

LCSD-Network Data Cabling Standards

PART 1: COMMUNICATION HORIZONTAL CABLING

SUMMARY

This section includes requirements for communication horizontal cabling and termination requirements.

MATERIALS

A. CAT6 Horizontal Cabling

1. Shall be unshielded twisted (UTP) copper conductors, Category 6, four-pair.
2. Indoor, plenum rated where required by local/state code.
3. Shall be rated for 550 MHz.
4. Conductors shall be 23 AWG solid bare copper.
5. Color shall be blue (or district approved optional color).
6. Cable shall be Ber-Tek, West Penn, Coleman, or approved equal.

B. CAT6A Horizontal Cabling

1. Shall be unshielded twisted (UTP) copper conductors, Category 6A, four-pair.
2. Plenum rated where required by local/state code.
3. Indoor rated.
4. Shall be certified by the Manufacturer to transport 10 Gb/s.
5. Color shall be blue (or district approved optional color).
6. Conductors shall be 24 AWG solid bare copper.
7. Provide Berk-Tek LANmark-10G2 Cat 6A UTP Series, or approved equal.

C. CAT6 Outdoor Horizontal Cabling

1. Shall be unshielded twisted (UTP) copper conductors, Category 6, four-pair.
2. Outdoor riser rated, water and UV resistant.
3. Shall be rated for 550 MHz.
4. Conductors shall be minimum 23 AWG solid bare copper.
5. Color shall be as follows:
 - a. Black (or district approved optional color).
6. Cable shall be Ber-Tek or approved equal.

D. RJ45 Jacks 6 and 6a

1. Color shall be as follows:
 - a. Red – General Data (Workstations and Printers)
 - b. Green (field and patch panel) – Wireless Access Points
 - c. White (field and patch panel) – Cameras
 - d. Yellow (field and patch panel) – HVAC
2. Shall be CAT6 or Cat6a compliant (should match category of cable terminating).
3. Jacks shall be Leviton Extreme QuickPort, or district approved equal.

E. Low Voltage Device Plates

1. Shall be single gang.
2. Shall be accept keystone connections.
3. Shall have two or four ports, and 1 or 2 identification windows.
4. Shall be provided with blank covers for all unused ports.
5. Shall be white, ivory, or steel (match current data/electric plates and/or wall color).

F. Wireless Termination Points.

1. Shall be recessed faceplate, flush with ceiling with 2-ports or where necessary surface mounted box with 2-ports.
2. Box shall have two CAT6A jacks with CAT6A cabling.

