from penetrating under the main barrier arm.
  - 2. The barrier arm shall contain LED warning lights to enhance night visibility.
  - 3. The barrier shall include a red — amber stoplight to display status to vehicles.
  - 4. A photoelectric eye capable of detecting a person or vehicle in the path of the barrier to prevent closure of the barrier arm when an obstruction is present. This feature shall not be active during Emergency Fast Close.
  - 5. Shield to prevent entrapment of bystanders between arm and catch post.
- D. Schedule of length and speed capacities:
  - 1. 12-14 ft clear opening: Travel time not to exceed six seconds from fully closed to fully open position. Maximum clear opening shall be 14 ft.
  - 2. 16-18 ft clear opening: Travel time not to exceed seven seconds from fully closed to fully open position. Maximum clear opening shall be 18 ft.
  - 3. 20-24 ft clear opening: Travel time not to exceed eight seconds from fully closed to fully open position. Maximum clear opening shall be 24 ft.
  - 4. All units shall contain, as standard equipment, a provision for Emergency Fast Close operation that shall move the barrier from fully open to the fully closed position in 1.5 seconds less than the normal travel time to open.
- E. Minimum standard mechanical components:
  - 1. Chassis: shall be 3/8" steel plate, welded, and edges ground smooth.

**CRASH BARRIER ARM**  
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2. Cover: shall be 14-gauge galvanized sheet steel, with a security lock to limit access.
3. Main shaft: shall be 3" diameter, high strength steel alloy.
4. Heavy duty sealed 1-15/16" bearings, with cast iron pillow blocks.
5. Resilient physical stop limiting open and close travel and to cushion stop at each end of travel.
6. Hydraulic hose: Shall be 3/8" wire braid reinforced, rated to 3,050 psi.
7. Hydraulic valves: Shall be individually replaceable cartridge type, in an integrated hydraulic manifold.
8. Hydraulic fluid: High performance type with a viscosity index greater than 375 and temperature range -40° F to 167° F (-40° C to 75° C). (optional biodegradable fluid requires a heater at temperatures below -10° F (-24° C))
9. A zero to 2,000 psi (13.7 MPa) pressure gauge, mounted on the manifold for diagnostics, shall be a standard component.
10. The hydraulic fluid reservoir shall be formed from a single piece of metal, non-welded, and shall be powder painted on the inside and the outside, to prevent fluid contamination.
11. Manual operation: in the event of a power outage the use of a "pull to release" bypass valve shall unlock the operator and allow the arm to be operated by a hand pump.
12. Arm: Aluminum oval shape for optimal strength, wind resistance and corrosion protection
13. Arm striping: shall be highly reflective alternating red and white vertical stripes, 16" (406 mm) intervals measured horizontally per MUTCD standards.
14. Finish: hot dipped galvanize coating per ASTM A123 G85.
15. Red LED lights shall be integrated into the barrier arm.

F. Minimum standard electrical components:

**All electrical and remote operation control components must be able to integrate and function within the existing Airport gate operating system.**

1. Pump motor: 2 hp, 3450 RPM, 56C, TEFC, three phase. (Note, the VFD converts single phase input power to drive a three-phase motor)
2. All components shall have overload protection.
3. Variable frequency drive to enable variable displacement pump operation.
4. Controls: Smart Touch Controller Board containing:
  - a. built in warning buzzer for Emergency Fast Close and in the event of Alerts, Faults, or Errors;

