SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 PROJECT SCOPE SUMMARY

A. Subject to the General and Special Conditions, this section shall specify Communications Equipment Room Fittings.

B. Section Includes:

1. Requirements for new Communication Equipment Rooms (MDF and IDF) and Enclosures.
2. Materials and installation of equipment racks/cabinets and equipment in MDF and IDF's.
3. Cable runway and cable support managers .

1.2 DESCRIPTION

A. This Section specifies the requirements of the Communications Equipment Room Fittings for the City of Houston, Houston, Texas.

B. Communications Equipment Room Fittings

1. The minimum number of 4-inch sleeves that must be used is based on the total square feet and number of IT drops that the sleeves support. For planning purpose:
   a. Up to 25,000 square feet = two 4-inch sleeves
   b. 25,000 square feet to 50,000 square feet = three 4-inch sleeves
   c. 50,000 to 100,000 square feet = four 4-inch sleeves
   d. 100,000 to 300,000 square feet = five to eight 4-inch sleeves
2. Space for new outside plant copper and fiber cable and terminating hardware will be provided in the MDF. Minimum of 3-ft clearance shall be provided in the front, back and one side of the equipment rack(s).
3. Minimum size MDF based on the size of the area it's serving.
   a. Minimum = 10'x 10'
   b. Reference drawings for dimensions.
4. Minimum size IDF based on the size of the area it's serving will be 8' x10'
5. Buildout of MDF/IDF Rooms
   a. There must be continuous and dedicated environmental control (24 hours per day, 365 days per year) to ensure that temperature and humidity values are within acceptable limits. If the facility is powered by a generator or other emergency power source then the dedicated HVAC system(s) within the MDF/IDF must also be powered by the generator. Maintain the room temperature between 64° F and 81° F. Humidity range, noncondensing: 16 ºF DP to 59 ºF DP and 50% RH to 70% RH. Provide network monitored sensor (APC#AP9641) in each MDF/IDF room. The cooling load shall be based on equipment to be installed initially and future growth (assuming that the equipment racks will be fully occupied eventually).
      1) Fan Coil Units are more desirable than split units. Fan coil units, condensation pipes/tubing, refrigerant pipes/tubing, and plumbing shall not be located in the

MDF/IDF room. The MDF/IDF room shall have only supply and return ducts to maintain cooling efficiency.

2) Split units are not desirable, but if used shall meet the following criteria: NO more than 6 in. of any plumbing pipes/tubing, including condensation and refrigerant, shall be visible in communications rooms; All 6 in. of visible pipes/tubing shall be insulated; Split units shall have a drain pan placed below the units to catch and divert any and all condensation/water to protect the electronic and cable warranties.

b. Ceiling height a minimum of 9 ft. above finished floor (AFF). No drop (false) ceilings is allowed.

c. Flooring: The floor must be sealed concrete or antistatic floor tile bonded to ground using manufacturer-recommended hardware. Carpet flooring is not allowed.

d. Lighting in MDF / IDF, must have a uniform intensity of 70 Foot Candles when measured 30 inches from the finished floor on all sides of equipment racks.

e. All light fixtures must be mounted a minimum of 8 feet 6 inches above the finished floor, and no light fixtures shall be mounted directly above the equipment racks/cabinets or overhead cable trays. Provide light at both the front and back of the equipment racks. A minimum of one set of lights shall be an emergency light.

f. Minimum electrical in MDF/IDF rooms:

1) A minimum of two dedicated 120V AC electrical outlets on separate branch circuits (one (1) L5-30R and one (1) 5-20R quad receptacles for each full height equipment rack, (1) NEMA L5-20R twist lock receptacle and (1) NEMA 5-20R quad receptacle for each half-height equipment rack) shall be provided above each equipment rack/cabinet (on the back side) at 7’6”AFF.

2) Separate duplex 120V AC convenience outlets with NEMA 5-20R (for tools, test sets, vacuums, etc.) installed at least 18 inches above the finished floor at 6-foot intervals around perimeter walls.

3) Provide power receptacles or hardwired power circuits for all wall mounted equipment.

