

SECTION 16742

TELEPHONE/DATA/CATV SYSTEMS

PART 1 DESIGN DIRECTIVES

1.1 DESIGN CRITERIA

- A. The intent of this Standard is to be used in new construction and substantial renovations of existing structures. For minor renovations, DC-Network Services will review the project to determine the wiring methodology.
- B. The standard for data wiring on campus is either Cat 6 or 10 gig standard. Generally, 10 gig shall be utilized in academic buildings. Cat 6 shall be utilized in non-academic buildings such as administration and residential life buildings. Please note the differences throughout this document between Cat 6 and 10 gig.
- C. Two (2) Cat 6, 4 pair media series data cables run to each ~~CommScope Uniprise Solutions Connector and connect to patch panels~~ *Siemons Duplex RJ-45 Coupler* in the MDF/IDF's. Existing MDF/IDF's that need expansion in order to comply with the new standard must meet the TIA/EIA specifications for a communications room. When dealing with an existing MDF/IDF, the design choice will be made and specified by Dartmouth Network Services on a case by case basis.
- ~~D. Two (2) 4pair Cat6 data cables run to each Comscope Systimax outlets and connect to patch panels in the MDF/IDF's. Existing MDF/IDF's that need expansion in order to comply with the new standard must meet the TIA/EIA specifications for a communications room. When dealing with an existing MDF/IDF, the design choice will be made and specified by Dartmouth Network Services on a case by case basis.~~
- ~~E.D.~~ The need for plenum rated cabling shall be determined by the design consultant. If so, the specifications shall reference only plenum rated wire; if not, wire shall be PVC coated. Refer to this Standard for specific wire types.
- ~~F.E.~~ Distribution Frames (MDF/IDF)
 - 1. The Building Main Distribution Frame (MDF), and/or the Intermediate Distribution Frame (IDF), may be shared with both the Telephone and CATv Networks. The MDF/IDF must have its own secure room.
 - 2. The designer is required to refer to and comply with the EIA/TIA-569 section, "Telecommunications Closet", for room design parameters including architectural elements, mechanical, & electrical requirements. The space shall be reviewed by DC-Network Services during the design development phase. Consultants may make arrangements to review the EIA/TIA-569 document with DC-Network Service's office.
 - 3. Each MDF/IDF must have a (2), 2-gang duplex- power receptacle. Each duplex receptacle to be on a dedicated, 120 volt, 20 amp, circuit. Location of this circuit breaker must be noted at the outlet.
- ~~G.F.~~ Where possible, the MDF/IDF shall be on emergency generator power. Refer to DC Standards, GENERATOR SETS.

1.2 CONTRACTOR RESPONSIBILITY

- A. The contractor shall be responsible for the following items:
 - 1. All cross connect rings or spools.
 - 2. All connecting blocks and/or patch panels
 - 3. All mounting brackets and/or relay racks.
 - 4. All station cable (voice, data and CATv as required).
 - 5. All communication outlets and terminating hardware as required.
 - 6. All conduit/inner duct (as required).
 - 7. All hangers and mounting hardware.
 - 8. All wraps, bushings and miscellaneous parts.
 - 9. All installation tools and equipment necessary to complete project.
 - 10. All coring, as required.
 - 11. All modular jack hardware as required. Two-pair cross-wire for data stations.
 - 12. All construction (labor & materials) as stated.
 - 13. Co-ordinate inspections with the on campus departments who will be maintaining the system at completion.

- B. The contractor is responsible for assembly of all components including, but not limited to, the following:
 - 1. Communication boxes.
 - 2. Faceplates.
 - 3. Connectors.
 - 4. Hamaco Racks.
 - 5. Patch Panels.

- C. Contractor will be required to attend a pre-wiring meeting with DC-Network Services and all other interested parties. Cabling will be subject to inspections throughout the cabling process to insure the correct understanding and implementation of our cable standards. It is the responsibility of the contractor to contact Network Services to arrange inspections per the following times:
 - 1. Before beginning.
 - 2. After first station location wires are pulled.
 - 3. Before terminations at both ends of cable have started.
 - 4. Final inspection after testing is complete. Test results will be required at this time.