INSTALLATION

A. General.

1. All identification labeling follow the following standards:
 - a. Labeled with "IDF#-PatchPanel-Port#" (Example: F3-P2-42)
 - b. All horizontal cabling shall be provided with a heat-shrinkable type-written label at BOTH ends.
 - c. Labeled on printed labels on nameplates of faceplates and/or surface jacks.
2. CAT6A cable shall be routed to all wireless terminal units and terminated at MDF/IDF with CAT6A RJ45 jacks.
3. CAT6 cable shall be routed to all other devices and terminated at MDF/IDF with CAT6 RJ45 jacks.
4. Cables shall be installed between patch panels and outlet jacks utilizing cable trays, J-Hooks, conduit, or raceway.
5. Cable shall not be secured to ceiling hanger wire.
6. Cable installation shall maintain the following clearances:
 - a. Power conduits - 12 inches.
 - b. Luminaires - 12 inches.
 - c. Mechanical equipment - 48 inches.
 - d. Transformers - 48 inches.
7. Neatly group cables together that terminate on the same patch panel in MDF and IDF rooms. Utilize Velcro cable ties.
8. Cable runs shall not obstruct walkways or service access to mechanical and electrical equipment. All cabling shall be self-supported and attached to the structure as required by Code. Cables shall follow a common path where possible. Sweep 90-degree bend radii shall be installed.
9. Cables shall be installed parallel and perpendicular to the structural elements of the building. Line of sight "spider webs" shall not be permitted.
10. Cables installed above accessible ceilings shall not block access to access panels, mechanical equipment, piping valves, electrical equipment, or other equipment requiring access for maintenance and service.
11. Cables shall not be supported by any temporary building structure, including conduit, duct work, water pipes, hydronic piping, storm water piping, T-bar ceiling tiles, and/or support wires.
12. Cables above accessible ceilings shall be supported every 4-6 feet.
13. Cables shall be bundled in groups no larger than 48. Cable bundles shall be of a similar system only (i.e. IT, Security). Bundling cables of different systems shall not be acceptable.
 - a. Exception: If no more than six cables of different systems serve the same area, they shall be permitted to be combined in bundles using j-hooks.
14. Cables in cable tray shall be combed to avoid crossing.
15. Cables bundles terminating on patch panels shall not cross the centerline of the patch panel. Split the cable bundle and install cables from each side of the patch panel.
16. All exposed cables shall be installed in a surface raceway.
17. All cables within walls or soffits shall be installed in metallic conduit.
18. Provide a minimum of 36" of coiled slack cable in the ceiling space above all outlet jacks.
19. Through-wall penetrations and through-floor penetrations smaller than 7/8" shall not require a metallic conduit sleeve. All penetrations shall be neatly made and sealed after cable installation. Penetrations through fire-rated partitions shall be sealed to maintain the required fire rating.

B. Identification

1. All horizontal cabling shall be provided with a heat-shrinkable type-written label at BOTH ends.
2. All identification labeling shall be printed and follow district labeling standards.

C. Testing

1. The permanent link shall be tested.

2. All test results shall be used by the CONTRACTOR to determine any polarity and noise anomalies and CONTRACTOR shall take immediate corrective action for all anomalies.
3. Test results shall be used by the CONTRACTOR and the Authorized Representative to determine the viability of each sheath for transmission in accordance with the specifications of the cable manufacturer and the requirements imposed by the transmission system. This shall form part of the acceptance procedure for the cable plant. All results obtained by use of pair-scanner testing shall be collated by terminal outlet number and or riser pair number and presented to the Authorized Representative at the conclusion of the testing. Test compilation shall be initialed and dated by the CONTRACTOR's technician performing the test.
4. The CONTRACTOR shall utilize a level-III Fluke, PentaScanner, Wavetek or equal, twisted pair test instrument for the testing of all System Category 6 and Catagory 6A copper cabling. All Category 6 and 6A cable paths shall be tested at each jack for the following parameters and meet the requirements imposed by the TIA/EIA 568-B3 building wiring standard, ANSI/TIA-568-C.4 Broadband Coaxial Cabling and Components Standard, and the manufacturer's written specification.
5. Category 6 and 6A data cabling systems shall be performance verified using an automated test set. This test set shall be capable of testing for the continuity and length parameters defined above and provide for the following tests.
 - a. Wire Map.
 - b. Cable Length.
 - c. Pair-to-Pair NEXT.
 - d. Power Sum NEXT.
 - e. Attenuation.
 - f. Pair-to-Pair ELFEXT.
 - g. Power Sum ELFEXT.
 - h. Return Loss.
 - i. Propagation Delay.
 - j. Delay Skew.
6. A complete cable certification report shall be provided covering all locations.
7. The CONTRACTOR shall compile test results into the forms that contain all applicable test data. Hard copy indicating successful testing for every location is not necessary or preferred. A thumb drive containing the test data and appropriate application (software) to display such in a windows-based environment is preferred. If a hard copy is provided, then all forms shall be neatly completed and legible when submitted. Hard copy optical traces shall be neatly and securely attached to the test results. The CONTRACTOR shall provide three (3) copies should hard copies be submitted.

