SECTION 27 11 00

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

BASED ON DFD MASTER SPECIFICATION DATED 03/01/23

Notes to A/E:

This section has been written to cover most (but not all) project requirements that you will encounter. Depending on the project, you may need to add material, delete items, or modify what is currently written.

Edit all areas as applicable to meet the requirements of the project. Common options or features recognized by the DFD, or items where A/E input is needed are enclosed in [brackets] and/or <less-greater brackets>.

Editing instructions are included throughout the document (italic text; red if viewed/printed in color). These instructions should be hidden or deleted for printing. Text can be hidden by modifying the MS-WORD Style “A/E Instructions” to use “Hidden Text” as part of the Font type. To display Instructions formatted as “Hidden Text”, configure MS-Word File Options /Display to “Show” Hidden Text on Screen.

The document is structured to automatically update the Table of Contents when printed or in response to an “Update Field” command (right mouse click on TOC opens menu) in MS-Word. Confirm that changes to the document outline are reflected in the TOC. TOC entries are Hyperlinks and can be used to navigate the document.

Revision History:

In the on-line “DFD Document Library” Under “Master Specifications/Design Guidelines / Division 27 – Communications” see “Div. 27 Revision History”.

1. GENERAL

Scope

This Section describes the general, product and execution requirements relating to equipment required in the fit-out of the Communications Equipment Room(s) for the project. Included are the following topics:

[PART 1 - GENERAL](#_Toc112169023)

[Scope](#_Toc112169024)

[Related Work](#_Toc112169025)

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[PART 2 - PRODUCTS](#_Toc112169028)

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[General](#_Toc112169035)

[Equipment Rack and Cabinet (Free Standing)](#_Toc112169036)

[Equipment Rack (Wall-mount)](#_Toc112169037)

[Cable Runway](#_Toc112169038)

[Grounding and Bonding](#_Toc112169039)

[Miscellaneous](#_Toc112169040)

Related Work

Applicable provisions of Division 1 govern work under this Section.

Section 01 91 01 or 01 91 02 – Commissioning Process

Section 26 05 26 – Grounding and Bonding for Electrical Systems

Section 27 05 53 – Identification for Communications Systems

Section 27 08 00 – Commissioning of Communications

Section 27 10 00 – Structured Cabling

References

All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the Wisconsin Electrical Code and present manufacturing standards.

All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

Other applicable standards are as follows:

* ANSI/IEEE C2 - National Electrical Safety Code
* SPS Chapter 316 – Wisconsin Dept. of Safety and Professional Services Electrical Code
* TIA-568-C.0, -568-C.1, -568-C.2, -569-C, -606-B and TIA-607-C (with exception) and standards referenced therein
* IEEE/ANSI 142-1982 - Recommended Practice for Grounding of Industrial and Commercial Power Systems
* EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment
* UL 2416 - Standard for Audio/Video, Information and Communication Technology Equipment Cabinet, Enclosure and Rack Systems

Submittals

Refer to Section 27 10 00 – Structured Cabling.

1. PRODUCTS

Equipment Rack

General

Refer to the project Drawings for quantities required at each location. Where additional Equipment Racks are required or where existing racks are in place and none are required, it shall be so noted on the Project Drawings.

Equipment Rack shall comply with State Building Codes for the seismic area where installed.

Rack shall be [84"] [other size] in height and shall be self-supporting.

Upright Mounting Channel (E-Rail on 4-post racks) spacing: Per EIA/ECA-310 to accommodate Industry standard 19” mounting.

Construction:

Unless required by the Agency, Black, powder coated, or painted finish should be specified. Clear-grained Aluminum is UW - Madison campus preference.

Material: Aluminum

Finish: [Powder coated or painted surface] [Clear grained Aluminum]

Color: [Black] [Gray] [N/A]

Upright Mounting Channel/Rail shall be drilled and tapped to accept 12-24 screws.

