

STRUCTURED CABLING STANDARDS

1.0 Introduction

1.1 Contents of this document

- 1.1.1 This document contains Metro Hartford Information Services (MHIS) standards for structured cabling implementation.
- 1.1.2 This is revision **6.0** and supersedes all previous versions.
- 1.1.3 Questions about these standards should be referred to the Director of Technical Services.

1.2 Scope of authority

- 1.2.1 MHIS is the information technology organization for the City of Hartford and the Hartford Public Schools (Hartford Municipal Code §2-105). As such, MHIS has authority over matters of technology systems, infrastructure and installation.
- 1.2.2 MHIS's authority is vested in the Chief Information Officer and his designees.
 - 1.2.2.1 The Manager of Convergent Services oversees voice communications systems.
 - 1.2.2.2 The Manager of End-user Services oversees purchasing, installation, and maintenance of personal computers and their peripherals.
 - 1.2.2.3 The Director of Technical Services oversees structured cabling and both local and wide-area network infrastructure. The Technical Services Division is responsible for the maintenance of this document.

2.0 Basic requirements

2.1 Standardization of designs

- 2.1.1 It is the goal of MHIS to deploy standardized, consistent technology systems across all school, library and municipal sites. Adherence to the standards described in this document is critical to realizing this goal.
- 2.1.2 Designers shall use standardized symbols for voice and data drops as described in Appendix A

2.2 Requirements for review and documentation

- 2.2.1 MHIS requires review of design drawings and bid specifications by MHIS at the following points: completion of schematic design, completion of design development, and 50% CDs
- 2.2.2 MHIS requires copies of all relevant plans and specifications put out to bid for technology systems.

2.3 Compliance with applicable codes

- 2.3.1 All designs and contractors' work must meet all applicable NEC, EIA/TIA, ADA, NFPA, and local building codes as minimum requirements.

3.0 Entrance Facility

3.1 Access from the street

3.1.1 MHIS requires four (4) four-inch conduits from the street, SBC manhole or telephone pole, as directed by MHIS. The first conduit shall contain three 1.25-inch inner ducts.

3.1.2 The fourth street conduit is for municipal fire alarm interconnect (a.k.a. the "Gamewell loop") and should be coordinated with the Hartford Fire Department Alarm and Signal Division.

3.2 Demarcation extension

3.2.1 If SBC's demarcation (demarc) is not located in the MDF room, MHIS requires a two-inch EMT conduit extending from the SBC demarcation point to the MDF room with two (2) 25 pair CAT3 cables to be terminated on 110 blocks at either end.

3.2.2 In the MDF room, the 110 block shall be on the wall field.

3.2.3 At the demarc, the 110 block shall be mounted to the wall within 24 inches of the demarc cabinet.

4.0 Cable Type and Manufacturers

4.1 Copper Cable

- 4.1.1 All copper cabling (data and voice) shall be Enhanced Category 5 (CAT5e) plenum-rated cable, except where otherwise specified in this document. Acceptable manufacturers: *Berk-Tek* (preferred), *Mohawk/CDT*, *AVAYA*, and *General Cable*.
- 4.1.2 All data cable shall be designated blue in color and voice cable shall be designated gray in color.
- 4.1.3 All copper connecting components (patch panels and jacks) shall be Enhanced Category 5 (CAT5e). Use all EIA 568B equipment. Acceptable manufacturers: *Ortronics* (preferred), *Hubbel Premise Wiring Inc*, and *Siemons*.
- 4.1.3.1 **Exception:** *Wiremold* jacks should be used where *Wiremold* two-channel raceway has been used.
- 4.1.4 Contractors shall provide a service loop of no less than six (6) feet at the MDF/IDF termination.
- 4.1.5 Voice riser cable shall be Category 5 (CAT5) grade or higher. Acceptable manufactures: *Berk-Tek* (preferred), *AVAYA Inc* and *CommScope*.