4) **Provide dedicated electrical panels for all equipment inside or serving Telecom Rooms (MDF/IDF). fed from emergency power and a building UPS, if available**.

g. Plywood Wallfield: Minimum of 3 walls must be lined with 3/4 inch fire rated plywood, 8 feet high, installed with the bottom at 12 inches from the finished floor. Paint the plywood with two coats of light color fire retardant paint. The paint color shall match the room finish color. Leave the fire rating stamp exposed after painting. The plywood must be securely fastened to the wall-framing members. With offset flush or flat mounted fasteners.

h. Fire Protection: Fire protection shall be provided as per the applicable code. Consideration should be given to the installation of pre-action sprinkler or other dry fire suppression system, or no fire protection if enclosed by fire rated walls. If wet pipe sprinklers are installed, the sprinkler heads shall be provided with cages to prevent accidental operation, and drainage troughs shall be placed under the sprinkler pipes to prevent leakage onto the equipment or cabling within the room.

i. A floor rating greater than 4.8 kPa (100 lbf/ft2) distributed loading. A floor rating greater than 8.8 kilonewton (kN) (2000 lbf) concentrated loading. The floor must be sealed concrete or antistatic floor tile bonded to ground using manufacturer-recommended hardware. Carpet flooring is not allowed.

j. Fully-open, secured, lockable doors that are at least 3-ft wide and 80-in tall.

k. Security: MDF and IDF rooms must be secured and controlled with a proximity card reader, and access must be restricted on a least privilege basis. Video surveillance

camera shall also be provided inside each MDF/IDF room. Consult with HITS for exact placement and orientation of the camera. Exceptions to this rule must be approved by HITS. A placard should be placed at all entrances to MDF/IDF rooms that reads as follows: “RESTRICTED AREA: Escort Required. Contact HITS at (832) 393-0383”.

l. A Primary Bonding Busbar (PBB) in the MDF, Secondary Bonding Busbar (SBB) in the IDF and bonding conductors sized per ANSI J STD-607 A Standards.

m. Room Layout: The Standard MDF/IDF room layout is to have multiple floor standing standard height (7-ft) equipment racks (2-post) in a row centered on the wall (minimum 10-ft wide) opposite or perpendicular to the entrance wall . Provide overhead ladder tray along the perimeter of room and over the equipment rack row, and vertical cable managers (minimum 6” wide and 7-ft high) between equipment racks and each end of the equipment rack row. Vertical cable runway shall also be provided from end of conduits/sleeves to horizontal ladder tray. Please note that exact number of racks might be different for specific projects depending on quantity of Data cables and amount of equipment required.

n. Rack Elevations: in MDF/IDF room, backbone and riser cables, voice gateway and core switches shall be located in Rack #1. Rack#2 (and #3 if needed) shall be reserved for terminations of horizontal cables and edge switches. The top half of each rack shall be reserved for cable terminations (patch panels, fiber enclosures, etc.), and bottom half of each rack shall be reserved for active network equipment (switches, UPS, etc.).

1.3 REFERENCES

A. Section 270000 in its entirety shall be included as part of this specification.

B. Related Sections:

1. Div 01
2. Section 270526 Grounding and Bonding for Communications Systems
3. Section 270528 Interior Pathways for Communications Systems
4. Section 270543 Exterior Pathway for Communications Systems
5. Section 270553 Identification for Communications Systems
6. Section 271300 Communications Backbone Cabling
7. Section 271500 Communications Horizontal Cabling
8. Section 272100 Data Communication Network Equipment

1.4 COORDINATION

A. Refer to General or Special Conditions.

B. Refer to Division 26, Electrical Work

1.5 QUALITY ASSURANCE

A. Refer to section 270000.

B. Assure that the "as installed" system is correct and complete per construction documents: including engineering drawings, manuals, and operational procedures in such a manner as to support maintenance and future expansion of the system.

C. Owner/Architect/Engineer retains the right to access and inspect all work during the entire duration of the project and any items that do not adhere to the standards, reference, contract, bid, or project documents will be corrected immediately at the expense of the contractor.

D. Provide shop drawings of equipment room layout and rack elevations for review and approval by HITS and IT Consultant before installation to start.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Refer to section 270000.

1.7 SUBMITTALS

A. Refer to section 270000

1.8 WARRANTY

A. Refer to section 270000.

B. If items supplied as part of Project have warranties longer than one year from date of final acceptance, Contractor shall supply longer warranty.