Vertical hole spacing: Per EIA/ECA-310 (5/8"-5/8"-1/2")

Upright Mounting Channels/Rails shall be marked with Rack Unit (RU) identifiers per ANSI/TIA-606-B. Numbering shall be “bottom-to-top” (e.g., “#1” at bottom of rack).

The accessory list below assumes the use of a ground bus on each equipment rack. A The use of a horizontal Bus Bar or vertical Grounding Strips that attached to the rack upright are both acceptable. Confirm agency preference and edit as applicable.

For each rack, provide:

* Mounting Screws; 12-24 (24 minimum quantity)
* [Ground Bar][Vertical Grounding Strip] and #6 AWG Ground lug

Free Standing Equipment Rack – 2-post

Base footprint shall be no smaller than 15” x 20”.

Upright Mounting Channels shall also be drilled on back to accept cable brackets, clamps, power strip(s), and other hardware. 3-inch hole spacing is acceptable.

Free Standing Equipment Rack – 4-post

Rail type: [Fixed][Adjustable]

Rack Depth (usable; inches): [24][29][30][36][40][Adjustable from ## to ##]

Upright Mounting Rails – front and rear – shall be drilled per EIA/ECA-310 as noted above in “General”.

Jumper Management

Rack shall be equipped with Vertical Jumper Management Hardware as to allow an orderly routing of twisted pair, optical fiber and coaxial jumpers from the patch panels to the customer provided network equipment.

Hardware shall provide for cable routing on front and, for 2-post construction, rear of each rack.

Vertical managers shall:

* Have non-metallic “fingers” spaced at 1.75” (1 Rack Unit; RU) aligned with each Rack Unit indicator on the equipment rack. Surface of fingers shall be curved to support cable bend radius goals.
* Be equipped with hinged front and, for 2-post construction, rear doors that cover the cable routing area.

Channel dimensions: Minimum width: 6” at end-of-row, 8” between adjacent racks or as shown on project drawings.

Hardware shall be designed to mount in a way that does not use holes intended for mounting of hardware and equipment and allows for full use of the equipment rack.

* Where multiple racks are to be installed, mount hardware between the uprights of adjacent racks.
* Secure rack uprights and spacers together per manufacturer recommendations.

Equipment Cabinet (Free Standing)

General

Where identified on the drawings, free standing equipment cabinets shall house all termination components installed under this contract. Equipment cabinets shall be fully gasketed to keep contaminants away from equipment.

Hinges and Latch shall be configurable to allow cabinet doors to open Left or Right.

Doors shall be lockable and furnished with two (2) keys.

Doors on all cabinets furnished under this contract shall use the same key.

Construction:

Material:

Frame: Steel or High strength extruded Aluminum

Doors, Sides and Top: Steel or Aluminum

Front Door: [Solid][Safety-glass] [Vented Safety-glass]

Rear Door: [Solid] [Perforated or Louvered]

Sides: [Solid] [Perforated or Louvered]. Not required between cabinets placed side-by-side.

Top: [Solid] [Perforated]; Configure Panel with cable access and/or ventilation as required.

Base: [Open] [Solid to support AC performance]; Integral Leveling Feet

Finish: Powder coated or painted surface; Color [Black] [Gray] [Beige] [other]

Where applicable, the Side Panel on which the AC Units is to mount shall have cutouts for in-field installation of the unit.

Dimensions (minimum):

Usable mounting height (RU) – [42] [other] (RU = 1-3/4”)

Width: 27 inches

Depth – [30] [other] inches

The cabinet shall be configured as to allow for adjustment of the channel uprights (front to rear) in 1-inch increments (maximum) and be spaced to accommodate industry standard 19-inch mounting. Uprights shall be tapped to accept mounting screws.

Cabinet(s) shall be equipped with:

Vertical cable management hardware (Left and Right).

Integral bonding points for grounding.

Ground Bar and #6 AWG Ground lug.