1.3 LABELING AND CABLE DOCUMENTATION

- A. *The contractor must establish cable records during the installation. These records will, at a minimum, correlate station location number and horizontal and riser distribution cable number. A clean, legible copy of these records must be submitted upon project completion. A diskette record using Microsoft Word format will also be submitted upon project completion.*

- B. *The successful bidder must present three (3) complete sets of as-built drawings following project completion. These drawings will, at a minimum, show the location and type of all closets, distributing cable runs, and outlets.*
 - 1. *Each IDF and MDF will contain a copy of "as-built" drawings provided by the contractor. These copies will be, whenever possible, placed in plastic sleeves prior to posting.*
 - 2. *The contractor will update all changes to drawings until the project is accepted.*
 - 3. *The original will be provided to Computing Services.*

- C. *Cable records will show cable lengths for all distribution and outside plant cable (by segment) and locations of splices, if required.*

- D. As-built plans of all cable pathway routes are to be provided.*

1.31.4 QUALITY ASSURANCE

- A. Contractor shall follow all Federal, State, and Local Fire and Electrical Codes and OSHA guidelines and perform all work exhibiting a good quality craftsmanship. The governing standards for contractors & subcontractors for all intra-building cable installations are the current EIA/TIA standards for cabling as follows:
1. EIA/TIA-568/B, Commercial Building Telecommunication Wiring Standards.
 2. TSB-36, Technical Systems Bulletin - Additional Cable Specifications for UTP Cables.
 3. TSB-40, Telecommunications Systems Bulletin - Additional Transmission Specifications for UTP Connecting Hardware.
 4. EIA/TIA-569, Commercial Building Standard for Telecommunication Pathways and Spaces.
 5. NFPA-70, National Electric Code.

PART 2 PRODUCTS

2.1 CABLE FOR DATA/TEL EXTERIOR OF BUILDINGS

- A. *Copper Outside Plant Cable : The copper outside plant cable shall be equivalent to:*
1. *Clifford -Catalog No. 50P22-B1-BJFAF (Filled BJFAF PE-89, 22AWG, 50 Pair).*
- B. *Building Entrance Protector at both ends, ie. two locations for the copper outside plant cable. Building Entrance Protector shall be equivalent to :*
1. *Clifford Catalog No. BEP - T - 50 - T - ___ -with protection modules (Output - 110 Style Block; Pair Count - 50; Input - 110 Style Block, 22 AWG fuselink; Cable stub length - none; with Protection modules for all pairs).*
- C. *Fiber Optic Cable (Inside and Outside)*

2.2 FIBER-OPTIC CABLING

- A. *Cable, Terminal, and Connector Product Manufacturers:*
1. *Preferred manufacturer: Corning FREEDM LSTTM Hybrid Interlocking Armored Cables*
 2. *Hybrid 12 fiber multimode 62.5/125-micrometer and 6 fiber single mode fiber unless otherwise specified by DC - Network Services.*
 3. *Fiber to be terminated in duplex SC connectors*
 4. *Comply with TIA/EIA-568B*
- B. *Fiber Cable- Building Interior: - Hybrid Armored Fiber:*
1. *Corning FREEDM LSTTM Hybrid Interlocking Armored Cables*
 2. *Comply with TIA/EIA-568-B.3*
 3. *NFPA 70, Type OFC complying with UL 1666.*
 4. *Minimum Modal Bandwidth: 200Mhz/500km*
 5. *Jacketed Interlocking Flexible Aluminium Armor*
 6. *Drygel water blocking systems.*
- C. *Fiber Cable Building Exterior - Hybrid Fiber-Riser Rated, Indoor/Outdoor:*
1. *Comply with TIA/EIA-568B*
 2. *NFPA 70, Type OFN complying with UL 1666.*