4.2 Optical Cable

- 4.2.1 All multimode optical cable plant shall be 50µm/125µm.
- 4.2.2 Acceptable manufactures: *Seicor* or *Corning*.
- 4.3 Installers must meet or exceed the cable or equipment manufacturer's minimum requirements for number of staff certified to install that product.

5.0 MDF/IDF Room Layout

5.1 Rack Arrangement

- 5.1.1 Racks will be free standing, 7 feet tall with minimum 1-inch rails for mounting equipment with 6-inch vertical wire management between all racks. Acceptable manufactures: *Chatsworth Products Inc, B-Line, and Ortronics*.
- 5.1.2 Voice cabling shall be installed in separate rack/racks, starting at the left-most rack as viewed from the front of the racks.
- 5.1.3 Data cabling shall be installed in separate rack/racks, starting to the right of the right-most voice rack.
- 5.1.3.1 **Exception:** In building MDFs, leave the left-most rack empty except for fiber LIUs (MHIS will install larger equipment in this rack) and start one rack to the right for voice terminations.
- 5.1.4 No more than 240 drops per rack/5 patch panels, 48 ports each. Fill racks up to 240 drops before placing any drops in the next rack
? **Example:** if a closet has two data racks with a total of eight patch panels, the left data rack will have five patch panels and the right data rack will have three.
- 5.1.5 Patch panels shall be 48-port, high-density 2U in size.
- 5.1.6 All wire management shall be 1U in size, and of all metal construction.
- 5.1.7 One 1U-wire manager shall be placed above each patch panel.
- 5.1.8 Fiber LIUs shall be placed at the top of the left-most rack in the closet.
- 5.1.9 Leave 1U empty below any installed LIU before starting with any wire managers and patch panels in that rack.

5.2 Conduits

- 5.2.1 All conduits shall be installed with unobstructed access to cable tray. When possible the entrance and distribution conduit should enter on the same wall allowing access to the cable tray.

5.3 Wall field

- 5.3.1 One wall in each MDF/IDF room should be installed with plywood, floor to ceiling. Plywood should be treated with a minimum of two coats of fire retardant paint. Stand-off construction is not required.
- 5.3.2 The wall field should be preferentially located behind the racks.
- 5.3.3 On the wall field, 110 blocks shall be installed in the following order from left to right: 110 block for demarc extension (3.2.1), 110 block reaching to MDF voice rack (5.12.7), 110 blocks terminating riser(s) to IDF(s) (5.12.5), 110 block for specialty connections (7.4.1).

5.4 Overhead equipment and space

- 5.4.1 All MDFs and IDFs will have full compliment of ladder rack. It shall be installed above racks, circling the room, and supplied with an extension to the voice/security plywood backboard.
- 5.4.2 If a ceiling must be installed, it must be a minimum of 8'6" in height to provide adequate space above distribution racks and cable tray.

5.5 Cable run lengths

- 5.5.1 It is imperative that closets be located so as to minimize cable lengths for both horizontal and vertical cable runs. These closets must be located as to maintain a maximum cable length no greater than (90) ninety meters from the communication outlet being served by that closet.

5.6 MDF/IDF Room Size

- 5.6.1 The MDF will be a private room 12' x 8'. Add 3' x 8' every additional rack required to keep cable count to 240 per rack.
 - 5.6.1.1 **Example:** Any MDF with 481 - 720 data/voice cables will require a 15' x 8' room. This MDF room will have a minimum of five distribution racks – one fiber/equipment rack, one voice rack and three data racks.
- 5.6.2 IDF will be a private room 9' x 8'. IDF rooms will have a minimum of three distribution racks. Add 3' x 8' every additional rack required to keep cable count to 240 per rack.

5.7 [removed]

5.8 Review of third-party equipment placement

- 5.8.1 MHIS must review and approve placement of other equipment in racks, cabinets, or on walls prior to installation.

