

## **27 11 23 BDF/IDF Cable Management Systems**

(Revision date: 5/7/12)

### **1.0 Purpose**

- A. These guidelines provide requirements for designers to incorporate into bid documents. They are part of the University Wiring Standard (UWS), version 3.0.

### **2.0 General Requirements**

- A. Telecom rooms. Telecom rooms will serve as termination points for horizontal, riser, and entrance telecommunications cabling within campus buildings. They will also house network electronics and associated equipment to support all communications services for the building occupants. The main telecom room for a building will be known as the Building Distribution Frame (BDF) room. Satellite telecom rooms will be known as Intermediate Distribution Frame (IDF) rooms.
- B. Cable management system. Each BDF and IDF will be equipped with a system of equipment racks, vertical and horizontal cable management hardware, and overhead ladder racks to support the above functions. The configuration of each room will be designed based on the specific architectural aspects of the site and for the specific equipment to be installed.

### **3.0 Materials and Standards**

- A. Materials. The materials used for this system are to be manufacturer and part number specific with no substitutions, unless specified as accepting "or equal." See Section 27 06 00 Schedules for Communications Systems for a list of materials acceptable for use in NC State University projects.
- B. Construction details. Detail drawings describing various rack and cabinet layouts are available for download and modification by designers at the NCSU ComTech website.
- C. Standards. All work shall also be in accordance with the latest versions of the BICSI TDMM manual and TIA-568 standard, and with manufacturer's recommendations.
- D. Floorplan views. The designer should include a plan view of each BDF and IDF denoting equipment to be installed and dimensioned location of all equipment in the room.
- E. Room sizes. Each BDF and IDF will be sized appropriately to support the equipment to be installed. Generally, all BDF/IDFs will be one of the following four types: multi-rack, single-rack, surface cabinet, or flush cabinet. Determination of type and size will be based chiefly on the number of telecom outlets in the service zone of the particular BDF/IDF.
- F. Multi-rack rooms. BDF/IDFs that support a service zone with more than 48 outlets (including 20%) should be equipped with multiple free-standing equipment racks.
  - 1. Rack layout. The placement of equipment racks in the room should be specified such as to allow maximum possible access to equipment by technicians. In general, racks should be positioned in a line abreast and parallel to the longest wall of the room. When possible, a minimum of 3'- 6" should be left between the vertical manager on each end of the line of racks and the wall. If this is not possible, the vertical manager on one end of the line of racks should be positioned directly adjacent to one wall of the room with maximum space (3'- 6" min.) remaining at the

opposite end of the line of racks. The minimum clearance from the rear of an equipment rack to the wall should be 30". A minimum of 48" should be maintained between the front of the equipment rack and the facing wall. In very large rooms, two rows of racks (facing each other) may be installed using the above criteria. A minimum of 48" should be maintained between the front of the equipment racks in the two rows.

2. Rack selection. Racks for termination of horizontal cabling come in five standard configurations: "192-outlet rack", "144-outlet rack", "96-outlet rack", "48-outlet rack", and "24-outlet rack". The cross connect rack selected should be based on the number of outlets in the service zone plus 20% (min.) growth. For zones exceeding the capacity of a "192-outlet rack", additional racks of appropriate size should be added.
  3. Rack pairs. Each "192-outlet rack" and "144-outlet rack" should be paired with an "electronics rack" installed adjacent to it. Generally, network switch ports in the electronics rack will be patched to horizontal cable terminations in its paired rack. In the "96-outlet rack", "48-outlet rack" and "24-outlet rack", the network switches may be installed within those racks without the need for a separate "electronics rack".
  4. Riser/entrance racks. One "BDF rack" should be installed in each BDF to house entrance and riser cabling termination hardware and network electronics. One "IDF rack" should be installed in each IDF to house riser cabling termination hardware and network electronics.
- G. Single rack rooms. BDF/IDFs that support a service zone with less than 48 outlets (including 20% growth) may be provisioned with a single free-standing equipment rack. The placement of the equipment rack should be specified such as to allow maximum possible access to equipment by technicians (to both the front and rear of the rack). In general, the rack should be placed so that equipment faces the door, with the front of the rack 6" inside the door frame. A minimum of 1'- 10" should be maintained between the rear of the equipment rack and the back wall of the room.
- H. Surface mounted cabinets. BDF/IDFs that support a service zone with less than 24 outlets (including 20% growth) may be provisioned with a surface mounted wall cabinet.
- I. Flush mounted cabinets. IDFs that support a service zone with less than 12 outlets (including 20% growth) may be provisioned with a set of flush cabinets mounted between two wall studs.
- J. Vertical management. Vertical management hardware will be installed on both sides of each rack. The size and type of vertical manager will be based on the rack type. This hardware will be used to support routing of horizontal, riser, and entrance cabling from the overhead ladder rack system down to specific termination panels in the rack.
1. Cross-connect racks. On each "192-outlet rack" and "144-outlet rack" install two double-sided 12"W x 20 5/16"D x 84"H vertical managers (without covers). On each "96-outlet rack" and "48-outlet rack" install two double-sided 10"W x 20 5/16"D x 84"H vertical managers (without covers). On each "24-outlet rack" install two 6"W x 20 5/16"D x 84"H vertical managers (without covers). For all managers, install with fingers side facing the front of rack and gates side facing the rear. Install manager using the two square-notch mounting holes in the front half of the manager fastened to the side rail of the equipment rack. Securely fasten the front and rear halves of the managers together. Install ten (10) plastic gates on the rear of the manager. Gates

