

SECTION 27 05 28 – COMMUNICATIONS PATHWAYS FOR INSIDE PLANT

1.01 SUMMARY:

- A. **Scope:** ^{A17}Scope of work shall be in accordance with Paragraph 1.01 D. of Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), as required, for buildings in the Works, including Agua Clara Substation. ^{A17} This Section of the Employer's Requirements shall be read in conjunction with the Sections listed in Table 27 05 28-1.
- B. **Related Sections:**

TABLE 27 05 28-1: ^{A9} Related Sections ^{A9}			
1.	Section 01 81 26	-	Communications, Control, Safety, and Security Systems.
2.	Section 01 81 36	-	Operations and Maintenance Buildings and Facilities - Program
3.	Section 07 84 00	-	Firestopping for Inside Plant.
4.	Section 09 69 00	-	Raised Access Flooring.
5.	Section 13 49 00	-	Radiation Protection.
6.	Section 26 05 26	-	Grounding and Bonding for Electrical Systems.
7.	Section 26 20 00	-	Electrical Low Voltage Distribution Work.
8.	Section 27 10 00	-	Structured Cabling System for Communications Inside Plant.

1.02 REFERENCE:

- A. **Applicable Publications:** Refer to ^{A9}Paragraph ^{A9} 1.02 of Section 01 81 26 (*Communications, Control, Safety, and Security Systems*).

1.03 REQUIREMENTS

A. **General Requirements:**

1. **General:** The ^{A17}Contractor ^{A17} shall meet all applicable requirements of Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), ^{A9}Paragraph ^{A9} 1.03.
3. **Crossunders:** Shall have ample space for walking as well as for separating power cables from communications and signaling cables.
4. **Grounding:** Metal items in communications inside plant shall be grounded and bonded in accordance with the applicable requirements of Section 26 05 26 (*Grounding and Bonding for Electrical Systems*), ^{A10}IEEE 142, NFPA 70, and TIA 607. ^{A10}

B. Spaces:

1. General:

- a. Dimensions shall meet or exceed the requirements of BICSI TDMM.
- b. All doors shall be full-opening and self-closing, and shall meet all fire codes relevant to its location.

2. Communications Equipment Rooms and Process Control System (PCS) Server Rooms (at ground floor of main control buildings):

- a. These rooms shall be for exclusive use of CCSS systems, with its associated AC and DC distribution equipment.
- b. Rooms shall have a *Faraday cage* in accordance with Section 13 49 00 (*Radiation Protection*).
- c. Rooms shall have an adequate and remotely monitored precision type cooling system, to isolate and preserve all the electronic equipment therein.
- d. These rooms shall have raised access floor in accordance with Section 09 69 00 (*Raised Access Flooring*) and no less than 3.353 m (11 ft) clearance between finished floor and roof. Under raised access floor, appropriate cable raceways shall be installed as specified on this ^{A9}Section.
- e. Rooms shall have a locally controlled exhaust system, and an appropriate lighting system.
- f. There shall be no batteries, power transformers, suspended ceiling, or windows in these rooms.
- g. Whenever possible, water lines not involved in the support of these rooms shall not run over them. This includes boiler lines, rain drains, and restroom drains.
- h. The main door to these rooms shall be no less than 1.829 m (72 in) wide and 2.438 m (8 ft) in height, and shall not have a doorsill or center post. Any other doors, as may be necessary, shall be a minimum of 914 mm (36 in) wide and 2.134 m (7 ft) in height.

2. Telecommunications Closets:

- a. The door to telecommunications closets shall be no less than 1.067 m (42 in) wide and 2.134 m (7 ft) high.

C. Equipment and Materials:

1. Aerial Raceway Systems for Fiber Optic Cables:

- a. Raceways shall consist of channels sized as required and equipped with covers to maintain cables inside. Horizontal sections shall have vertical derivations to reach equipment in racks. Minimum width shall be 102 mm (4 in).
- b. Channels shall be easy to cut or adapting to rack or rack cabinet width, and shall include cutting tools.
- c. Each segment shall be capable of coupling to others, and the final elements shall have side covers.
- d. The raceway systems shall include all necessary accessories for supporting the structure.
- e. Color shall be black (preferable), ivory, or yellow.

2. Cable Trays:

- a. Trays shall meet the requirements of Section 26 20 00 (*Electrical Low Voltage Distribution Work*) as modified herein.
- b. Trays for cabling in tunnels, confined areas, and between tower and radio equipment rooms shall be fire retardant, and be made of fiber glass, not metallic. In addition, trays between tower and radio equipment rooms shall be UV resistant.
- c. ^{A9}Trays for cabling under raised access floors shall be rib type, 508 mm (20 in) or wider, made of metal. ^{A9}

3. Conduits: Shall meet the requirements of Section 26 20 00 (*Electrical Low Voltage Distribution Work*). Size and capacity shall be in accordance with ^{A10}NFPA 70 and TIA 569. ^{A10}

4. Identifiers: Inside plant identifiers in drawings and data bases shall be in accordance with ^{A10}TIA 606. ^{A10}

5. Vertical Ladders: Shall be the same as horizontal cable trays (ref. shafts between Crossunders and upper level).

D. Installation:

- 1. Aerial Raceways for Fiber Optic Cables:** Shall be firmly attached to roofs and racks, as required.