3. *Maximum Attenuation: 3.5/1.0*
4. *Minimum Modal Bandwidth: 200Mhz/500km*

2.22.3 COMMUNICATIONS STATION OUTLET SPECIFICATIONS (Cat 6)

- A. Communication station outlets will be located in the permanent building structure.
- B. At the station communications outlet end:
 1. Data twisted pair cable will be connected to ~~Commscope Uniprise Solutions connectors-Siemons Duplex RJ-45 Couplers~~ (part #~~UNJ600CT-C6-C6-XX~~). Color to be specified by job (Default ~~XX= Ivory-20~~).
 2. Where Floor Boxes will be used, ~~Commscope Uniprise Solutions outletsSiemens Duplex RJ-45 Couplers~~ with spring door option (part #~~UNJ600CT-C6-C6-XX-D-xx~~) should be used. Color to be specified by job (Default ~~XX= Ivory-20~~).
 3. Where wall phones are required they should be connected to Suttle Apparatus Corp (part #SE 630A4).
- C. At the station communications outlet end, all couplers will be installed into ~~single or double port adaptors part # single UNF FX SOA XX Ivy default double UNF FX DOA XX IVY default~~. These are then installed into ~~Commscope Uniprise Solutions Flexible Faceplate #UNF FX SG XX Color to be specified by job (Default =Ivory).~~ *Siemens Single Gang Cover Faceplate (part # CT4-FP-XX) (Default XX= Ivory-20)*
- D. Provide a pull rope labeled to match the service identification within all boxes. It should be secured in the box on one end and tied to the overhead Cable tray or Unistrut on the other.
- E. At the station communications outlet end, blank inserts, ~~Commscope Uniprise SolutionsSiemens~~ (part # ~~UNF FX DOA-CT-BLNK-XX~~) will be placed into all positions not in use. Color to be specified by job (Default ~~XX=Ivory -20~~).
- F. A minimum of twelve (12) inches of each cable will be left coiled in the ceiling above the workbox for future re-terminations and will include the cable label.
- G. All cables will be marked clearly and legibly at both ends twelve (12) inches from the ends of the cable with indelible marker or other approved method (i.e. P-touch labels). Using each specific method respectively.

2.22.4 COMMUNICATIONS STATION OUTLET SPECIFICATIONS (10 gig)

- A. Communication station outlets will be located in the permanent building structure.
- B. At the station communications outlet end:
 1. Data twisted pair cable will be connected to ~~Commscope Systimax outletSiemens 10G Max Modules~~ (part #~~760-023-60610GMX-XX~~). Color to be specified by job (~~XX=Default Ivory -MGS500-24620~~).
 2. Where Floor Boxes will be used, ~~Commscope SystimaxSiemens~~ outlet with spring door option should be used. Color to be specified by job (Default=~~Ivory~~).
 3. Where wall phones are required they should be connected to Suttle Apparatus Corp (part #SE 630A4).
- C. At the station communications outlet end, all outlets will be installed into ~~single orSiemens double port adaptors 760-009-431Faceplate double (part # single M30FP-1RJ45-246 Ivory) 760-008-656 (double M30FP-2RJ45-246 Ivory).~~ *10GNMX0FPS02-XX (XX=Default Ivory-20), Faceplate quad part # 10GMX-FPS04-XX (XX=Default Ivory-20).*

~~These are installed into Commscope Systimax Solutions single frame faceplate (part #760-010-017). Color to be specified by job (Default Ivory).~~

- D. Provide a pull rope labeled to match the service identification within all boxes. It should be secured in the box on one end and tied to the overhead Cable tray or Unistrut on the other.
- E. At the station communications outlet end, blank inserts, ~~Commscope Systimax Solutions~~ ~~Siemons (part # 760-009-472)~~ ~~part # MX-BL-(XX)~~ will be placed into all positions not in use. Color to be specified by job (Default =Ivory-20).
- F. A minimum of twelve (12) inches of each cable will be left coiled in the ceiling above the workbox for future re-terminations and will include the cable label.
- G. All cables will be marked clearly and legibly at both ends twelve (12) inches from the ends of the cable with indelible marker or other approved method (i.e. P-touch labels). Using each specific method respectively.

2.32.5 DATA TWISTED PAIR CABLE TERMINATION (Cat 6)

- A. Data station cabling will consist of two unshielded, 4-pair, 24 gauge copper, solid conductor, media series twisted pair cable with overall blue plenum or PVC jackets. The specified data station cable must be Commscope UnipriseSolutions Media series cable plenum (6504)or non plenum (65N4) Color default is Blue
- B. Wall Outlet Termination:
 - 1. Two (2) 4pair media series data cables run to each ~~Commscope Uniprise Solutions outlet~~ ~~Siemons Duplex RJ-45 Coupler~~ (part number ~~UNJ600CT-C6-C6-xx~~.Ivory is color default ~~XX=20~~). The odd patch panel position to position "A" on the outlet and the even patch panel position to position "B" on the outlet. All 4 pairs will be terminated as defined in the EIA/TIA standard EIA/TIA T568B.
- C. All data cable will be labeled with identifying jack number for ease of identification such as 3AA-10. Coordinate the jack numbers with the permanent room numbers.
 - 1. The first position will be a number to indicate the floor where this wire terminates at either the MDF or an IDF.
 - 2. The second position will be a letter to indicate the station wire termination point on that floor (i.e. A = the first station wire IDF termination point, B = the second IDF, etc.).
 - 3. The third position will be a letter to indicate the group of patch panels.
 - 4. The fourth position will be a number to indicate the patch panel position.