**CRASH BARRIER ARM**  
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- b. built in timer to close;
  - c. 32-character OLED display for reporting of functions and codes;
  - d. multiple programmable output relay options;
  - e. anti-tailgate mode;
  - f. built-in power surge/lightning strike protection;
  - g. Dual gate communication connection for bi-parting, sally port, or sequenced gates.
  - h. Electromechanical and solid state relays.
  - i. Radio option outputs.
- 5. Control circuit: 24 VDC.
  - 6. Transformer: 75 VA, non-jumpered taps, for all common voltages.
  - 7. Open and close limits shall be via encoder, providing continuous position sensing of arm position and the stop positions shall be adjustable from the controller with an LCD display.
- G. Optional control devices (choose one or more of the following): card reader, key switch, radio control, pushbuttons, free egress vehicle detectors, vehicle obstruction loop detectors, reset loop, keypads, seven day timers or various emergency vehicle open devices as dictated by local code.
  - H. Optional alert devices: Flashing lights or rotating beacon. Configurable audible beacon included as standard.
  - I. Other options (*choose from the following list*):
    - 1. 5" (127 mm) x 7" (177 mm) single piece aluminum arm with integrated LED lights on both sides from 12 ft (3,657 mm) to 24 ft (7,315 mm) in 2 ft (609 mm) increments.
    - 2. Optional Signal Yellow (RAL1003) or custom color TGIC polyester powder coating over zinc plating per ASTM B633 Type 3 SC-2.
    - 3. Main and remote operator panels.
    - 4. Magnetic Lock
    - 5. 208/230 VAC single phase and 208/230/460 VAC three phase available. 115 VAC single phase is not available. (50 Hz is available, specify voltage)
    - 6. UPS AC battery backup for systems up to 1 hp or VFD equipped. 208/230 VAC single phase only. 115 VAC single phase not available.
- 2.3. FACTORY TESTING
- A. Fully assemble and test, at the factory, each barrier to assure smooth operation, sequencing and electrical connection integrity.
  - B. Inspect and test all hydraulics are leak free.

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- C. Maintain records of material and process traceability for all critical structural elements.
- D. Check all mechanical connections for tightness and alignment. Check all welds for completeness and continuity.
- E. Inspect finishes for completeness. Touch up imperfections prior to shipment.
- F. Check all hydraulic hoses and electrical wires to assure that chafing cannot occur during shipping or operation.

**PART 3 — EXECUTION**

3.1. SITE EXAMINATION

- A. Locate concrete footings forms in accordance with approved shop drawings and in compliance with local building codes.

3.2. INSTALLATION

- A. Install barrier in accordance with the safety regulations and the manufacturer's product literature and installation instructions, current at the time of installation. Coordinate locations of operators with contract drawings; other trades and shop drawings.
- B. Installer shall ensure that the electrical service to the barrier is at least 20A. Electrical wiring to conform to NEC and manufacturer's installation instructions.
- C. Install grounding rods in accordance with Section 26 05 26.

3.3. BARRIER SITING AND SAFETY PRECAUTIONS:

- A. Careful consideration must be given to the selection, placement, and design of a vehicle barrier installation. As is the case with any active vehicle barrier system, perimeter security device, or security gate that blocks a roadway, it is essential to ensure that approaching vehicles as well as pedestrians are fully aware of the presence of the barrier and its operation. Installer will work with End User Customer to provide proper illumination and clearly worded signage (with appropriate graphics) warning of the barrier's presence and its hazards. It is recommended that a traffic and/or safety engineer be consulted before installing any active vehicle barrier and that an installation configuration be employed that physically limits approach speeds to no more than 20 MPH. End User Customer agrees that it will be responsible for selecting the location of the barrier and the configuration of approaches and warnings.

3.4. FIELD QUALITY CONTROL

- A. Test operator through ten full open and close cycles and adjust for operation without binding, scraping or uneven motion. Test limit switches for proper open and close limit positions.
- B. All anchor bolts shall be fully tightened in the finished installation.
- C. Owner, or owner's representative, shall complete "punch list" with installing contractor prior to final acceptance of the installation and submit completed warranty documentation to manufacturer.



3.5. CONTINUED SERVICE AND DOCUMENTATION

- A. Train owner's personnel on how to safely shut off electrical power, release and manually operate the barrier. Additionally, demonstrate the general maintenance of the gate operator and accessories and provide one copy of "Programming and Operations Manual" for the owner's use. Manuals will identify parts of the equipment for future procurement.

**END OF SECTION**

**SECTION F-162**  
**CHAIN-LINK FENCES**

**PART 1 — GENERAL**

- 1.1 DESCRIPTION - This Item consists of furnishing and erecting a chain-link fence in accordance with these specifications and the details shown on the Plans and in conformity with the lines and grades shown on the Plans or established by the Owner's Authorized Representative.
- A. Fence. The fence shall be the product of a manufacturer who has demonstrated by actual installations of a similar nature that its product is of the type required by these specifications. The Contractor shall include all supplementary parts necessary or required for a complete and satisfactory installation within the true meaning and intent of the Plans and these specifications. All runs of the fence shall present the same general appearance and the product of one manufacturer only will be accepted, except for items which do not influence the appearance of the completed fence. No used, rerolled, or open seam steel shall be permitted in posts, gate frames, rails, or braces for new fence installation.
  - B. Mow Strip. Fence may be specified with concrete mow strip as shown on the Plans.
  - C. Gates. Gates shall be constructed as described in SS-2 "Linear Crash Gate System."
- 1.2 Submittals Provide fence and gate material, layout and signage information for review by the Owner's Authorized Representative.