PART 2 PRODUCTS

2.1 EQUIPMENT RACKS

A. Approved Manufacturers:

1. CPI or COH approved equal.

B. For floor standing racks, Include base flanges with mounting holes securing the rack to the floor. Each mounting hole must be at least 5/8” in diameter.

C. Where the rack is to be mounted to VCT flooring or bare concrete, an insulating pad must be used, and care must be taken that anchors, used to secure the rack to the floor, do not come in contact with any reinforcing steel embedded in the concrete slab.

D. Vertical and horizontal wire management shall be provided in each rack/cabinet.

E. City’s standard is to use floor standing 2-post racks in all MDF/IDF rooms, wherever possible. Cabinets are only used in place of equipment racks based upon security and cleanliness of the room to replace open frame racks.

2.2 FREE STANDING 2-POST RACK:

1. 2-Post rack shall be 7’ high 19” wide.

2. CPI # 55053-703 or COH approved equal.

2.3 FREE STANDING NETWORK CABINET:

A. Cabinets shall be fully assembled by the manufacturer with the components listed below. Individual component part numbers:

1. Chatsworth 45RU; 800mm W; 1100mm D; ZetaFrame # ZB44-A1200-71

2. 12-24 Tapped sliding rails / 2-pair

3. Single perforated metal front door with swing latch w/padlock feature

4. Double perforated metal rear door with swing latch w/padlock feature

5. Gromet top panel, no bottom panel.

6. Two solid two-piece side panels

7. Black

8. PDU Power Strips:

a. Core Switch Cabinet QTY (2) Chatsworth Vertical eConnect Monitored Pro PDUs (Part # P4-1F0C3) Input Nema L6-30P; Output (18) C13s and (6) C19s. And (1) Horizontal Metered Power Strip (Part # 13239-755) Input Nema 5-20P; Output (12) Nema 5-20R

b. All other Cabinets QTY (2) Chatsworth Vertical eConnect Monitored Pro PDUs (Part # P4-1D0A5) L5-30P input; output (24) 5-20Rs.

9. Grounding Bus Bar:

a. Provide Rack-Mounted Ground Bar. See Specification 270526

2.4 WALL MOUNTED CABINET:

A. CPI CUBE-iT 12419-748 (26RU, 24”W, 30”D, Black, Tempered Glass Door)

B. Or COH approved equal.

2.5 SLIDING SHELF

A. RackSolutions SKU#115-4779

1. Provide one (1) per floor standing rack/cabinet and mount it at RU23, UON.

B. Or COH approved equal.

2.6 CABLE MANAGEMENT

A. Approved Manufacturers:

1. CPI

B. Vertical Cable Management:

1. Double-sided cable routing
2. 6” or wider depending upon application requirements
3. Lockable latching sections with protective edge guards
4. Space slots at 1 RU intervals
5. Black finish
6. CPI # 13912-703 (6”W, 45RU) or COH approved equal
7. CPI # 13914-701 (10”W, 45RU) or COH approved equal

C. Horizontal Cable Management:

1. Capable of attachment to a 19” rack
2. 2 U, maximum 4” deep
3. Heavy-duty aluminum rings with rounded edges
4. Incorporate cable routing guides and supports on rear panel
5. Black finish
6. CPI# 35431-702 (Motive 2U) or COH approved equal

2.7 CABLE RUNWAY

A. Use in MDF and IDF

B. Specifications

1. UL Classified for suitability (as an equipment grounding conductor only)
2. Minimum 12” wide

3. Support at 5’ intervals
4. Install at 7’ AFF
5. Secure to equipment racks with approved hardware
6. Crossmembers at 9” intervals
7. 10-foot sections
8. Bond to PBB/SBB per TIA-607 standard.

C. Products

1. Universal Cable Runway: CPI # 10250-712 (12”W)
2. Runway Elevation Kits: CPI # 10606-706 (4”, 5” or 6” elevation)
3. Runway Radius Drop-Stringer: CPI # 14305-701
4. Runway Radius Drop-Cross Member: CPI # 14304-712
5. Runway Retainer Post-8”H: CPI # 10596-708

D. Include required accessories for a complete cable runway inside MDF and IDF

E. Provide other sizes as needed to meet the project requirements.

2.8 PLYWOOD WALLFIELD

A. All wallfield plywood shall be minimum 8’ x 4’ x ¾” fire rated unless noted otherwise.

B. Paint all backboards with a minimum of 2 coats of fire-retardant paint on all sides and edges.

C. For all new IDF or MDF Rooms, provide plywood on a minimum of 3 walls with 8’ high x ¾” plywood backboard or as noted on the contract documents.