Cabinet Active Ventilation and Cooling

Edit as applicable. Where no active ventilation or cooling is required – this is unusual – , edit to indicate “Not applicable to this Project” or delete.

Ventilation

Provide Fan Kit at [Top] [Top and Bottom] of enclosure to ensure adequate airflow.

Provide filter kit at air intake location(s).

Air Conditioning (AC) Unit.

Where identified on the drawings, cabinets shall be equipped with a side-mounted Air Conditioning (AC) Unit.

The AC Unit shall be by the same manufacturer as the Equipment Cabinet and intended for the specified purpose.

Construction: Painted or powder-coated steel or aluminum enclosure.

Refrigerant Type: R134a or R407c

Power: [120 VAC] [208 VAC]

Capacity: [1,400] [other] BTU/Hr.

Features:

Thermostat control.

EMI/RFI noise suppressor included.

Remote access controller to communicate via Ethernet/IP.

Closed-loop cooling separates clean, recirculated air from ambient airflow system.

Cover hinges open for access to all components.

See PART 3 direction re: cable entry in AC-equipped cabinets.

Equipment Cabinet (Wall-mount)

Where identified on the drawings, wall mounted equipment cabinets shall house all termination components installed under this contract.

Be of a “three-section” construction including (a) wall-mount section that incorporates cable entry, (b) center section and (c) Door. Each section shall be hinged to facilitate access. Hinges shall be configurable to open LEFT OR RIGHT.

The Wall-mounted section shall incorporate knockouts (top and bottom) for cable access.

Include lockable doors when requested by the Agency where the need is otherwise determined.

The Door shall be solid. Door depth shall be 2-inches or greater. [Door shall be lockable and furnished with two (2) keys. Doors on all cabinets furnished under this contract shall use the same key.]

Door shall be at least 25-inches in width. (It is understood that this may require a custom configuration. Use of standard cabinet designs with extended mounting rails is to be considered).

Hardware mounting depth (from front of channel upright to wall) shall be 18-inches (minimum).

Include the requirement for Fan/Filter Kit for most instances. Confirm expected equipment heat load with agency.

[Provide Fan/Filter Kit at top and bottom of enclosure to ensure adequate airflow. Position Fan/Filter at top on side opposite location of the Fan/Filter on bottom.]

The cabinets shall be constructed of painted Steel or Aluminum.

Confirm mounting height and depth with User Agency.

Dimensions:

Minimum usable mounting height – [15 RU] [other] (RU = 1-3/4”)

Mounting depth – [18] [21] [other] inches

Cabinet shall have a load-bearing capacity of 100 [150] lbs. or greater.

The cabinet shall be configured to allow for adjustment of the channel uprights (front to rear) in 1-inch increments, spaced to accommodate industry standard 19-inch mounting, and tapped to accept 12-24 screws. The cabinet shall be vented to allow for airflow through the cabinet.

Cabinet(s) shall be equipped with vertical and horizontal cable management hardware, in the form of rings and guides, as to allow an orderly routing of optical fiber and twisted pair jumpers from the patch panel to the customer provided network equipment. At a minimum, provide one such horizontal jumper management panel with each cabinet.

Cable Runway

This article assumes the use of common “Ladder-type” Cable Runway. Use of mesh-type cable support within a Telecommunications Equipment Room is also acceptable where that approach is standard for the project site or Agency. Edit the section as applicable.

Sometimes referred to as “Ladder Rack”, Cable Runway is used for support and routing of cabling within a Telecommunications Equipment Room.

Construction: Rungs welded to tubular stringers.

Material: Steel; 0.065 inch thick

Stringer Height - 1.5 inches

Rung Spacing - 9 inches on center

Finish: Manufacturer's standard epoxy paint or baked-polyester powder coat.

Match finish of Cable Runway to Equipment Rack finish.

Color: [Black] [Gray]

Width: As shown on drawings.

Miscellaneous Materials

Add miscellaneous small items that may be required as part of the fit-out. ESD Kit is required. Power Strip / Surge Suppressor is optional per agency requirements.