D. As-Built Documentation.

1. All outlet locations, cable routes, core-drills and penetrations shall be documented by the CONTRACTOR on a set of as-built plans.
2. Outlet locations shall include their respective unique identification numbers.
3. As-built documentation is due within three (3) weeks after final wiring installation is accepted by the OWNER.
4. A copy of the as-built drawings shall be maintained by the CONTRACTOR for one (1) year from the time of acceptance by the OWNER.

PART 2: COMMUNICATION OPTICAL FIBER BACKBONE CABLING

SUMMARY

This section includes requirements for the installation of the optical fiber backbone cabling and termination requirements.

MATERIALS

- A. **Single Mode Fiber Optic Cable**

1. Single mode fiber. Strand count shall be twelve (12). Rating shall be suitable for applications with a minimum rating of OFNR.
2. Shall be rated for indoor/outdoor use.
3. Shall be loose tube, gel-free.
4. Shall be Corning Altos series, or approved equal.

B. Fiber Optic Termination

1. Fiber shall terminate utilizing type LC connectors.

INSTALLATION

A. General

1. Cable ties shall be finger tight. The cable tie shall not distort the outer jacket.
2. The bending radius shall be no less than 10 times the outside cable jacket.
3. Only Velcro-type wraps shall be used to bundle cables on the back of the equipment racks located on the Telecommunications and equipment rooms.

B. Installation

1. Fiber shall be installed continuously without intermediary splices.
2. Provide spare fiber, coiled within underground enclosures, 100-ft length.
3. Install per manufacturer's instructions.
4. Install the fiber optic cable by hand or by using a mechanical pulling machine. If a mechanical machine is used, ensure the manufacturer's recommended pulling tension is not exceeded and the proper cable attachment is utilized.
5. Ensure that excess cable is coiled in a figure eight and fed manually when pulling through pull boxes.
6. Label fiber patch panels with the origin point and destination point of the cables.

C. Splicing

1. Splicing of fiber optic cable at any point other than the termination locations as show on the Drawings shall not be permitted.
2. Fibers shall be spliced using fusion splicing only. Mechanical splicing methods shall not be acceptable.
3. Utilize cleavers, fusion splicing machines, and stripping tools which are approved by the manufacturer.

D. Testing

1. Testing shall comply with the latest TIA/EIA standards.
2. A calibrated optical time domain reflectometer (OTDR) shall be used for all fiber testing.
3. Testing shall include the following:
 - a. End-to-end continuity and attenuation of each optical fiber.
 - b. Transmission test utilizing a stabilized light source. The test shall be conducted in both locations on each fiber.
 - c. Trace test for fiber loss.
4. A written report of the test results shall be submitted to the District for approval.

PART 3: HANGERS AND SUPPORTS FOR COMMUNICATION SYSTEMS

SUMMARY

This section includes requirements pertaining to electrical equipment anchoring and electrical equipment hanging and support.