2.42.6 DATA TWISTED PAIR CABLE TERMINATION (Cat 10gig)

- A. Data station cabling will consist of two unshielded, 4-pair, 24 gauge copper, solid conductor, Category 10gig twisted pair cable with overall blue plenum or PVC jackets. The specified data station cable must be Commscope Systimax Solutions Gigaspeed X10D cable; plenum 760-024-190,2091 series or non plenum 760-021-682#1091series.
- B. Wall Outlet Termination:
 - 1. Two (2) 4pair 10 gig data cables run to each ~~Commscope Systimax Siemons outlet~~ (part number ~~760-023-606~~) ~~10G 6 Max Modules part # 10GMX-(XX)~~ (XX default color Ivory-20). The odd patch panel position to position "A" on the coupler and the even patch panel position to position "B" on the outlet. All 4 pairs will be terminated as defined in the EIA/TIA standard EIA/TIA T568B.

- C. All data cable will be labeled with identifying jack number for ease of identification such as 3AA-10. Coordinate the jack numbers with the permanent room numbers.
 - 1. The first position will be a number to indicate the floor where this wire terminates at either the MDF or an IDF.
 - 2. The second position will be a letter to indicate the station wire termination point on that floor (i.e. A = the first station wire IDF termination point, B = the second IDF, etc.).
 - 3. The third position will be a letter to indicate the group of patch panels.
 - 4. The fourth position will be a number to indicate the patch panel position.

2.52.7 DISTRIBUTION FRAMES (MDF/IDF) SPECIFICATIONS

- A. All buildings will be wired with “home run” cabling which is defined as one continuous run from the communications station outlet to the MDF/IDF.
- B. All station cables will be left with a service loop of six (6) feet of slack, coiled, and secured above each service respectively in Cable tray or Unistrut. Cable tray or Unistrut is required to support all horizontal sections of cable in MDF and IDF room(s).
- C. Data Specifications (Cat 6):
 - 1. At the IDF/MDF using ~~CommScope Uniprise Solutions~~ *Siemon* Patch Panel (manufacturer part# ~~UNP600-48PHD6-48~~) a data 4pair media series cable will be terminated to each RJ45 jack position. With the RJ 45 jack “A” position corresponding to the odd numbers on the patch panel and the “B” position corresponding the even numbers on the patch panel.
 - a. When patch panels are mounted in a 19-inch rack, the rack system specified is Homaco rack#19-84-T2SD with Panduit vertical Wire Management Part Number WMPVC45 mounted on the left side of each rack (jacks facing). The patch panels to be used are ~~CommScope Uniprise Solutions Patch Panel #UNP600-48P~~ *Siemon Patch Panel #HD6-48*. ~~Below each 48-jack patch panel there will be one horizontal wire management device CommScope Uniprise UN-PCO-C2 mounted in front.~~ Network Services will decide rack position on a case-by-case basis. Floor space should include 3’ front and rear access.
- D. Data Specifications (10 gig):
 - 1. At the IDF/MDF using ~~CommScope Systemax Solutions Patch Panel~~ *Siemons 10G 6 Patch Panels* (manufacturer part# ~~760-051-169 10GX-48~~) a data 4pair 10 gig cable will be terminated to each RJ45 jack position. With the RJ 45 jack “A” position corresponding to the odd numbers on the patch panel and the “B” position corresponding the even numbers on the patch panel.
 - a. When patch panels are mounted in a 19-inch rack, the rack system specified is Homaco rack#19-84-T2SD with Panduit vertical Wire Management Part Number WMPVC45 mounted on the left side of each rack (jacks facing). The patch panels to be used are *Siemons 10G 6 Patch Panels (manufacturer part#10GX-48* ~~CommScope Systemax Solutions Patch Panel #760-051-169~~. Below each 48-jack patch panel there will be one horizontal wire management if needed it will be decided on a case by case basis mounted in front. Network Services will decide rack position on a case-by-case basis. Floor space should include 3’ front and rear access.