**PART 2 - MATERIALS**

- 2.1 FABRIC. The fabric shall be woven with a 9-gauge galvanized steel wire in a 2-inch (50 mm) mesh and shall meet the requirements of ASTM A 392, Class 2.
- 2.2 BARBED WIRE. Barbed wire shall be 3-strand 12-1/2 gauge zinc-coated wire with 4-point barbs and shall conform to the requirements of ASTM A 121, Class 3.
- 2.3 POSTS, RAILS AND BRACES. Line posts, rails, and braces shall be a C- Section roll formed from steel conforming to the requirements of ASTM A 570, Grade E, 1.875" x 1.625" with minimum bending strength of 247 pounds under a 6-foot cantilever load, or 2-3/8" outside diameter standard weight steel galvanized pipe with minimum bending strength of 201 pounds under a 6-foot cantilever load.

All end, corner, and pull posts and gate posts for gate leaves 6'-0" wide and less shall be roll formed sections 3.5"x 3.5" with minimum bending strength of 453 pounds on 6-foot cantilever load or 2-7/8" O.D. galvanized standard weight pipe with minimum bending strength of 381 pounds on 6-foot cantilever load.

Gate posts for gate leaves over 6'-0" wide shall be 4 inch O.D. galvanized pipe Schedule 40 conforming to ASTM A 120. Attachment of chain link fabric to roll formed

## CHAIN-LINK FENCES

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terminals shall be made by weaving directly into integral lock loops formed in the post.

Attachment of chain link fabric to tubular terminal posts shall be made with minimum 1/4" x 3.4" tension bar and 12 gauge x 1" wide clamps using minimum 3/8" diameter carriage bolts.

Top and brace rails shall be roll formed section of 1.625" x 1.25" channel shaped rail with minimum vertical bending strength of 192 pounds on 10-foot span or 1.66" O.D. standard weight galvanized pipe with minimum vertical bending strength of 202 pounds on 10-foot span.

Top rail couplings 6 inches minimum in length shall be spaced at maximum 21 foot centers, and 9-gauge minimum fabric tie wires shall be spaced at 24 inch maximum centers.

The dimensions of the posts, rails, and braces shall be in accordance with Tables I through VI of Federal Specifications RR-F-191/3.

- 2.4 WIRE TIES AND TENSION WIRES. Wire fabric ties, wire ties and tension wire for use in conjunction with a given type of fabric shall be of the same material and coating weight identified with the fabric type. Tension wire shall be 7- gauge coiled spring steel wire with the same or similar coating as the fabric type and shall conform to ASTM A 824. Wire fabric ties shall be hog rings, aluminum wire, or galvanized steel wire not less than 9-gauge.

All material shall conform to Federal Specifications RR-F-191/4.

- 2.5 MISCELLANEOUS FITTINGS AND HARDWARE. Miscellaneous steel fittings and hardware for use with zinc-coated steel fabric shall be of commercial grade steel or better quality, wrought or cast as appropriate to the article, and sufficient in strength to provide a balanced design when used in conjunction with fabric posts, and wires of the quality specified herein. All steel fittings and hardware shall be protected with a zinc coating applied in conformance with ASTM A 153. Barbed wire support arms shall withstand a load of 250 pounds (113 kg) applied vertically to the outermost end of the arm.

- 2.6 CONCRETE. See TxDOT 421 shall be of a commercial grade with a minimum 28-day compressive strength of 3000 psi (20,688 kPa) unless otherwise shown on the Plans.

- 2.7 MARKING. Each roll of fabric shall carry a tag showing the kind of base metal (steel, aluminum, or aluminum alloy number), kind of coating, the gauge of the wire, the length of fencing in the roll, and the name of the manufacturer. Posts, wire, and other fittings shall be identified as to manufacturer, kind of base metal (steel, aluminum, or aluminum alloy number), and kind of coating.

- 2.8 SIGNAGE. All AOA security fences and gates shall be equipped with security signage conforming to the following Airport requirements.

