CONTRACTOR

GUIDELINES

FOR

VOICE/DATA COPPER CABLING

INSTALLATION

Revision Date: 2-20-17

Purpose

As a constantly growing and changing organization, Mercy Health (Mercy) has an ongoing need for voice and data cabling installations. In order to ensure uniformity and consistency throughout the organization, this guideline, based on industry-standard practices, has been developed to outline the standards and expectations set forth by Mercy Technology Services (MTS) Data Cabling Services for voice and data wiring. This document should be considered a "living" document that will be revised as necessary to incorporate technology changes to meet or exceed Mercy business requirements. ***This guide is for the use of Data Cabling Services-approved wiring contractors only.***

Process

For every project the Data Cabling Services group will create a scope of work document specific to that project and provide back to PD&C for quoting. After review and acceptance of the quote by the General Contractor and MTS Data Cabling Services, the wiring contractor will be hired as a sub-contractor by the general contractor of the project, and will report to and be managed by the general contractor. Management in this case refers to the overseeing of the scheduling, safety and general workmanship of the wiring contractor. The general contractor will follow contractual agreement and responsibility guidelines established by Mercy Health Planning, Design and Construction for hiring and managing sub-contractors.

All work shall be done under permit and be inspected for full compliance with all local building, electrical, fire, safety or other pertinent codes. Permits are the responsibility of the wiring contractor.

When the project is completed, the wiring contractor shall supply cable test results in CD form and drawings indicating jack numbers and locations to MTS Data Cabling Services group for inclusion into the wiring database and for payment sign-off.

Cabling

MTS Data Cabling Services has standardized on Panduit's **Mini-Com** cabling system and ***blue*** General Cable GenSPEED 5350 enhanced Category 5 (5e), or ***white*** GenSPEED 10 MTP Category 6A plenum-rated data cabling in specially designated areas. Refer to Table 2 for MTS approved specific items and part numbers.

Installation of Copper Cabling

Mercy utilizes a "converged" wiring standard where cabling for both voice and data is a Category 5e or 6A data cable. For locations with IP phone systems, the standard complement of station cabling is one Category 5e or 6A data cable into one yellow (gray for 6A) RJ-45 jack. For locations with traditional phone systems, the standard complement of station cabling is two Category 5e or 6A data cables into two yellow (gray for 6A) RJ-45 jacks. Data-only locations receive one Category 5e or 6A data cable. Voice-only, wall phone, wall-mount arm and time clock locations receive one Category 5e or 6A data cable. Wireless Access Point locations receive one Category 6A cable. See Fig. 1 for faceplate layout. See Table 1 for the symbol legend. See Table 2 for parts descriptions and numbers.

The contractor shall install solid-copper plenum-rated blue-jacketed Category 5e or white 6A data cabling for both voice and data such that it originates at the nearest IDF on the same floor and continues, without splicing, to termination in a specified RJ45 jack. **Direct connection of cabling to a device without termination or cross-cabling between floors is not allowed**. The contractor should consult the construction drawings for IDF locations to use.

Voice trunks for analog systems shall be terminated into 50-pin Telco-to-RJ45 voice patch panels in the data racks. Refer to the Scope of Work document and IDF drawings for details. See Table 2 for parts descriptions and numbers.

The routing of data cabling shall be run in conformance to the EIA/TIA-569 wiring standard, which states that the data wiring shall not exceed ninety meters (295 ft) from the patch panel to the wall jack nor have a bend radius of less than four (4) cable diameters. The outer jacket of the Category 5e or 6A cable shall not be stripped back more than one-half inch from the termination point. The cabling should be terminated as 568B at both ends.