5.9 Electrical and Grounding Requirements

- 5.9.1 Power sufficient to provide two (2) 120V 20A receptacles per rack should be installed at the top of the racks (or on overhead cable tray). If this is not possible, wall installation behind the racks is acceptable.
- 5.9.2 Each pair of 20A receptacles will be on its own circuit (e.g. if two racks share a quad outlet box, there should be two 20A circuits feeding that box).
- 5.9.3 Where available, all circuits in the MDF and IDFs will be connected to a building generator.
- 5.9.4 Any HVAC, lighting, and motor circuits will not connect to the communication closet's isolated panels.
- 5.9.5 A number-six isolated building ground bus bar shall be installed in all MDF/IDFs.
- 5.9.6 All distribution racks and ladder rack will be grounded with a number six-ground green in color. This ground must be installed and connected to a bus bar supplied by the electrical contractor.

5.10 MDF/IDF Environment

- 5.10.1 All MDF/IDFs will have year-round continuous cooling to support temperatures of 64-75°F with a humidity value of 15% to 80% relative.
- 5.10.2 All distribution rooms should be supplied with adequate and uniform lighting. Coordinate light fixture positions with equipment layout, especially cable trays and ladder racking, to ensure no direct light will be obstructed.
- 5.10.3 All distribution rooms shall be free of any school/city storage and supplies.
- 5.10.4 All MDF/IDFs must be cleaned before being turned over to MHIS.

5.11 Access control

- 5.11.1 All MDF and IDF rooms must be secured by a locking door.
- 5.11.2 All MDF/IDFs will be keyed with the MHIS standard bubble key. (To be named later.)

5.12 MDF/IDF Room Connectivity

- 5.12.1 Two (2) four inch conduits will be installed to every IDF originating from the MDF.
- 5.12.2 Each IDFs shall be connected to the building MDF with 24 strands of optical fiber (12 strands of multimode and 12 strands of single mode).
- 5.12.3 When running optical fiber into any provided conduits it must be run through inner-duct.
 - 5.12.3.1 **Exception:** Interior armored fiber-optic cable installed
- 5.12.4 All optical fiber termination solutions shall be SC-type using; epoxy, heat cured polishing, etc.
 - 5.12.4.1 ***Use of mechanical terminations (e.g. Uni-Cam) is strictly forbidden.***
- 5.12.5 Each IDF shall be connected to the building MDF with 50 pairs of CAT5 copper run as two (2) 25 pair cables.
- 5.12.6 The two (2) 25 pair riser cables shall terminate on a 48-port 2U high-density patch panel in the IDF and on a 110 block on the wall field in the MDF.
 - 5.12.6.1 In IDFs, terminate each pair of the riser (MDF-to-IDF) cables on the blue pair (pair one) of each port of the IDF riser patch panel. Coil the 25th pair (violet-slate) of each cable for later use.
 - 5.12.6.2 Install the patch panel at the top of the IDF voice rack with a 1U wire manager above it; patch panel and wire manager shall be directly below the fiber LIU.
- 5.12.7 In the MDF room install two (2) 25 pair CAT5 cables from the wall field to the voice rack, terminated on a 110 block on the wall field and on a patch panel in the rack. Terminate the patch panel as described in 5.12.6.1
 - 5.12.7.1 If the SBC termination cabinet is in the MDF room, the terminations shall be beneath or adjacent to the termination cabinet.

5.12.8 A temporary six strand multimode fiber-optic cable and 50 pair voice cable may be required between the original MDF/IDF and the new MDF/IDF locations for renovation projects in order to maintain voice and data service throughout the project. ***MHIS and approved project/construction managers shall determine this solution.***

6.0 User-Side Jacks and Faceplates

6.1 Jack Color

- 6.1.1 Data cabling shall be terminated at the top of the location with WHITE jacks.
- 6.1.2 Voice cabling shall be terminated the bottom of the location with BLACK jacks.