- A. Sign Material and Fabrication. All sign faces shall be manufactured of 3M Scotchlite High Intensity pressure-sensitive adhesive sheeting #3870, or approved equivalent. Sign layout shall be accomplished with two layers; the first for white background shall be 3M #3870 or approved equivalent; the second for color graphics shall be 3M Electronic Cuttable Film series #1170

or approved equivalent, and shall be reverse-weeded to reveal white base as copy color. Sheeting shall be of a matched component system and shall be applied per the manufacturer's recommendation. The Owner will inspect and approve the adhesion and application process as well as the sign construction environment and materials before signs are installed.

- B. Sign Blank. Sign blanks shall consist of 24"x30"x0.080 aluminum with 1 1/ " outside corner radii. Aluminum blank will be prepared prior to face application by surface treatment consisting of dipped acid etching and clear anodizing to enhance adhesion and minimize tarnishing. Each blank shall have one 3/16" diameter edge to provide for mounting on fence.
- C. Sign Background. The background shall be white reflective pressure sensitive film, 3M Scotchlite Series #3870 or approved equivalent, applied to blank.
- D. Branding/Logo. DFW Airport branding/logo shall be placed on the upper side of the fence sign.
- E. Legal Restriction Copy. Background shall be red, 3M Scotchlite Electronic cuttable film, #1172. All artwork and layout details will be provided by the Owner to the Contractor after award of the Contract.
- F. Sign Copy. Sign copy shall be as follows (see Plans for details):

Gate Sign:

RESTRICTED .....FHA Series C 3"  
AREA .....FHA Series C 3"  
AUTHORIZED ENTRY ONLY .....FHA Series C 2"

Fence Sign:

AIRCRAFT OPERATIONS.....FHA Series C 2"  
AREA.....FHA Series C 2"  
NO TRESPASSING.....FHA Series B 3"

- G. Gate Signage. AOA gates may require additional signage as shown on the Plans.
- H. Sign Fabricators. Signs may be purchased from Economy Sign or Centerline Supply of Dallas.

**PART 3 — CONSTRUCTION METHODS**

- 3.1 CLEARING FENCE LINE. All trees, brush, stumps, logs, and other debris which would interfere with the proper construction of the fence in the required location shall be removed a minimum width of 2 feet (61 cm) on each side of the fence centerline before starting fencing operations. The cost of removing and disposing of the material shall not constitute a pay item and shall be considered incidental to fence construction.
- 3.2 INSTALLING POSTS. All posts shall be set in concrete at the required dimension and depth and at the spacing shown on the Plans. Posts should be spaced not more than 10 feet (3 m) apart and should be set a minimum of 36 inches (90 cm) in concrete footings. If the frost depth is greater than 36 inches (90 cm), the posts

## CHAIN-LINK FENCES

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should be set accordingly. The postholes Shall be in proper alignment so that there is a minimum of 3 inches (75 mm) of concrete on all sides of the posts.

The concrete shall be thoroughly compacted around the posts by tamping or vibrating and shall have a smooth finish slightly higher than the ground and sloped to drain away from the posts. All posts shall be set plumb and to the required grade and alignment.

No materials shall be Installed on the posts; nor shall the posts be disturbed in any manner within 7 days after the individual post footing is completed.

Should rock be encountered at a depth less than the planned footing depth, a hole 2 inches (50 mm) larger than the greatest dimension of the posts shall be drilled to a depth of 12 inches (300 mm). After the posts are set, the remainder of the drilled hole shall be filled with grout, composed of one part Portland cement and two parts mortar sand. Any remaining space above the rock shall be filled with concrete in the manner described above.

In lieu of drilling, the rock may be excavated to the required footing depth. No extra compensation shall be made for rock excavation.

3.3 INSTALLING TOP RAILS. The top rail shall be continuous and shall pass through the post tops as shown on the Plans. The coupling used to join the top rail lengths shall allow for expansion. Top rails may not be required as shown on the Plans.

3.4 INSTALLING BRACES. Horizontal brace rails, with diagonal truss rods and turnbuckles, shall be installed at all terminal posts.

3.5 INSTALLING FABRIC. The wire fabric shall be firmly attached to the posts and braced in the manner shown on the Plans. All wire shall be stretched taut and shall be installed to the required elevations. The fence shall generally follow the contour of the ground, with the bottom of the fence fabric no less than 1 inch (25 mm) or more than 4 inches (100 mm) from the ground surface or as shown on the Plans. Grading shall be performed where necessary to provide a neat appearance.