2.62.8 WIRELESS

- A. The cable installed for the wireless project will comply with all cabling standards previously outlined but only ~~two~~ *one* cable per station instead of ~~two~~. *Use Siemon single angle coupler (part # CT-C6-XX) (Default XX= Ivory-20).*

2.72.9 MODULAR FURNITURE

- A. As modular furniture is not part of the permanent building structure, no station run cabling shall be located or terminated within it. Patch cables shall be run from communication station outlets located in the building structure by the Modular furniture contractor. Accessibility to communications station outlet critical when installing Modular furniture.
- B. The modular furniture contractor will determine the lengths of voice and data patch cords required at each location. They will document this information on drawings and in a spreadsheet.
- C. DC-Network Services shall provide cables in lengths of 7', 14', and 25'. More specialized lengths need more notice make plans accordingly.
- D. All cables will be protected from metal edges with grommets or other permanent means (tape is not acceptable). Applicable Cat 6 or 10 gig bend radiuses for flexible cable will be observed.
- E. Power will be avoided as much as is reasonably possible.
- F. The contractor will be responsible for the cable installation within the Modular furniture and are not done until the data cable is plugged into the wall jack below the blue icon.

2.82.10 MISCELLANEOUS PARTS LIST SUMMARY (Cat 6)

- A. This is a list of parts specified in this document for convenience. It should not be mistaken for a complete parts list.
 1. ~~Commscope Uniprise Solutions outlets~~ *Siemons Duplex RJ-45 Couplers* (part # ~~UNJ600-CT-C6-C6-xx~~). Color to be specified by job (Default ~~XX=Ivory-20~~).
 2. ~~Commscope Uniprise Solutions outlets~~ *Siemons Duplex RJ-45 Couplers* with spring door option (part ~~UNJ600CT-C6-C6-xx~~). Color to be specified by job (Default ~~XX=Ivory-20~~).
 3. Suttle Apparatus Corp (part # SE 630A4).
 4. ~~Commscope Uniprise single outlet adaptor~~ *Siemons F type coupler, 45 degree angle UNF-FX-SOA(part# CT-A-FA-XX)-XX double outlet adaptor is UNF-FX-DOA-XX. Commscope Uniprise Flexible faceplate (part # UNF-FX-SG-xx) Color to be specified. Color to be specified by job by job* (Default =Ivory-20).
 5. ~~Commscope Uniprise Double Gang Faceplate Frame~~ *Siemons Duplex Cover Faceplate* (part # ~~UNF-FX-DGCT4-FP-XX~~). Color to be specified by job (Default =Ivory-~~IV-20~~).
 6. ~~Commscope Uniprise (part # UNF-FX-BLA-XX) color to be specified by job (Default =Ivory-IV).~~ *Siemons (part# CT-BLNK-XX) color to be specified by job (Default XX=Ivory-20).*
 7. ~~Commscope Uniprise~~ *Siemon* 48port Patch Panel (manufacturer part#~~UNP600-48PHD6-48~~)
 8. The specified data station cable must be ~~one of~~ the following:
 - a-~~Commscope~~ *Commscope Uniprise Solutions CAT6 Non-Plenum 65N4+, Plenum 6504+*

9. Gilbert male "F" connector (manufacturer Part#GF-6-AHS/312).
- ~~10. Commscope Uniprise jack ("F" type coupler, UNC F F).~~
- ~~11.10.~~ Homaco rack (manufacturer part#19-84-T2SD).
- ~~12.11.~~ Panduit vertical Wire (management part#WMPVC45).
- ~~13.12.~~ Commscope Uniprise patch panel part# UNP600-24Siemons patch panel part # HD6-48PBelow each patch panel there will be one Commscope Uniprise horizontal wire management device (manufacturer part# UN PCO C2).
- 14.Siemons cross connect frame specified (manufacturer part#CC-2024 NS NB).
- 14.Siemons stand off bracket (manufacturer part # SOB CC).
- 15.Commscope horizontal wire management device (manufacturer part# UN PCO C2).

- B. Method of banding cables shall be with hook & loop (i.e., Velcro) bands, not plastic tie wraps.