6.2 Labeling

- 6.2.1 Data and drops shall be labeled with the room number and sequential letters starting with "A" (e.g. the first three data drops in Room 201 would be labeled 201A, 201B, and 201C). Skip the letter "V". If a room has more than twenty-five (25) data drops, label the twenty-sixth (26th) as xxxAA, the twenty-seventh (27th) as xxxAB, etc.
- 6.2.2 Voice drops shall be labeled with the room number and the letter "V" (e.g. the telephone drop in Room 128 would be 128V). If there are multiple voice drops in one room, label them xxxV, xxxV1, xxxV2, etc.
 - 6.2.2.1 Exception: City buildings will be handled on a case to case basis and will be approved by MHIS Technical Service department. – See Appendix B: City Hall Structured Cabling.
- 6.2.3 In each room with multiple jacks, data drops shall be labeled in a clockwise direction (left to right) starting at the entrance doorway. Where drops are not on walls (i.e., floor and ceilings), a logical orderly sequence shall be laid out. Voice drops shall start with xxxV at the wall telephone location (classroom) and proceed clockwise, or at the presumed primary desk location in offices and other spaces. At the patch panels in the MDF and IDFs, drops shall be cut down in sequence (left to right) by room number and letter. Exception: Drops added subsequent to initial installation shall be inserted on the patch panel at the end of the row for that floor. (See section 5.1.7)

7.0 User End-Points

7.1 Wall Phones

- 7.1.1 Flush mounted voice jacks shall be located 42-48 inches to center above the finished floor (AFF).
- 7.1.2 Surface mounted voice jacks will originate from the ceiling to a height of 52 inches AFF.
 - 7.1.2.1 Surface mounted jacks shall be in a low-profile box, protruding no more than 1 1/2" from the wall.
- 7.1.3 Wall phones shall be located with a minimum of eight inches clearance from center on either side horizontally and twelve inches below center of jack from any obstruction, switchplate or fixture.
- 7.1.4 All classroom wall phones will be located within 4 feet of the entrance door.
 - 7.1.4.1 Exception: classroom wall phones may be placed elsewhere if the four foot requirement would result in a condition where the teacher cannot see all student seats from the wall phone position.
- 7.1.5 Any non-office space where it is reasonably expected that a person might enter, close the entry door, and work for an extended period of time shall be provided with a wall-mounted telephone.
 - 7.1.5.1 Examples: classrooms, conference rooms, workrooms, store rooms, elevator machine rooms, book rooms, boiler rooms, MDF and IDF rooms.
 - 7.1.5.2 Exceptions: phones are generally **not** provided in locker rooms.

7.2 Office Areas

- 7.2.1 Each work location shall be wired with two data drops and one voice drop (2D+1V).
 - 7.2.1.1 Most offices of greater than 120 square feet shall require this configuration on two opposite walls to permit desk placement on either side of the room.
- 7.2.2 Selected other locations shall be provided with a double voice/double data (2D+2V) drop. Examples: principals' desks and nurses' desks (where an analog telephone set is provided for emergency backup), and the location of multi-function fax/copier/printer machines.

7.3 Classrooms

- 7.3.1 The Hartford Public Schools district technology plan calls for classrooms to be equipped with four (4) student computers, one (1) teacher computer, and one (1) network printer. In order to provide flexibility in placement of printers and support for such things as laptop carts with integral wireless access points, MHIS specifies that classrooms be equipped with eight (8) data drops and two (2) voice drops.
- 7.3.2 Classrooms will have 6 (six) data drops for student computers.
- 7.3.3 Instructor's desk locations shall be provided with a standard desk complement of two (2) data drops and one (1) voice drop.
 - 7.3.3.1 The location should be coordinated with other cabling needed to support interactive white boards, LCD projectors and the like.
- 7.3.4 A wall-phone drop will be placed at the entrance door as specified in 7.1 *et seq.*