At locations of small natural swales or drainage ditches and where it is not practical to have the fence conform to the general contour of the ground surface, longer posts may be used and multiple strands of barbed wire stretched thereon to span the opening below the fence. The vertical clearance between strands of barbed wire shall be 6 inches (150 mm) or less.

3.6 ELECTRICAL GROUNDS. Electrical grounds shall be constructed where a power line passes over the fence. The ground shall be installed directly below the point of crossing. The ground shall be accomplished with a copper clad rod 8 feet (240 cm) long and a minimum of 5/8 inch (15 mm) in diameter driven vertically until the top is 6 inches (150 mm) below the ground surface. A loo. 6 solid copper conductors shall be clamped to the rod and to the fence in such a manner that each element of the fence is grounded. Installation of ground rods shall not constitute a pay item and shall be considered incidental to fence construction.

3.7 SIGNAGE. Warning signs with the copy "AIRCRAFT OPERATIONS AREA NO TRESPASSING" shall be affixed to AOA fences on centers of 200 feet maximum. Warning signs with the copy "RESTRICTED AREA AUTHORIZED ENTRY ONLY"

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shall be affixed to each AOA accessgate. Signs shall be mounted 9" from the top of the fence, level regardless of fence grade, with 1/16" copper coated steel wire, threaded through 3/16" holes in sign and each end of the wire twisted until tight.

Twisted ends shall be turned into fence fabric to prevent snagging. Provide additional Gate signage as shown on the Plans.

#### **PART 4 — METHOD OF MEASUREMENT**

- 4.1 Chain-link fence will be measured for payment by the linear foot. Measurement will be along the top of the fence from center to center of end posts, excluding the length occupied by gate openings. Concrete mow strip (if shown on the Plans) shall be subsidiary to the chain-link fence and will not be measured separately.
- 4.2 Installed or relocated gates will be measured as complete units per each gate opening length.
- 4.3 Temporary fencing will be measured for payment by the linear foot or lump sum as per the Proposal Form. Measurement will be along the top of the fence from center to center of end posts, excluding the length occupied by gate openings.
- 4.4 Fence removed and salvaged will be measured for payment by the linear foot. Measurement will be along the top of the fence from center to center of end posts. Removal shall include demolition and disposal of existing mow strip as shown on the Plans.
- 4.5 Fence removed and relocated will be measured for payment by the linear foot. Measurement will be along the top of the fence from center to center of end posts.
- 4.6 Signage for AOA fencing and gates shall not be measured separately but shall be considered subsidiary to the chain-link fence and gates.

#### **PART 5 — BASIS OF PAYMENT**

- 5.1 Payment for chain-link fence will be made at the Contract unit price per linear foot. The price shall be full compensation for installation of mow strips as shown on the construction Plans, and for furnishing all materials, and for all preparation, erection, and installation of these materials, and for all labor equipment, tools, and incidentals necessary to complete the Item.
- 5.2 Payment for installed or relocated gates will be made at the Contract unit price for each gate.
- 5.3 Payment for temporary fencing will be made at the Contract unit price bid per linear foot or lump sum as shown on the Proposal Form. The price shall be full compensation for installation of mow strips as shown on the construction Plans, and for furnishing all materials, and for all preparation, erection, and installation of these materials, and for all labor equipment, tools, and incidentals necessary to complete the item.
- 5.4 Payment for salvaged fencing will be made at the Contract unit price bid per linear foot. This price shall include all removal, salvage, and delivery of fence materials to the location indicated by the Owner and will be full compensation for installation of

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mow strips as shown on the construction Plans, and for furnishing all materials, and for all preparation, erection, and installation of these materials, and for all labor equipment, tools, and incidentals necessary to complete the item.

- 5.5 Payment for relocated fence will be made at the Contract unit price per linear foot. The price shall be full compensation for installation of mow strips as shown on the construction Plans, and for furnishing all materials, and for all preparation, erection, and installation of these materials, and for all labor equipment, tools, and incidentals necessary to complete the item.