MATERIALS

A. Wide Base J-Hooks

1. Shall be 1-5/16" diameter loop, pre-galvanized steel.

2. Provide all accessories required to independently support the J-hooks from the structure. The CONTRACTOR shall provide the required supports based on the location of the J-hook installation.
 3. Provide multiple J-hook "trees" to allow a stacked installation of multiple cabling systems. Do not mix separate cabling systems (IT, CATV, fire alarm, building automation, security) within the same J-hook.
 4. Shall be Erico Caddy Cat HP, or approved equal.
- B. Hot Dipped Galvanized Hardware**
1. Bolts shall be hot dipped galvanized steel and sized for the load served and have a hex head unless specifically specified otherwise elsewhere. Nuts shall be hot dipped galvanized steel hex nut.
 2. Washers shall be hot dipped galvanized steel, USS pattern flat washers.
 3. Split lock washers shall be hot dipped galvanized steel.
 4. Threaded rods and couplings shall be hot dipped galvanized steel.
 5. Eye-bolts, u-bolts, bent-bolts and similar connecting hardware shall be hot dipped galvanized steel.
- C. Galvanized Hardware**
1. Shall be similar to hot dipped galvanized hardware except finish shall be regular galvanized instead of hot dipped galvanized.
- D. Hot Dipped Galvanized Anchors**
1. Wedge or stud anchors installed in concrete or masonry shall be hot dipped galvanized steel and sized for the load served.
 2. Toggle type fasteners shall only be used in hollow sheetrock wall. The wing part of the fastener may be mild steel, but the bolt shall be hot dipped galvanized steel.
- E. Galvanized Anchors**
1. Shall be similar to hot dipped galvanized anchors except finish shall be regular galvanized in lieu of hot dipped galvanized.
- F. Hot Dipped Galvanized Beam Clamps**
1. Beam clamps shall be hot dipped galvanized steel and sized for the load served.
- G. Galvanized Beam Clamps**
1. Beam clamps shall be regular galvanized and sized for the load served.
- H. Hot Dipped Galvanized Strut Channel.**
1. Galvanized strut channel shall be hot dipped galvanized after fabrication and shall be a minimum of 12 gauge.
 2. Galvanized strut channel shall have factory pre-drilled holes.
- I. Galvanized Strut Channel**
1. Shall be similar to hot dipped galvanized strut channel, except finish shall be regular galvanized in lieu of hot dipped galvanized.

INSTALLATION

- A. General.**
1. J-hooks shall be utilized for horizontal cabling between cable tray and wall conduit.
 2. J-hook spacing shall not exceed 60".
 3. Cable sag between j-hooks shall not exceed 12".
 4. Bundle cables using velcro straps. The use of plastic cable ties to bundle cable at J-hooks is prohibited.
 5. J-hooks shall be independently supported by the building structure. J-hooks shall not be secured to ceiling hanger wires.
 6. J-hooks shall be installed a minimum of 12" from all power branch circuit conduit and wiring and luminaires.
 7. J-hooks shall be installed a minimum of 3" above removable ceiling tiles.
 8. J-hooks shall be installed with a minimum of 18" clear space on the working side.
 9. Where specific pathways are not shown on the Drawings, the design of the j-hook system shall be CONTRACTOR's choice.
 10. CONTRACTOR shall provide j-hook trees where multiple low voltage systems (IT, nurse call, CATV, fire alarm, security, building automation) serve the same space. The number of

hooks on the tree shall be sufficient to permit all of the different systems to be installed on a separate j-hook. Where less than six cables of different systems serve the same area, combining cables within the same bundle and j-hook shall be acceptable.

11. CONTRACTOR shall be responsible for coordination the installation of j-hooks and horizontal cabling with other trades.
 12. Hardware shall be set to a torque as recommended by the manufacturer.
 13. Washers and split lock washers shall be installed on all bolts, threaded rods and anchors.
 14. Lead or plastic type anchors are prohibited from use on the project.
 15. When threaded rods are installed in drop-in type anchors, a washer, split lock washer and a jamb nut shall be installed at the anchor to ensure stability.
 16. When channel (strut) is installed as a hanger or support from threaded rod, washers, split lock washers and jamb nuts shall be installed on both sides of the strut to lock it in place.
 17. Cut ends of channel, strut, threaded rods or other cut fittings shall be filed smooth before installation.
 18. Cut ends of hot dipped galvanized channel and strut shall be coated with three coats of cold galvanizing compound after the channel has been filed to prohibit rust.
 19. Concrete anchors shall be installed as per the manufacturer's directions and set using the manufacturer's supplied tool.
 20. Threaded rod shall not extend more than one (1) inch beyond the channel, strut or other material it is supporting.
 21. Hangers and supports shall be installed level and plumb.
 22. Hangers and supports shall be installed per the National Electrical Code, Building Code and Structural Code and shall be designed to safely support the load.
- B. **Indoor and Outdoor Installation**
1. Hot dipped galvanized products shall be used in all outdoor locations.
 2. Regular galvanized products shall be used in all indoor locations

CONDUITS AND BOXES FOR COMMUNICATION SYSTEMS

SUMMARY

This section includes requirements pertaining to pathways for communications systems.