should be evenly spaced and aligned with each 72-port patch panel. Install four cable retaining bars, evenly spaced to separate the front vertical channel from the rear vertical channel. The front channel will be used for data patch cords (by NCSU). The rear channel will be used for horizontal cabling.

2. Other racks. On each side of each "BDF rack", "IDF rack", and electronics rack, install (6) 2.30" x 3.80" D-rings, spaced 12" apart. Mount D-rings to the back of rear rail on the equipment rack. Install with short side flush with the back of the rear rail with the ring extending to the front of the rack. These will be used to route fiber jumpers and patch cords that inter-connect ComTech-owned equipment.
  3. Single rack BDF/IDFs. For the single rack in these rooms, install one double-sided 6"W x 20 5/16"D x 84"H vertical manager (without cover). Install on side of rack farthest from the door. Install with fingers side facing the front of rack and gates side facing the rear. Install ten (10) plastic gates on the rear of the manager. Gates should be evenly spaced and aligned with each 72-port patch panel. Install four cable retaining bars, evenly spaced to separate the front vertical channel from the rear vertical channel. The front channel will be used for data patch cords (by NCSU). The rear channel will be used for horizontal cabling.
- K. Horizontal management. The size and type of horizontal manager will be based on the type of equipment supported. All will be mounted on the front of the equipment racks. These managers will be used to support data patch cords, voice patch cords, and fiber jumpers.
1. Rack mount UTP patch panels. Each rack mount 72-port patch panel will be provisioned with an accompanying 3RU, finger style, 5 1/2" deep horizontal manager mounted just below the panel.
  2. Surface mounted cabinet UTP patch panels. Each 72-port patch panel installed in a surface cabinet will be provisioned with an accompanying 2RU, ring-style, 4" deep horizontal manager mounted just below the panel.
  3. Coax patch panels. If installed, coax (video) patch panels will be installed without horizontal managers.
  4. Voice riser panels. Each voice riser panel will be provisioned with one 1RU, finger style, 5 1/2" deep horizontal manager installed immediately above or below the panel (alternating).
  5. Rack cross-over panels. At the top each rack, one 1RU, 6"D transition tray will be installed to route fiber jumpers and patch cords that inter-connect ComTech-owned equipment in non-adjacent racks. At the bottom of each rack, one 2RU, 6"D transition tray will be installed to route voice patch cords between non-adjacent racks.
  6. Voice analog gateways. One 1RU, finger style, 5 1/2" deep horizontal manager will be installed immediately below each gateway (by NCSU).
  7. Network switches. Horizontal managers will be installed with network switches by NCSU.
- L. Rear support bar. On the rear of each cross-connect rack, one 1RU cable management bar will be installed behind each 72-port patch panel. This will be used to separate and manage horizontal cables as they route to the rear of the patch panel.