#### MATERIAL REQUIREMENTS

ASTM A121	Zinc-Coated (Galvanized) Steel Barbed Wire
ASTM A123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products ASTM
A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A392	Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A491	Aluminum-Coated Steel Chain-Link Fence Fabric
ASTM A572	High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Steel Quality
ASTM A653	Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process
ASTM A824	Metallic-Coated Steel Marcellled Tension Wire for Use With Chain Link Fence
ASTM A1011	Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low- Alloy and High-Strength Low-Alloy with Improved Formability
ASTM B117	Standard Practice for Operating Salt Spray(Fog) Apparatus
ASTM B 221	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire Shapes and Tubes
ASTM B429	Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM F668	Poly (vinyl Chloride)(PVC) and other Organic Polymer- Coated Steel Chain-Link Fence Fabric
ASTM F1043	Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework
ASTM F 1083	Pipe, Steel, Hot-Dipped Zinc-coated (galvanized) Welded, for Fence Structures
ASTM F1183	Aluminum Alloy Chain Link Fence Fabric
ASTM F1345	Zinc-5% Aluminum-Mischmetal Alloy-Coated Steel Chain Link Fence Fabric
ASTM G152	Operating Open Flame (Carbon-Arc) Light Apparatus for Exposure of Nonmetallic Materials
ASTM G153	Operating Enclosed Carbon-Arc Light Apparatus for Exposure of Nonmetallic Materials

**CHAIN-LINK FENCES**

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ASTM G154 Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

ASTM G155 Operating (Xenon- Arc) Light Apparatus for Exposure of Nonmetallic Materials

Federal Specifications: RR-F-19113 Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces)

Federal Specifications: RR-F-191/4 Fencing, Wire and Post, Metal (Chain-Link Fence Accessories)

**END OF SECTION**



**SECTION F-164**  
**SLIDE GATE OPERATORS**

**PART 1 — GENERAL**

- 1.1 This Item covers pre-wired, self-contained, high-speed, slide gate operator for horizontal sliding gates, including all selected attachments and accessory equipment as part of the overall security fencing in accordance with these specifications and accompanying details and the details shown on the Plans.
- A. The sliding gates and the operator shall be part of the overall fence system furnished and shall be the product of a manufacturer who has demonstrated by actual installations of a similar nature that its products are of the types required by these specifications. The Contractor shall include all supplementary parts necessary or required for a complete and satisfactory installation within the true meaning and intent of the Plans and Contract Documents.
1. Related System Components For fence system requirements refer to Item F-162, "Chain-Link Fences." For slide gates refer to sections:  
Special Section "V-Track Sliding Gate"  
Special Section "Linear Crash Gate."
  2. Submittals. Changes in specifications may not be made after the bid date. Provide the following information as part of the submittal process:
    - a. Shop Drawings: Submit drawings showing connections to adjacent construction, range of travel, and all electrical and mechanical connections to the operator. Drawings shall also show the size and location of the concrete mounting pad. Underground electrical runs shall be shown on shop drawings. Include installations instructions. Provide details for any electrical control connection to gate house if required by the Contract Documents.
    - b. Installations Instructions: Manufacturer's Project specific installation instructions.
    - c. Test Reports: Submit affidavits from the manufacturer demonstrating that the gate mechanism has been tested 200,000 cycles without breakdown.
    - d. Labels: Each operator shall bear a label indicating that the operator mechanism has been tested for full power and pressure of all hydraulic components, full stress tests of all mechanical components and electrical tests of all overload devices.
  3. Special Warranty. Provide manufacturer's standard limited warranty covering slide gate operator system against failure resulting from normal use for a period of 5 years from date of final acceptance of the gate system. Failure is defined as any defect in manufacturing that prevents the operator from operating in a normal manner. The warranty shall cover all defects in materials and workmanship. Defective materials shall be replaced with comparable materials furnished by the manufacturer, at no cost to the Owner. Freight, labor and other incidental costs are not

covered under the factory warranty, but may be covered by a separate service agreement between installing company and the Owner.

4. Quality Assurance. Minimum requirements for the manufacturer and installer are as follows:
  - a. Manufacturer: A company specializing in manufacturing of hydraulic gate operators of the type specified, with a minimum of ten years' experience.
  - b. Installer: An installer with a minimum of three years of experience installing similar equipment.
5. Delivery and Storage. Store products in an upright position, in the original shipping containers, covered, ventilated and protected from all weather conditions.

## **PART 2 - CODES AND REGULATORY REQUIREMENTS**

- 2.1 Operators shall be built to UL325 standards and be listed by a testing laboratory. Complete all electrical work according to local codes and National Electrical code. All fieldwork shall be performed in a neat and professional manner, completed to journeyman standards.
- 2.2 Current safety standards require the use of multiple external sensors to be capable of reversing the gate in either direction upon sensing an obstruction. See also 2.02D.
- 2.3 Vehicle gates should never be used by pedestrians. Separate pedestrian gates must always be provided when foot traffic is present.
- 2.4 Current safety standards require gate operators to be designed and labeled for specific usage classes.