2.92.11 MISCELLANEOUS PARTS LIST SUMMARY (10 gig)

- A. This is a list of parts specified in this document for convenience. It should not be mistaken for a complete parts list.
1. ~~CommScope Systimax Solutions Information outlet prod code MGS500-xxSiemons 10G 6 MAX Modules part # 10GMX-XX~~ Color is specified by job. Ivory is default -24620.(p/n 760-023-60610GMX-20)
 - a. ~~CommScope Systimax single port adaptor for outlets prod code M30FP-1RJ45-Siemons 10G Max Faceplates part # 10GMX-FPS02-XX xx~~ Color is specified by job, Ivory is default -24620(p/n 760-009-43110GMX-FPS02-20)
 - b. ~~CommScope Systimax dual port adaptor for outlets prod code M30FP-2RJ45-xx~~ Color is specified by job, Ivory is default -246 p/n 760-008-656)Siemons 10G Max Faceplate Blanks part # MX-BL-XX (default XX=Ivory-20).
 2. Siemons Duplex RJ-45 Couplers with spring door option (part # CT-C6-C6-XX-D). Color to be specified by job (Default XX=Ivory -20).
 3. Suttle Apparatus Corp (part # SE 630A4).
 - ~~4. CommScope Systimax Solutions Flexible Single Gang Faceplate prod code M13FP-xx. Color to be specified by job. Ivory is default -246 (p/n 760-010-017)~~
 - ~~4. CommScope Systimax Solutions Flexible Double Gang Faceplate prod code M26FP-xx. Color to be specified by job. Ivory is default -246 (p/n 760-008-615).~~
 - ~~5. CommScope Systimax Solutions adaptor blanks prod code M30FP-xx. Color to be specified by job. Ivory is default. -246.(p/n 760-009-472)~~
 - ~~6. CommScope Systimax 48 port Patch Panel prod code 1100GS5 48 (p/n 760-051-169)~~
 - 8.4. The specified data station cable must be the following:
 - a. CommScope Systimax Solutions GigaSPEED series 91 (10gig) plenum or non plenum
 - b. Plenum prod code 2091 004AXX color default is blue-BL. (p/n 760-024-190)
 - c. Non Plenum prod code 1091 004AXX color default is blue-BL (p/n 760-021-683)
 - 9.5. Gilbert male "F" connector (manufacturer Part#GF-6-AHS/312).
 - ~~9. CommScope Systimax Solutions F 81 Coaxial Coupler prod code M181C (p/n 108-009-432)~~
 - ~~11.6.~~ Homaco rack (manufacturer part#19-84-T2SD).
 - ~~12.7.~~ Panduit vertical Wire (management part#WMPVC45).
 - ~~12. Siemons horizontal wire management device (manufacturer part#WM-143-5) when specified.~~
 - ~~13. Siemons cross connect frame specified (manufacturer part#CC-2024 NS NB).~~
 - ~~14. Siemons stand off bracket (manufacturer part # SOB CC).~~
 - ~~15. Siemons horizontal wire management device (manufacturer part#WM-143-5).~~

- B. Method of banding cables shall be with hook & loop (i.e., Velcro) bands, not plastic tie wraps.

PART 3 EXECUTION

3.1 INSTALLATION

- A. All cabling shall be installed in a dedicated pathway/raceway system. These pathway/raceway systems shall be installed in accordance with the applicable sections of this document. The system is generally composed of EMT and cable tray but may also include ~~Cablefil~~ Wire Basket where necessary. Non-metallic Wiremold is not allowed. Refer to EIA/TIA-569 Pathway & Spaces.
- B. All wiring shall be neatly installed and individually supported without using any other electrical conduits, plumbing, heating or air conditioning structures for support. Wiring shall be routed so that it does not interfere with access to panels, switches, valves or other maintenance systems. Exposed wiring is not acceptable in any occupied space without prior written consent of Owner.
- C. All cabling will have a continuous pathway from the wiring closet to the wall jack. The pathways are expected to be a course affording passage from one place to another with ease. The purpose for pathways is to be able to add more cable in future from the wiring closet to the wall jack without reconstruction. Stud wall cavities are not considered pathways.
- D. All cabling installed in surface raceways will be concealed in Wiremold, EMT conduit, or other approved system. All transitions (bends, tees, et cetera) will be done with factory made fittings or properly executed field bends.
- E. All station cable concealed above ceiling grids will be supported off of ceiling grid using D-Rings or bridle rings and, wherever practical, bundled together.
- F. All penetrations in station raceway will have rubber or equivalent grommets to prevent cable cuts on rough edges. Refer to DC Standards section 16110, 'RACEWAYS'.
- G. All pathway/raceway will be of sufficient size to accommodate all wiring. Fill density not to exceed 40%.
- H. All raceway will be attached to the building structure using screws and anchors. At a minimum, attachment will be every two feet. See division 16190 'SUPPORTING DEVICES' for requirements of supports.
- I. Color code identification of cables must be maintained throughout.
- J. All coring in viewable areas must be patched with appropriate material and painted if necessary. This work will be inspected to the satisfaction of the Owner.
- K. Existing cable trays may be used where available.
- L. In all dry wall office areas, modular jacks and inserts will be flush mounted in 2-1/4" deep double gang boxes with plaster rings. All double gang boxes will be fed with a minimum of a 1" conduit. In residence halls, laboratories and computer oriented workplaces, the mounting height for the boxes is 32" above the finished floor (i.e. just