D. Paint plywood backboard in light color that shall match the wall finish color, and leave the fire stamps exposed.

2.9 GROUNDING

A. All equipment, racks/cabinets, runway, armored cables shall be properly grounded/bonded to the PBB/SBB in accordance with the TIA-607 standard.

PART 3 EXECUTION

3.1 GENERAL

A. Telecommunications rooms are generally considered a zone serving facility. These rooms may be equipped with fiber and copper cables, wall mounted termination blocks/patch panels, rack mounted copper and fiber patch panel terminations, vertical and horizontal cable management systems and equipment racks. Cable Contractor shall provide proper identifications/labeling scheme for all structured cabling components installed in these rooms.

B. Follow manufacturer’s recommended installation and termination practices.

C. Cabling within racks and enclosures: provide adequate length of cabling. Train conductors to termination terminal points that follow manufacturer’s installation procedures for maintaining cable performance specifications. Provide lacing/mounting bars to restrain cables, to prevent straining connections, and to stop bending cables to smaller radii than minimums recommended by manufacturer.

D. Equipment Racks: Provide 19” wide x 7'-0” tall racks with number of vertical rack sections as required to allow space for all equipment, cabling and horizontal cable managers, plus space for future growth (minimum 25%).

E. Locate/space racks and enclosures (cabinet) according to TIA guidelines for front and around access.

F. Vertical wire management: double-sided vertical rack cabling sections shall be a minimum width of 6 inches or wider. Reference T. Drawings

G. Entrance: Arrange and coordinate locations of distribution frames, patch panels, cross- connections (furnished by others) in communication rooms and racks to optimize space requirements of any service provider requirements, telephone system and LAN equipment.

H. Provide cable runway in equipment room above all racks and up to cross- connects/runway/conduits/sleeve's entering room from corridors. Form a complete runway system by ringing the room and connecting all hardware installations. Route the cables within the room by taking the longest available path through the perimeter cable tray. Attach grounding lugs to each rack/cable raceway, conduit, etc. Refer to 'T' drawings for details.

I. The MDF contains cross-connect facilities for terminating cables and for connecting the horizontal and riser segments and telecommunications equipment. The MDF may also support other building information systems such as security, audio, and other telecommunications systems.

J. Coordinate runway locations with lighting, air-handling systems, and fire extinguishing systems so that fully loaded trays will not obstruct or impede their operation. In the United States, NEC Article 392 provides requirements for cable trays.

K. Provide horizontal cable runways. Equip each 19” rack with overhead ladder style cable runway installed between the wall and horizontal/equipment racks. Refer to COMMUNICATIONS “T” drawings for proposed locations and sizing of each runway.

L. Securely attach to wall studs with support brackets (and racks if applicable), in accordance with manufacturers written instructions.

M. Provide ground lug for each 19” rack. Racks shall be grounded to wall mounted ground bus bar using #4 AWG stranded, green jacketed, insulated copper conductor. Furnish all required bonding material and hardware, and bond PBB in MDF to building grounding electrode subsystem. If crimp connectors are used to bond the #6 AWG wire, follow NEC bonding procedures/specifications.

N. An inert dielectric material shall separate dissimilar metals apt to corrode through electrolysis under the environmental operating conditions specified.

3.2 EXAMINATION

A. Verify conduit, raceways, boxes, fittings and bodies are properly installed as specified in Division 16.

B. Verify grounding and bonding following Section 270526 and this section.

C. Verify supporting devices are properly installed following Section 270526.

D. Verify conduit has a minimum 1-inch diameter for Category 6 home runs.

E. Verify 4 inch or 6 inch conduits are used for building entrance cables or cables going between closets or buildings.

F. Verify liquid-carrying pipes are not installed in or above voice and data system equipment rooms.

G. All electrical circuits used for the connection of technology equipment should be dedicated single fused 120 volt 20 or 30 amp circuit. These outlets should be served from dedicated panels within the nearest electrical room. All of these outlets should be on an emergency backup power system to provide continuous uninterrupted power to the equipment.