## **PART 3 - PRODUCTS**

- 3.1 GATE OPERATORS: Hy-Security Gate Operators Model SlideDriver 50VF2/3, SlideDriver 80, or SlideDriver 200, or other comparable operator, as approved by the architect.
  - A. OPERATION: Operation shall be by means of a metal rail passing between a pair of solid metal wheels with polyurethane treads. Operator motors shall be hydraulic, geroller type, and system shall not include belts, gears, pulleys, roller chains or sprockets to transfer power from operator to gate panel. The operator shall generate a minimum horizontal pull of 300 pounds without the drive wheels slipping and without distortion of supporting arms. Operator shall be capable of handling gates weighing up to 12,000 pounds. For gate panels weighing under 5,000 pounds, velocity shall not be less than 3.0 feet per second. Gate panel weighing over 5,000, velocity shall not be less than 1.0 foot per second. All gates shall be stopped gradually to prevent shock loads to the gate and operator assembly. The "soft stop" feature of the gate operator shall be controlled by two adjustable hydraulic brake valves (one for each direction). The "soft start" feature shall allow the pump to start at zero pressure, then progressively increase the pressure, over a period less than two seconds, to 1,000 psi.

## SLIDE GATE OPERATORS

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- A. Standard mechanical components shall include as a minimum:
1. Supporting arms: Cast aluminum channel. Arms shall incorporate a fully bushed 1-1/2" bronze bearing surface, acting on arm pivot pins. (Item 2 below).
  2. Arm pivot pins: 7" diameter, stainless steel, with integral tabs for ease of removal.
  3. Tension spring: 2-1/2" heavy duty, 800-pound capacity.
  4. Tension adjustment: Finger tightened nut, not requiring the use of tools.
  5. Drive release: Must instantly release tension on both drive wheels, and disengage them from contact with drive rail in a single motion, for manual operation.
  6. Limit switches: Fully adjustable, toggle types, with plug connection to control panel.
  7. Electrical enclosure: Oversized, metal with hinged lid gasketed for protection from intrusion of foreign objects, and providing ample space for the addition of accessories.
  8. Chassis: 1/4" steel base plate and 10 Ga. Sides and back welded and ground smooth.
  9. Cover: 16 Ga. Galvanized sheet metal with a powder paint finish. All joints welded, filled and ground smooth. Finished corners square and true with no visible joints.
  10. Finish: Fully zinc plated then finish coat of high glass powder paint withstanding 1000-hour salt spray test.
  11. Drive wheels:
    - SlideDriver 50VF2/3: 8" diameter metal hub with polyurethane tread.
    - SlideDriver 80: 8" diameter metal hub with polyurethane tread, 8" XtremeDrive wheel and 27' of track
    - SlideDriver 200 8" diameter metal hub with polyurethane tread, 8" XtremeDrive wheel and 52' of track
  12. Drive rail: Shall be extruded 6061 T6, no less than 1/8" thick. Drive rail shall incorporate alignment pins for ease of replacement or splicing. Pins shall enable a perfect butt splice.
  13. Hydraulic hose: Shall be 1/4" synthetic, rated to 2,750 psi.
  14. Hydraulic valves: Shall be individually replaceable cartridge type in an integrated hydraulic manifold.
  15. Hose fittings: At manifold, shall be quick-disconnect type, others shall be swivel type.
  16. Hydraulic fluid: High performance type with a viscosity index greater than 375.

- A zero to 2000 psi pressure gauge mounted on the manifold for diagnostics, shall be a standard component
- The hydraulic fluid reservoir shall be formed from a single piece of metal, non-welded, and shall be powder painted on the inside and the outside, to prevent fluid contamination.

### 3.2 PUMP MOTOR

- A. SlideDriver 50VF2/3: Shall be a 2 HP, 56C, TEFC, continuous duty motor, with a service factor of 1.15 or greater.
- B. SlideDriver 80: Shall be a 2 HP, 56C, TEFC, continuous duty motor, with a service factor of 1.15 or greater.
- C. SlideDriver 200: Shall be a 5 HP minimum, 56C, TEFC, continuous duty motor, with a service factor of 1.15, or greater.
- D. Standard voltages available, single or three phase. All components shall have overload protection.