above desktop level). Otherwise the DC-FPO or DC-FOM Project Manager will specify the heights of all boxes as part of the detailed design process before work begins.

- M. In demountable partition and/or areas requiring surface mount boxes, Contractor will supply and install single gang boxes with a minimum depth of 2-1/4" near existing services. Boxes will be affixed to surfaces using screws and/or special purpose clips; the use of double-sided tapes is not acceptable.
- N. All outlets positioned in sheetrock should conceal all cable exit holes.
- O. All outlets will be clearly marked with labels provided by Contractor as to station and cable number. All outlets will be marked on the box using indelible marker as well as on the faceplate. Labeling on the faceplate will be typed in bold black over white and will match the station cable label respectively. Voice label appearing above, Data and ~~CATV~~ label below. An example of the label for a data jack is: "3AA-10"; where 3 is the floor number, the first A is the station wire termination group, the second A indicates the termination block row, and the 10 is the termination block position.
- P. After all cables are installed and successfully tested, station runs penetrating fire and/or smoke barriers will be sealed with a UL listed removable smoke and flame stop having a fire rating suitable for the penetration concrete not acceptable.
- Q. Rack units will be securely fastened to the floor after positioning approved by Network Services.
- R. All blocks will be mounted on plywood backboards that have been raised from the back of the MDF/IDF's.
- S. All voice riser cables will be brought through the back of the backboard. Penetration will be provided after position has been approved by Network Services.
- T. Contractor will be responsible for supplying and constructing infrastructure to support cable runs above ceiling levels. Cable tray or Unistrut is required to support all horizontal sections of riser cable and in MDF/IDF's.
- U. All riser cables will be labeled with the same number at each end. An example for a riser cable label would be 3A1 where:
 - 1. '3' indicates that the riser is going to the third floor.
 - 2. 'A' indicates that the riser is terminated at the first riser termination point on the floor.
 - 3. '1' indicates that the riser cable is the first riser cable terminated on the floor.
- V. There must be enough conduit space in the riser path between the MDF and each IDF to allow for a doubling of the amount of backbone cabling, i.e. as much spare conduit as there is active conduit.
 - 1. Included in this conduit should be a sub-duct for future fiber optic cable and a pull rope.
 - 2. The riser path must be smooth with no right angles or sharp bends.
 - 3. All cable sheaths will be protected from sharp metal edges. Where the cable passes over a sharp edge, a bushing or grommet will be installed to protect the cable.
- W. *All fiber without jacketed interlocking flexible aluminum armor shall be installed in inner duct. After installation, inner ducts are to be permanently labeled as containing fiber optic cable. Instruction for labeling will be provided by DC Network Services.*

3.2 FIELD QUALITY CONTROL

- A. Contractor will test all twisted wire cabling to 99% accuracy level or replace the wire.
- B. It is the responsibility of the contractor to install all raceway systems so that they are in continuous contact with and securely fastened to building surfaces. In many locations there are existing raceways supplying power, lighting and fire alarm systems, which will need to be reworked to provide a clear path for the new raceways. The contractor is responsible for the relocation of all pre-installed raceways that conflict with the proposed routing. The contractor may propose an alternate route to minimize interference with existing systems, however all alternate routes must be approved by Dartmouth College.