H. All 120-volt circuits should be clearly marked and dedicated for technology.

I. All telecommunications rooms, MDF's and IDF's should not be located adjacent to any space that contains sources of Electromagnetic Interference (EMI). Transformers shall not be placed in any telecommunications closet and should be located at least 4 feet away from any communication cable or termination equipment.

J. All protected telecommunication terminations require bonding, grounding and a Busbar.

K. Flooring in Telecommunication Rooms shall be anti-static vinyl tile with vinyl baseboard as specified in Division 09.

L. Telecommunication rooms will have open ceilings at a minimum height of 9' with all exposed concrete sealed to prevent dust.

3.3 PREPARATION FOR IT EQUIPMENT INSTALLATION IN MDF/IDF ROOM

A. All communication rooms that will service the area to be opened must be completed. That means a final walkthrough of these areas has been completed. It is not necessary that the entire project achieve substantial completion, but IT equipment installation can not begin until the following minimum criteria is met:

1. Space is built out and vacuumed clean – free from debris and dust.
2. Electrical installation is complete and meets the City's IT standard.
3. All racks/cabinets with vertical/horizontal managers) are installed and grounded/bonded/labeled.
4. The grounding busbar is installed/labeled and properly tied to the main grounding bus bar in MDF
5. HVAC is installed and functioning properly and is adequately filtering dust. Temperature and humidity can be monitored and controlled.
6. Door access control (card reader, cyberlock -or- an approved temporary provision)) is installed and operational. Simple key access is not permissible.
7. Lighting is installed and operational.
8. Cable trays/ladder racks are installed and grounded/bonded.
9. Permanent or temporary signage identifying the permanent room number.

B. All cabling necessary to operate the areas to be opened is completed.

1. Backbone cabling (copper and fiber) from the applicable communication room(s) is installed, tested, labeled, and approved by the inspector and communications design consultant.
2. Horizontal cabling for all areas to be occupied is installed, tested, labeled, and approved by the inspector and communications design consultant.
3. Copper cross-connects and/or fiber jumpers have been installed per the owner/tenant requirements.
4. Cable test report and redline drawings for installed cables are submitted and approved. PRIOR to putting any active circuits on the new cables. Cable test report and cable IDs shall reflect all installed cables **and** any cross-connects, or jumper assignments installed by the contractor.
5. All jumpers and patch cords specified by the contract are turned over to HITS.

6. NOTE: cable labels and permanent room numbers need to match. GC needs to be sure to get design team, CoH, HITS, and Communications Contractor reps together to review permanent room numbers prior to installing cable labels.

C. Move-in buffer period needs to be a minimum of 6 weeks for HITS and it's contractor to install/extend services within the area to be occupied prior to occupation of the facility or spaces. Additional time may be necessary if Tenant IT organization is involved, or if the contractor has other systems that must be configured/tested and require HITS resources (i.e. cabling or data network connections). This is frequently the case for PA System, Building Automation System, television, radio, Fire Alarm, pay telephone, Intrusion Alarm, access control & CCTV, etc.

D. Once HITS accepts a communications equipment room and begins to install/configure equipment in preparation for hosting live applications, this room becomes a restricted area with access to be controlled by HITS. Contractors must be substantially complete with systems inside the communications room so that access is generally not required. Minor punch list and scheduled testing with escort can be arranged, but access will be very limited.

3.4 INSTALLATION

A. Install work following drawings, manufacturer's instructions and approved submittal data. The number of cables per run, outlet configuration and other pertinent data will be included on the drawings.

B. All installation shall be done in conformance with TIA 568B and BICSI standards. The Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines will require the Contractor to provide in a timely fashion the additional material and labor necessary to properly rectify the situation. This shall also apply to any and all damages sustained to the cables by the Contractor during the implementation.

C. The Structured Cabling System (SCS) installation should meet all applicable national and local codes pertaining to low voltage cable system installations.

D. The contractor will adhere to the installation schedule of the general contractor and should attend all construction meetings scheduled by the general contractor.

E. The contractor will be responsible for the cross connection of the horizontal cable runs to the backbone cable system. The connection to voice and data systems will be performed by the vendors installing and/or maintaining those systems.

F. All components of the cabling system shall be installed in a neat, workmanlike manner. Wiring color codes will be strictly observed and terminations shall be uniform throughout the installation. All cables shall be neatly dressed at the termination points. Final installation shall be subject to the Engineer's approval.