### 3.3 CONTROLS

**All electrical and remote operation control components must be able to integrate and function within the existing Airport gate operating system.**

Smart Touch Controller Board with 128K memory containing

- A. Inherent entrapment sensor
- B. Built in "warm before operate" system
- C. Built in timer to close
- D. Liquid crystal display for reporting of functions
- E. 19 programmable output relay options
- F. Anti-tailgate mode
- G. Built-in power surge/lightning strike protection
- H. Capable, with optional software, of event logging EEPROM for troubleshooting diagnostics
- I. RS232 port for connection to laptop or other computer peripheral and RS485 connection of Master/Slave systems.
- J. Transformer: 75 VA, non-jumpered taps, for all common voltages
- K. Control circuit: 24 VDC port for connection

3.4 OPTIONAL EXTERNAL SENSORS: Specify photo eyes or gate edges or a combination thereof to be installed such that the gate is capable of reversing in either direction upon sensing an obstruction.

3.5 OPTIONAL CONTROL DEVICES: (consider one or more of the following: card reader, key-switch, radio control, push buttons, vehicle detectors, keypads)

- A. OPERATIONAL CONTROL DEVICES: Flashing lights or rotating beacon

3.6 OTHER OPTIONS:

- 1. Base Extension: Raise Slide Driver up 12 inches for additional conduit accessibility and operator flexibility.
- 2. XtremeDrive System™ (for HySecurity only): Handle exceptionally difficult to move, large or heavy gates with this added drive wheel system.
- 3. Special locks for operator cover.
- 4. Weather-stripped drive rail slot in chassis, and snow wiper blades for drive rail.
- 5. Remote gate release devices. Places operator in "manual mode" from remote location.
- 6. 208/230 VAC single phase and 208/230/460 VAC three phase available. 115 is not available. (50 Hertz is available specify voltage.)

**PART 4 - FACTORY TESTING**

4.1 TESTING

- A. Fully assemble and test, at the factory, each gate operator to assure smooth operation, sequencing and electrical connection integrity. Apply physical loads to the operator to simulate field conditions. Tests shall simulate physical and electrical loads equal to the fully rate capacity of the operator components.
- B. Check all mechanical connections for tightness and alignment. Check all welds for completeness and continuity. Check welded corners and edges to assure they are square and straight.
- C. Check all mechanical connections for tightness and alignment. Check all welds for completeness and continuity. Check welded corners and edges to assure they are square and straight.
- D. Inspect painted finish for completeness and gloss. Touch up imperfections prior to shipment.
- E. Check all hydraulic hoses and electrical wires to assure that chafing cannot occur during shipping or operation.

**PART 5 - EXECUTION**

- 5.1 SITE EXAMINATION: Locate concrete mounting pad in accordance with approved shop drawings.
  - A. Make sure that gate is operating smoothly under manual conditions before

## **SLIDE GATE OPERATORS**

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installation of gate operators. Do not proceed until gate panel is aligned and operates without binding.

#### **PART 6 – INSTALLATION**

- 6.1 Install gate operator in accordance with the manufacturer's printed instructions, current at the time of installation. Coordinate locations of operators with contract drawings, other trades and shop drawings.
- A. Installer shall insure that the electric service to the operator is at least 20 AMPS. Operator wattage is 2400.
  - B. Install grounding rods in accordance with Section 26 05 26.

#### **PART 7 - QUALITY CONTROL**

##### **7.1 FIELD QUALITY CONTROL**

- A. Test gate operator through ten full cycles and adjust for operation without binding, scraping or uneven motion. Test limit switches for proper "at rest" gate position.
- B. All anchor bolts shall be fully concealed in the finished installation.

##### **7.2 CONTINUED SERVICE AND DOCUMENTATION**

Train owner's personnel in the general maintenance of the gate operator and accessories and provide one copy of "operations and maintenance" manual for the owner's use (a second manual is available upon request). Manuals will identify parts of the equipment for future procurement.

#### **PART 8 - METHOD OF MEASUREMENT**

Sliding gate operators will be measured as a complete unit for each location as indicated on the Plans and or in the "Proposal Form."

#### **PART 9 - BASIS OF PAYMENT**

Payment for Sliding gate operator will be made at a complete unit per each location. The price shall include all products, installation and adjusting. The price shall be full compensation for furnishing all operator materials installation of all major components and appurtenances as shown on the construction Plans all labor equipment, tools, and incidentals necessary to complete this Item.

**END OF SECTION**