2. **Cable Trays:**

- a. Trays in tunnels and confined areas shall be installed on walls opposite to trays for power cables.
- b. Trays for telecom and electronic signaling cabling shall not be used for power cabling, and shall not have power cables except as allowed for PoE.

3. **Conduits:**

- a. Bending radius shall be at least 305 mm (12 in), eight (8) times the cable diameter or the manufacturer rating, or ten times the conduit internal diameter per Table 27 05 28-1, whichever is the largest.

TABLE 27 05 28-2: ^{A9}Curvature Radius for Conduits in Communications Horizontal Cabling ^{A9}					
Nominal Size		Conduit Internal Diameter		Minimum Curvature Radius	
mm	in	mm	in	Mm	in
25.40	1	26.67	1.05	304.80	12.00
31.75	1.25	35.05	1.38	350.52	13.80
38.10	1.5	40.89	1.61	408.94	16.10
50.80	2	52.58	2.07	525.78	20.70
63.50	2.5	62.74	2.47	627.38	24.70
76.20	3	77.98	3.07	779.78	30.70
88.90	3.5	90.17	3.55	901.70	35.50
101.60	4	102.11	4.02	1,021.08	40.20

- b. Cable fill shall meet the requirements of NFPA 70.
- c. Whenever conduits are used, a 200 lb-test (minimum) pull cord will be installed in the conduit along with the cable.
- d. Ends of all conduits will be fitted with plastic bushings to protect emerging cables from abrasion during installation and use.

4. **Elbows:**

- a. Metallic conduit bends shall be made with an appropriate bending tool.
- b. PVC bends shall be prefabricated.
- c. No more than two 90° bends shall be installed between pull boxes or in any single conduit run.
- d. *Condulet* type elbows are unacceptable.

5. **Grounding:** All metallic trays shall be grounded.
6. **Pathways:** Telecommunications inside plant pathways, including cable trays and conduits, shall be separated horizontally or vertically from other utilities and Electro-Magnetic Interference (EMI) sources in accordance with the following:

TABLE 27 05 28-3: ^{A9} Separation Between Conduits for UTP Cables and Electrical Lines/Equipment ^{A9}						
Condition	Minimum Separation					
	< 2 kVA		2 – 5 kVA		> 5 kVA	
Unshielded power lines or electrical equipment in proximity to open or nonmetal pathways	130 mm	(5 in)	300 mm	(12 in)	610 mm	(24 in)
Unshielded power lines or electrical equipment in proximity to a grounded metal pathway	65 mm	(2.5 in)	150 mm	(6 in)	300 mm	(12 in)
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal pathway	75 mm	(3 in)	75 mm	(3 in)	150 mm	(6 in)

TABLE 27 05 28-4: ^{A9} Separation of Telecommunications Pathways from Other Utilities And Emi Sources ^{A9}	
Structure	Minimum Separation
Electrical Power Distribution Cables and Conduits	300 mm (1 ft)
Fluorescent Lighting	610 mm (2 ft)
High Level EMI Sources	1,200 mm (4 ft)
Motors	1,200 mm (4 ft)
Pipes (gas, oil, steam, water)	150 mm (6 in) when crossing pipe 300 mm (12 in) when parallel to pipe
Transformers	1,200 mm (4 ft)

7. **Pull boxes:** Boxes shall not be used to change direction of cabling. Elbows shall be used instead.

1.04 DESIGN CRITERIA/SYSTEM PERFORMANCE:

A. General:

1. **Problem to be Solved:** Pathways shall solve the following business needs:
 - a. Provide safe and easily accessible space for inside plant communications cabling.

- b. Provide adequate separation between cabling and noise sources.
 - c. Provide appropriate infrastructure support and protection for running inside plant cable.
- 2. **Restrictions to be Considered:** (reserved)
- B. **Design Criteria:**
 - 1. Pathways shall be designed as required for all communications and electronic signaling necessary for locks and Agua Clara Substation operations, and shall comply with BICSI TDMM.
 - 2. All new cable pathways using ladders, trays, J-hooks, or conduits shall be designed and installed for 50% free capacity.
- C. **System Performance:** Shall be in accordance with the applicable requirements of ^{A10}TIA 568, 569, 606, and 607. ^{A10}

1.05 SUBMITTALS: The following shall be submitted for substantiation purposes:

- A. **Design:** The following shall be in accordance with Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), ^{A9}Subparagraph 1.05 D: ^{A9}
 - 1. Calculations, including heat load (Btu/h) in each equipment and machinery room with air conditioner(s).
 - 2. CPM diagram, with monthly updates.
 - 3. Descriptive literature.
 - 4. Drawings.
 - 5. Specifications.
 - 6. Any other data required for review.
- B. **Re-submittals Just Prior to Purchasing Materials:** All items in A. above that have changed from original submittal shall be resubmitted in a Design Conference in accordance with Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), Paragraph 1.05.
- C. **Upon Receipt of Shipped Items in Panama:**
 - 1. Packing lists.
- D. **Prior to Issuance of Taking Over Certificate:**
 - 1. As-built drawings.

1.06 QUALITY ASSURANCE: Shall include the following in accordance with Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), ^{A9}Paragraph ^{A9} 1.06:

- A. Factory Quality Control Tests (FQCT).
- B. Warranty.

END OF SECTION

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