~~C. The contractor installing the cabling system shall be fully trained and qualified by CommScope on the installation and testing of the equipment to be installed. Evidence that the vendor is a current certified installer of CommScope cabling systems must be provided in writing prior to work commencing on the structured cabling for the building.~~

3.3 DATA CABLE TESTING

- A. All tests must be documented. Date, time, technician, test set identifier and for Category 6 tests, the technician and the witness are to be logged. The test log file is one of the deliverables required for system acceptance and job completion certification.
 - 1. Results of testing will be provided to the Owner's on-site representative on paper and on disk in Microsoft Word Format.
 - 2. A paper copy of test results must be signed and dated by the Contractor's foreman or project manager to certify that testing was conducted according to the specified procedures and the results are as stated.
 - 3. Testing documentation should include all information necessary to replicate tests at a future date.
 - 4. Test and Acceptance document will list the building, MDF/IDF, outlet number, and location of the outlet.
 - 5. Test document will list summary & detailed results.
- B. All data station wire runs will be tested for compliance with the EIA/TIA 568 CAT 6, level 6, using test equipment capable of CAT 6, level 6 testing.
- C. If the testing is done with Contractor's equipment, the contractor will provide a detailed and complete list of the test equipment used identifying manufacturer model number, serial number, calibration date, and calibration period of all units used for testing.

3.4 PROJECT CLOSEOUT

- A. The contractor must establish cable records during the installation. These records will, at a minimum, correlate station location number and horizontal and riser distribution cable number. A clean, legible copy of these records must be submitted upon project completion. A diskette record using Microsoft Word format will also be submitted upon project completion.
- B. The successful bidder must present three (3) complete sets of as-built drawings following project completion. These drawings will, at a minimum, show the location and type of all closets, distributing cable runs, and outlets.
 - 1. Each IDF and MDF will contain a copy of "as-built" drawings provided by the contractor. These copies will be, whenever possible, placed in plastic sleeves prior to posting.
 - 2. The contractor will update all changes to drawings until the project is accepted.
 - 3. The original will be provided to Computing Services.

- C. As-built plans of all cable pathway routes are to be provided.

~~Outside Plant Cable for Data/Tel~~

~~Copper Outside Plant Cable : The copper outside plant cable shall be equivalent to:
Clifford Catalog No. 50P22-B1-BJFAF (Filled-BJFAF-PE-89, 22AWG, 50-Pair).~~

~~Building Entrance Protector at both ends, ie. two locations for the copper outside plant cable. Building
Entrance Protector shall be equivalent to :
Clifford Catalog No. BEP-T-50-T ___ with protection modules (Output 110 Style Block; Pair Count
50; Input 110 Style Block, 22 AWG fuselink; Cable stub length none; with Protection modules for all
pairs).~~

~~Fiber Optic Cable (Inside and Outside)~~

~~2.01 FIBER OPTIC CABLING~~

~~A. Cable, Terminal, and Connector Product Manufacturers:~~

~~1. Preferred manufacturer~~

~~Corning Corning FREEDM LSTTM Hybrid Interlocking Armored Cables~~

~~B. Fiber Optic Cable: Hybrid 12 fiber multimode 62.5/125 micrometer and 6 fiber singlemode.
fiber unless Network Services specifies higher count fiber.~~

~~2. Fiber to be terminated in duplex SC connectors~~

~~3. Comply with TIA/EIA 568B~~

~~C. Inside Plant Fiber Cable Hybrid Armored Fiber:~~

~~1. Corning FREEDM LSTTM Hybrid Interlocking Armored Cables~~

~~3. Comply with TIA/EIA 568-B.3~~

~~4. NFPA 70, Type OFC complying with UL 1666.~~

~~5. Minimum Modal Bandwidth: 200Mhz/500km~~

~~6. Jacketed Interlocking Flexible Aluminium Armor~~

~~7. Drygel water blocking systems.~~

~~D. Outside Plant Fiber Cable Hybrid Fiber Riser Rated, Indoor/Outdoor:~~

~~2. Comply with TIA/EIA 568B~~

~~3. NFPA 70, Type OFN complying with UL 1666.~~

~~4. Maximum Attenuation: 3.5/1.0~~

~~5. Minimum Modal Bandwidth: 200Mhz/500km~~

~~E. All fiber without jacketed interlocking flexible aluminium armor shall be installed in inner duct.~~

~~After installation, inner ducts are to be permanently labelled as containing fiber optic cable. Instruction
for labelling will be provided by DC Network Services.~~

3.5 GUARANTEE

- A. At the completion of all work, the Contractor shall deliver a Letter of Guarantee to the Owner. This guarantee certifies that the Contractor shall promptly replace or repair any equipment or materials found to be damaged by workmanship or failure due to workmanship that becomes apparent within one (1) year from the date of job completion. This letter shall be included in the documentation.

END OF SECTION 16742