- M. Rack mounting. Free-standing racks are to be mounted securely to floor with four bolts each. A suitable bolt and anchor system for the floor structure present is required.
- N. Surface cabinet mounting. Install 36" high cabinet directly onto wall (no plywood required) at 3'- 0" AFF. Construct support frame using 1 5/8" steel channel as follows: Install two vertical runs adjacent wall, spaced 1'- 8" apart. Install horizontal run on top of vertical runs at approximately 5'- 9" AFF. Fasten securely to floor with steel post bases with a bolt and anchor system suitable for the floor structure present. Install one welded steel universal shelf bracket on each vertical channels at 3'- 0" AFF. Fasten rear section of cabinet to shelf brackets. Support frame should be installed in such a manner as to support loaded cabinet in the open position free-standing (without attachment to wall). However, to provide additional stability, one of the vertical channels should be fastened to the wall stud with lag bolts and the second vertical channel to the gypboard wall with toggle bolts. For masonry walls, a suitable bolt and anchor system should be installed. Install black rotating hasp (for padlock installation by Owner) near top of non-hinged side between rear and main cabinet sections. Install hasp with machine screws and nuts (not with sheet metal screws provided).
- O. Flush cabinet mounting. Install one 42" Structured Media Center (SMC) cabinet between two wall studs (16" O.C.) at 12" AFF. Install one 28" SMC cabinet immediately above the lower cabinet such that when closed both doors are flush and aligned with each other. Orient both cabinets with round conduit knockouts facing up. Remove all knockouts between the cabinets to create pathways for patch cables.
- P. Ladder rack. A system of overhead ladder racks shall be installed to support and distribute all cabling from where it enters the room to its appropriate termination location. Ladder rack shall be installed at 7'- 2" AFF, and attached to the equipment racks and walls. It shall be supported at every 6' (min.). The designer should specify the layout of these ladder racks in order to allow smooth cable flow between locations where wireway and conduits enter the room. The system installed shall comply with industry best practices (as interpreted by ComTech) for cable routing and support. The overhead ladder rack system should also allow for installation of all needed slack loops.
1. Multi-rack rooms. In typical rooms, one 18" ladder rack should be installed directly above each row of equipment racks and extended to the room walls. Additionally, 12" wide ladder racks should be installed around the perimeter of the room, attached directly to the walls. These 12" ladder racks should be connected into the sides of the 18" ladder racks.

The 18" ladder racks should be centered longitudinally above the top of the equipment racks. Two standoff angles should be installed at the top of each equipment rack with the horizontal flanges facing outward. The front angle will be installed between the upper transition tray and the rack's vertical rails. The rear angle will be installed between the rack's rear top rail and the vertical rails. The ladder rack will be fastened to the standoff angles with hold down plates.

Four cable drop outs will be installed in the 18" ladder rack above each cross-connect rack. Drop outs will not be installed for the following rack types: "BDF rack", "IDF rack", and "Electronics rack". Two drop outs should be installed aligned with and on each side of the rear half of each vertical manager. Openings should be cut in the bottom of the ladder rack to facilitate smooth routing of the horizontal cables from the ladder rack into the vertical managers.

Wall termination kits should be installed facing down (except where obstructions - e.g. door frames - require installation facing up) where ladder rack ends connect to

walls. "L" bracket supports should be used where ladder rack sides connect to walls. Typically, all splicing of ladder rack sections will be accomplished using washer splice kits. At horizontal turns in the ladder rack or where two horizontal sections of ladder rack meet perpendicularly, rollers or sweeps (shields) will not be required. Sections can be bent in the field or spliced together at these locations.

Vertical runs of 12" wide ladder rack shall be installed on the wall where cables penetrate up through the floor of the room. These should be installed to allow smooth transition to the overhead horizontal ladder rack system. Also, in locations where conduits or wireways penetrate the ceiling of the room or the rooms walls above 9'- 0" AFF, vertical ladder racks shall be installed to route cables down to the horizontal ladder rack system. Typically, vertical ladder racks will be attached to walls using wall mount kits.

All exposed wire ends shall be filed smooth to prevent damage to cabling or injuries to technicians. Rubber caps shall be installed exposed wire ends where applicable.

Some BDF/IDF rooms will have obstructions (e.g. columns, HVAC hardware, piping, etc.) that will require modifications to both the horizontal and vertical routing of the ladder rack. Ladder racks may be offset as required (typically by bending) as long access to ladder racks for future cable installation is maintained and technician safety is considered. The designer/contractor should coordinate these atypical routing scenarios with ComTech prior to installation. In very large BDF/IDFs, a second run of horizontal ladder rack may be required. Typically, this should be installed at 9'- 0" AFF.

2. Single rack rooms. In typical rooms, one run of 12" ladder rack should be installed directly above the equipment rack and extended to the room walls. The ladder rack shall be fastened to the equipment rack using standoff angles as described above. One cable drop out should be installed to facilitate smooth horizontal cable routing into the rear half of the vertical manager. An opening should be cut in the bottom of the ladder rack to align with the vertical manager. Wall termination kits should be installed facing down where ladder rack ends connect to walls.

End of Section