7.4 Specialty Services

- 7.4.1 7.4.1 MHIS requires that all non-IP telephone and non-standard data services be served by dedicated cable drops to the nearest IDF or home run to the MDF as follows:
- 7.4.2 The following analog voice services are provisioned by MHIS and shall be served by voice-only or standard desk drops (terminated at the IDF or MDF in patch panel ports):
- ? Failover and emergency trunks lines to Call Managers (IP-PBXs)
 - ? Emergency analog desk sets for principals, nurses, custodians, and others
 - ? Fax machines (main office, food services, libraries, special programs, and others)
 - ? Personal (desktop PC) or system modems (energy management, temperature control, etc.)
 - ? Extension or night bells
 - ? Paging system interconnect (system provider to specify the number of talk paths/drops)
- 7.4.3 The following critical services shall be served by dedicated voice-only drops home run to the MDF (terminated in a 110 block on the telco wall backboard):
- ? Security system interface (whether dial circuit or dedicated leased circuit)
 - ? Fire alarm system monitoring interface (NOTE: for system trouble reporting)
 - ? Gas, electric, and water meter dialup connections (gas line to be extended in conduit)
 - ? Elevator emergency phone (conduit in mechanical rooms, through to the elevator machine)
 - ? Area of refuge/rescue assistance (AOR) control panel interconnect (where not integrated with fire alarm system) NOTE: System provider shall specify the number of talk paths required. Each one shall require a separate four-pair Cat 5e drop.

7.5 Miscellany

- 7.5.1 Many school and municipal buildings are used as polling places. A standard desk compliment of two (2) data one (1) voice drop is required in polling places for temporary use during elections.
- 7.5.2 Where there is any uncertainty regarding these requirements or a question regarding structured cable placement or termination, the issue must be brought to the attention of MHIS for direction prior to field installation.

8.0 Project Completion

8.1 Testing

- 8.1.1 The communication contractor will test each cable to Cat 5e basic link standards and provide test results electronically to MHIS Technical Services Division.
- 8.1.2 The contractor will test all fiber optics plant installed and provide test results electronically to MHIS Technical Services Division.
- 8.1.3 All test results and shall be provided on or before scheduled customer turnover date.

8.2 Coordination with telco / fiber-optic carriers

- 8.2.1 MHIS is responsible for the scheduling and the installation of leased and owned street service copper and optical fiber plant.

8.3 Documents to be provided

- 8.3.1 Contractors will provide "as built diagrams" electronically accompanied by a half size blue print mounted and protected in wiring closets.

8.4 Warranty

- 8.4.1 Manufacturer shall warranty the installation for a minimum of twenty years.



Single data drop



Multiple data drop - count indicated by number



Single voice drop



Wall phone drop



Standard office location: one (1) voice + two (2) data drops



Flush floor drop - triangle follows scheme above to indicate drop type(s) and count



Wireless AP: above-ceiling single data drop



Wireless AP: single data drop on wall

NOTES:

1. Single data drop is presented for illustration only - use a minimum of two (2) data in all location (except wireless, where a single drop is explicitly called for)
2. Wall phone height must conform to ADA requirements (see sec. 7.1.1)
3. Wall phone jacks must have a minimum of 7" horizontal clearance on both sides (see sec. 7.1.3)

STRUCTURED CABLING – APENDIX B: CITY HALL

This document contains and addendum to Metro Hartford Information Services (MHIS) standards for structured cabling implementation. The addendum covers structured cabling labeling in City Hall. Questions about these standards should be referred to the Director of Technical Services.

Labels for new station cables in City Hall should conform to the following scheme:

CCC-TFXXX

Where *CCC* is the closet identifier, *T* is the cable type, *F* is the floor the cable terminates on, and *XXX* is a sequential numeric identifier.

Closets are identified by floor and section of the building (North or South and East, West, or Middle). For example *3NW* indicates a closet in the North West section of the 3rd floor.

Type is either *D* for data or *V* for voice.

Floor is the floor of the building, either *B*, *G*, *1*, *2*, *3*, or *4*.

The sequential numbering should start at *001* and count up.

A typical label might read: *2SW-D2004* -- This indicates a cable originating in the 2nd floor South West closet, a data cable terminating on the 2nd floor, the 4th one installed.