MATERIALS

- A. **EMT Conduit**
1. Minimum size of 0.75 inch unless specified otherwise.
 2. EMT conduit may be used in all indoor and outdoor locations. In outdoor locations the fittings shall be watertight compression fittings. Set screw fittings shall be acceptable in indoor locations.
 3. Conduit connectors shall have insulated throats, plastic bushings or ground bushing
- B. **Galvanized Sheet Metal Boxes**
1. Shall comply with NEMA specifications for sheet metal boxes.
 2. All boxes shall be deep. No shallow boxes shall be permitted.
 3. Provide mud rings or industrial covers for the devices installed and a depth to match the sheetrock where applicable.
- C. **Audio Visual Boxes**
1. Shall be 4" deep.
 2. Knockout sizes shall vary from ½" to 2".
 3. Shall be 2-gang, 3-gang, or any combination thereof as required for the audio visual outlets shown on the Drawings. Boxes shall be capable of being ganged together to create boxes sized 4-gang or larger.
 4. Shall be provided with metallic divider to separate power and low voltage wiring.
 5. Hubbell, or approved equal.
- D. **Sleeves**
1. Provide conduit sleeves through floors or ceilings.
 2. Sleeves shall be EMT conduit.

3. Provide conduit bushing on each end.
- E. **Firestopping**
1. Firestopping products shall be provided in all fire and smoke rated partition penetrations per local code requirements.
 2. Shall be Listed for the conduit, raceway or box being installed.
 3. Install per the Manufacturer's instructions

INSTALLATION

- A. **General.**
1. Galvanized sheet metal boxes shall be used for all surface mount applications.
 2. No section of conduit shall exceed two 90 degree bends.
 3. Sections of conduit shall not exceed 100 feet without a pull point.
 4. Utilize field or factory bends only.
 5. Where specific pathways are not shown on the Drawings, the design of the pathway shall be CONTRACTOR's choice.
 6. CONTRACTOR shall be responsible for coordination the installation of conduits and boxes with other trades.
 7. Conduits shall be reamed.
 8. Metallic threads shall all be coated with conduit thread lubricant before assembly.
 9. Exposed conduits shall be installed parallel or perpendicular to the structural members and surfaces and shall be level and or plumb.
 10. When two or more conduits are routed in the same general direction their routing shall be parallel with symmetrical bends.
 11. Conduits shall be bent with equipment specifically designed for this purpose and for the specific size and type of conduit.
 12. Conduits that are creased or crushed shall be replaced.
 13. Install conduits such that they do not interfere with the proper and safe operation of equipment and do not block or otherwise interfere with the ingress and egress and installation of removable hatches and covers.
 14. Install expansion joints as needed across expansion joints in the structure and at other locations where necessary to compensate for thermal or mechanical expansion or contraction.
 15. Conduits shall be routed at least six (6) inches from high temperature piping, ducts and flues.
 16. Conduits over 10 feet in length shall be provided with a pull string.
 17. Raceways shall be electrically and mechanically complete before the conductors are installed.
 18. Routing of conduits may be adjusted to avoid obstructions. Coordinate with other trades prior to installation of raceways. Lack of such coordination shall not be justification for extra compensation and removal and reinstallation to resolve conflicts shall be at the CONTRACTOR's expense.
- B. **Conduit for Exposed Wiring**
1. No Division 27 wiring shall be exposed. In all areas where wiring is exposed, conduit or raceway shall be provided.
- C. **Conduit Sleeves above Inaccessible Ceiling or for Penetrations**
1. Conduit sleeves shall be provided across inaccessible ceilings to allow cables to be pulled across these areas both during construction and in the future.
 2. Conduit sleeves shall be for through-wall or through-floor penetrations to allow cables to be pulled across these areas both during construction and in the future.
 3. The CONTRACTOR shall be responsible for providing all sleeves required for a complete installation. The final quantity and location of all sleeves shall be provided by the CONTRACTOR, whether or not they have been shown on the DRAWINGS. Coordination of sleeve requirements with the Division 27 installer shall be the responsibility of the CONTRACTOR.
 - a. Any penetration 7/8" or smaller shall not require conduit sleeves, but shall be fire stopped, grout filled, and / or filled with drywall.