G. Any cable placed in space used as an air return or in any way connected with air-handling plenums or building ventilation shall be low-smoke, fire retarding cable, and must comply with the NEC 725, 760, and 800. No cabling shall be placed in plenums without written approval from the City Engineer.

H. All vertical cables shall be affixed to a permanent structure at each floor in accordance with industry standards to avoid cable pull back.

I. All conduit and cabinet entrances shall be sealed with an approved, re-enterable sealant material to prevent ingress of water, dust, or other foreign materials.

J. The Contractor shall conceal all horizontal distribution wiring within conduit provided in the walls. If it becomes necessary to use an alternative method, the Contractor shall obtain approval from the Owner prior to the use of the alternate method.

K. Install work following drawings, manufacturer's instructions, and approved submittal data.

L. The installation shall meet all applicable national and local codes pertaining to low voltage cable system installations.

M. The contractor will provide service loops (slack) for cables terminating in the main equipment room or the telecommunications closets. A 6- foot service loop will be provided above the access ceiling or cable trays unless specified otherwise. This will allow for future changes or expansion with having to install new cables.

N. The installation will include coordination, testing and problem resolution with the system vendors.

O. Provide any necessary screws, anchors, clamps, tie wraps, distribution rings, miscellaneous grounding and support hardware, etc., necessary to facilitate the installation of the cable plant system.

P. Furnish any special installation equipment or tools necessary to properly complete the installation.

Q. Failure to follow the appropriate guidelines may require the installer to provide additional material and labor necessary to properly rectify the situation. This shall also apply to any and all damages sustained to the cables by the installer during the implementation.

R. Plug conduits where cabling has been installed in the main equipment room, backbone and other cable entrance locations with re-enterable duct seal of flame retardant putty.

S. All wiring, materials, and equipment must be listed and labeled by a nationally recognized testing laboratory. Original Equipment Manufacturer (OEM) documentation must be provided to the Owner, which certifies performance characteristics which meet TIA 568 Standards.

T. All techniques and fixtures must result in ease of maintenance and ready access to all components for testing measurements. No self tapping screws shall be used. All parts shall be made of corrosion resistant material, such as plastic, anodized aluminum or brass.

U. All materials used in installation shall be resistant to fungus growth and moisture deterioration. Dissimilar metals apt to corrode through electrolysis under the environmental operating conditions specified shall be separated by an inert dielectric material.

V. Provide firestop at all fire rated penetrations.

W. Field coordinate exact feeder, tie and riser backbone cabling pathways with other trades prior to construction. All existing pathways shown are suggested routes for the contractor to use as a guideline. The contractor is required to coordinate the exact pathway. In any case where the communication pathway must be removed and re-routed due to conflicts with other trades which were not previously coordinated with all building trades, the contractor is responsible for all costs associated with the removal and relocation.

X. Provide reducer brackets in all 23” cabinets and/or racks full length of rack for installation of 19” equipment.

Y. Provide bushings on all conduit ends.

3.5 DATA RELAY RACK

A. Bolt rack to floor.

B. Mount racks end to end in single continuous row with vertical wire managers located full length of rack between each end and on each row end.

C. Provide horizontal wire managers as follows:

1. Front/Rear: Between each 24 port copper patch panel.

2. Front: Between each 24 port network switch.

3. Locate plug strips in racks with electronics.

3.6 HORIZONTAL CABLE ROUTING AND SUPPORT

A. The cable shall be routed un-exposed above the ceiling with 12" of clear space above route whenever possible.

B. Conduit runs shall not exceed two 90-degree bends or 100 feet without a pull box.

C. All conduit located in the ceiling shall protrude 2 inches into the closet. Provide bushing on conduit end. Label all conduit ends and cables inside or passing through MDF and IDF Rooms.

3.7 LABELING

A. Refer to section 270553

3.8 GROUNDING AND BONDING

A. Refer to section 270526

3.9 CLEANING

A. Clean rooms after each installation phase of the Project so that construction debris or installation debris are removed continuously as the Project progresses and new equipment being installed is not contaminated from existing construction dust or debris.

B. Provide final cleaning of room, cabinets, and equipment prior to inspection by Engineer.

3.10 ACCEPTANCE

A. Refer to section 270000

END OF SECTION 271100