It is not necessary to include incidental items such as screws, tape, bonding components, etc.

Power Strip / Surge Suppressor

Coordinate power in Telecommunications Rooms. Consider the option of using quad 5R-20 (or Agency-defined plug configuration) mounted at the bottom of the rack. Confirm plan with Agency. Confirm requirement for Surge Suppressors with Agency. Many may decline if UPS’s are installed.

Some agencies may prefer a vertically-mounted Power Strip. If applicable, add language requiring that the unit does not impede equipment mounting. Require a mock-up prior to construction to confirm clearances.

Power Strip / Surge Suppressor shall:

Be rack mountable (19-inch rack)

Be compliant with UL-1449, UL-1283 and UL-497A.

Provide Transient suppression to 13 kA. Protection shall be in all 3 modes (hot-neutral, hot-ground & neutral-ground).

Meet or exceed IEEE 587 Category A & B specification.

Provide High Frequency Noise Suppression as follows:

>20 dB @ 50-kHz

>40 dB @ 150-kHz

>80 dB @ 1-MHz

>30 dB @ 6- to 1000-MHz

Provide a minimum of 320 Joules of AC Energy Absorption.

Be equipped with a 12-foot power cord

Provide a minimum of six (6) outlets

Electrostatic Discharge (ESD) Kit

Lug:

Two-hole Mounting

Accommodates standard ESD wrist strap 4mm plug

Barrel marked with the ground symbol

Wrist Strap:

Adjustable fabric strap with 6' coil cord, 4 mm plug, resistor.

1. EXECUTION

General

Refer to Project Drawings that indicate Equipment Room layout

Furnish and install hardware and equipment as shown on drawings and as specified above.

It is the contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.

Beginning installation means contractor accepts existing conditions.

Should it be found by the Engineer that the materials or any portion thereof furnished and installed under this contract fail to comply with the specifications and drawings with the respect or regard to the quality, value of materials, appliances or labor used in the work, it shall be rejected and replaced by the Contractor. All work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.

Equipment Rack[ and Cabinet] (Free Standing)

General

Refer to the Project Drawings for Quantities by location.

Confirm exact location and orientation with agency prior to permanent installation.

Position racks and cabinets to provide minimum clearances as follows:

* ~6” between the rack upright or cabinet sidewall and the wall to allow for cabling in that area.
* 40” from the rear of the rack upright or cabinet rear door to the wall behind the rack to allow for access by maintenance personnel.
* 40” workspace in front of the rack or cabinet front door.
* To allow for full swing of cabinet front and rear door(s).

Locations where these guidelines cannot be followed should be brought to the attention of the Engineer for resolution prior to installation.

Mount all hardware and equipment between 18" and 79" above floor level. This is to afford easy access and, in the case of the lower limit, prevent damage to the components. Positioning of hardware should be reviewed and approved by the Engineer and DFD Construction Representative prior to installation.

Provide cable management hardware on both the front and back of rack/cabinet to allow an orderly and secure routing of cabling.

Provide horizontal cable management hardware per specification Section 27 10 00.

Vertical jumper management shall provide for cable routing on front and rear of each rack and cabinet. See below.

Use Paint Piercing Washers and screws per manufacturer’s recommendations to ensure that all elements of the rack or cabinet assembly are electrically common. Apply antioxidant paste to surfaces with which Paint Piercing Washers will come into contact per manufacturer’s recommendations.

For each Equipment Rack and Cabinet, provide:

* Mounting Screws; minimum quantity (24).
* Releasable (e.g., "hook & loop") cable support ties; minimum quantity (12).

Equipment Rack

Bolt Equipment Rack(s) to the floor as recommended by the manufacturer. Multiple racks shall be joined, and the ground made common on each. Rack shall also be stabilized by extending a brace extending to the wall. Alternately, overhead cable runway (“ladder rack”) over which the cabling accesses the equipment rack(s) shall provide this function.