4. If conduit sleeves are not shown on the Drawings, they shall be provided by the CONTRACTOR. When sleeves are not shown on the Drawings but are required, the CONTRACTOR shall provide appropriately sized sleeves. The sleeves shall meet the following Codes and standards:
 - a. NEC / OESC.
 - b. TIA / EIA standards.
 - c. 25% spare capacity minimum.
- D. **Conduit Terminations at Cable Tray**
 1. Conduit that terminates at a cable tray shall be provided with a bushing and shall be bonded and secured to the cable tray using a Manufacturer approved clamp or clip. Bond conduit to the cable tray using #6 AWG minimum.

COMMUNICATION EQUIPMENT ROOM FITTINGS

SUMMARY

This section includes requirements for equipment room fittings.

MATERIALS

- A. **Wall Mounted Rack**
 1. District specified in original bid and will be installed by district. Cabling contractor will not need to provide unless they bid and won the contract to provide this piece of equipment.
- B. **Patch Panels CAT6**
 1. Contractor shall determine # needed based on design requirements and existing patch panel free capacity.
 2. Shall be 48 port Leviton QuickPort Patch Panel or district approved equivalent.
 3. Shall be Leviton Extreme QuickPort CAT6 or Cat6a RJ45 jacks (jacks must match terminating cable category) or district approved equivalent. Provide all RJ-45 jack modules with patch panel.
 4. Each jack module shall be individually labeled with printed label.
 5. Finish shall be powder coated black.
 6. RJ45 Jack colors are as follows:
 - a. Red – General Data (Workstations and Printers)
 - b. Green – Wireless Access Points
 - c. White – Cameras
 - d. Yellow – HVAC
- C. **Fiber Optic Pre-Loaded Drawer 12 Port**
 1. Pre-loaded fiber drawer with minimum 12 pre-configured LC adapters or district approved alternate type.
 2. Shall be one 1.0 rack units high.
 3. Two fiber management spools, two rubber grommets, cable gland, and cable ties.
 4. Dedicated labeling area for adapters.
 5. Corning CCH Series, or approved equal.
- D. **Power Strip**
 1. District will purchase and install.

ACCESSORIES

- A. **Fire Rated Backboard**
 1. District will purchase and install.

SEISMIC BRACING

- A. **Seismic Anchoring and Bracing Products**
 1. Provide seismic bracing for all vertical and lateral restraints of all cable trays required by the International Building Code and Oregon Structural Specialty Code.
 2. Provide seismic bracing for all racks and cabinets as required by the International Building Code and Oregon Structural Specialty Code.

INSTALLATION

A. General

1. All identification labeling shall be done uniformly with printed labels.
2. Neatly group cables together that terminate on the same patch panel in MDF and IDF rooms. Utilize Velcro cable ties.
3. Cables shall be bundled using Velcro wraps only. The use of plastic tie wraps is prohibited.
4. Cables shall be bundled in groups no larger than 24. Cable bundles shall be of a similar system only (i.e. IT, Nurse Call, Security). Bundling cables of different systems shall not be acceptable.
 - a. Exception: If no more than six cables of different systems serve the same area, they shall be permitted to be combined in bundles using j-hooks.
5. Cables in cable tray shall be combed to avoid crossing.
6. Bond rack mounted equipment to the Equipment Rack Ground Bus Bar.
7. Bond all racks to the Technology Main Ground Bus / Technology Ground Bus using #6 AWG Copper.
8. Provide primary protection of communication circuits per NEC 800.