Mount Vertical Jumper Management hardware on spacers attached to the rack uprights and not on the upright itself. Where multiple racks are to be installed, mount this hardware between the uprights of adjacent racks and at each end of the row. Secure rack uprights and spacers per manufacturer recommendations. Refer to PART 2 or Project Drawings for Vertical Manager dimensions.

Equipment Cabinet

Where multiple cabinets are installed or are being added to an existing installation, provide with Joining Kits. Remove cabinet sides of adjacent cabinets unless otherwise noted in drawings.

Provide cable access in cabinet top(s) to facilitate cable entry. Field fabrication is acceptable.

Where cabinet is Air Conditioned, configure cable entry to maintain integrity of the enclosure and proper air-flow. Use of a “Brush Kit” is an example of an acceptable method.

Mount Vertical Jumper Management hardware using means recommended by the cabinet manufacturer. Provide such hardware left and right side of all cabinets. Refer to PART 2 or Project Drawings for Vertical Manager dimensions.

Equipment Rack (Wall-mount)

Confirm location of rack/cabinet to ensure equipment access and clearances, including when assembly is rotated as required to provide access to back of mounted equipment.

Mount per manufacturer’s recommendations.

Use anchoring means appropriate for the wall type and to support the rated load of the Cabinet.

Cable Runway

Provide cable runway and accessories necessary for complete system.

Size and layout cable runway per project Drawings.

Install per manufacturer’s recommendations with cross- members (rungs) at the top of the stringer.

Brace to racks with support brackets made by runway or rack manufacturer and intended for this purpose. Method shall provide adequate clearance for use of cable dropouts and to maintain cable bends to greater than recommended minimums.

Provide radius drops where cables drop from Cable Runway to Equipment Rack and at elevation changes of 6 inches or more.

Support at wall and at intermediate points not supported by equipment racks per manufacturers recommendations. Maximum allowable deviation of runway from level horizontal plane measured across length of cable runway shall be 5/8 inch, with tray loaded to capacity.

Fasten cables to cable runway at intervals not to exceed 48 inches using hook and loop cable ties.

Grounding and Bonding

Ground per specification Section 26 05 26 and manufacturers recommendations.

Bonding Conductor may be routed unenclosed on Cable Runway and on Equipment Rack.

Equipment Racks and Cabinets

Bond each rack and cabinet via on-rack ground bar or grounding strip to the Telecommunications Ground Busbar (TGB) using a #6 AWG (or larger) insulated stranded copper conductor (GREEN jacket or GREEN jacket with one or more yellow stripes per NEC paragraph 250.119).

Bond each rack to the TGB via a separate conductor.

Alternately, a single bonding conductor may be run from the TGB to the row of racks and a conductor for each rack tapped off the single Bonding conductor.

Install ground bar such that there is a bond between it and rack/cabinet. Remove paint from the rack/cabinet at the connection point. Use thread-forming (paint piercing) type mounting screws.

Cable Runway

Use manufactured straps between spliced sections per manufacturer’s recommendations.

Bond each segment to Telecom Grounding Busbar in room.

Miscellaneous

Power Strip / Surge Suppressor

Coordinate power in Telecommunications Rooms. Consider the option of using quad 5R-20 (or Agency-defined plug configuration) mounted at the bottom of the rack. Confirm plan with Agency. Confirm requirement for Surge Suppressors with Agency. Many may decline if UPSs are installed.

Unless noted otherwise on project drawings, provide (1) Power Strip / Surge Suppressor at each equipment rack for powering of the network electronics (by others):

At the Main Equipment Room.

At each Telecommunications Room (as applicable).

Install per manufacturer’s recommended practices.

Electrostatic Discharge (ESD) Kit

Provide ESD Kit(s) in each Telecom Room.

Where (1) kit will not allow user to reach all racks, provide multiple kits. Consider both left- and right-handed use.

Provide (1) kit for each free-standing cabinet.

END OF SECTION