Use of OSP Cabling In Underground Conduits

Outside plant (OSP) cabling must be used for below grade data pathways, such as those feeding ground floor islands. If the data room is more than 50ft from the end of the conduit, the cable must be transitioned to indoor cabling at a consolidation point, with all pairs cross-connected.
Conduit pathways for incoming data, voice and CATV services shall be provided by two diverse pathways utilizing a 2-4" conduits one conduit from each divers path filled with 3 -1 1/4" inner-ducts; conduits shall stub up into data room. Data and voice services shall terminate in the IDF. If a systems room is available the carrier will then terminate voice and data services in that room and fiber/copper will be extended from the IDF/MDF. CATV service will not terminate in the IDF.

Back Boxes

Back boxes for CAT-5E: use a 4-square box with a 2.125" depth. Use a 1" conduit in the wall to the back box.

Back boxes for CAT-6A cable: use a 5-square box with a minimum 2.75" depth. This will accommodate a jack depth close to 1.5 inches and a cable bend radius of 1.24 inches. Use a 1.25" conduit in the wall to the back box.

Hooking Path Systems

The contractor shall install copper cabling in data cable-only trays exiting the IDF/MDF and in major corridors, then step down to J-hooks independently secured to the upper deck a maximum of every four and a half feet as the cable count diminishes. Cabling must not lay on, touch or be secured to ceiling tile, existing conduit, lights, pipes, other cabling, ceiling grid wires, etc. No cabling shall be exposed. Any exceptions must be approved by the MTS Data Cabling Services representative. **Plastic cable ties are not to be used above the drop ceiling. Only use plenum Velcro.**

Service Loops

The contractor shall make every attempt to install cabling with a service loop of between five and ten feet. If the overall circuit length cannot allow for this, this requirement will be waived by MTS Data Cabling Services.

IDF

IDF's shall be located within 295 cable feet of the most-distant communication outlets they will serve. It is preferable to have IDF's centrally located on a floor. All IDF's doors must open onto an easily accessible hallway or space and shall not require passage through any other assignable or otherwise occupied space. No plumbing or mechanicals are to be mounted in or pass through IDF's unless they are specifically needed for the space. IDF's shall be dedicated to communications use only and cannot be shared with departmental storage, janitorial staff, Security, Fire Alarm, Access Control or other materials. IDF's may not have any windows and must be insulated for noise suppression. To avoid electromagnetic interference, IDF placement should avoid adjacencies with motors, X-ray equipment and other electromagnetic generating equipment. The selection of IDF locations must be cleared by MTS staff before construction commences.

IDF Size

Minimum Room size for two rack system without using a 4-post rack is 8' X 8' 6' with all walls going to the deck. See IDF room and rack drawings for specifics.

Minimum room size for a three rack system without using a 4-post rack is 8' X 11' with all walls going to the deck. See IDF room and rack drawings for specifics.

Minimum room size for a four rack system without using a 4-post rack is 10' X 14' with all walls going to the deck. See IDF room and rack drawing for specifics.

HVAC

Sufficient HVAC shall be included in the design of the IDF to maintain temperatures between 64 to 75 degrees Fahrenheit at 30% to 55% relative humidity. The IDF must be provisioned for continuous HVAC (24 hours per day, 7 days per week, 365 days per year) with local control. A positive pressure shall be maintained with a minimum of one air change per hour, or as required by applicable code. The HVAC unit will not be powered off the same electrical panel as the telecommunications spaces. Final BTU load estimates can be provided after the equipment has been selected. For maximum planning purposes, assume at least 5,000 BTUs per equipment rack/cabinet to be installed. A typical telecommunications space contains at least three racks, with one rack dedicated to electronics. If mechanical cooling equipment is installed, drip pans will be installed toshunt any condensation away from the installed telecommunication equipment. MTS moisture sensors are to be installed in all drip pans when the HVAC units installed in the IDF.

Badge Access

Every Mercy MTS MDF/IDF is to have badge access for IS Security to be PCI compliant. For construction, use the same card reader as all the other building door readers. The MTS card reader is to run back to the Lenel panel for all doors and wired into its own LNL2210 or LNL2220 controller. The controller can be wired to the same power supply as the other building doors. The panel is to be installed in the systems room and not in the MDF/IDF.

Communications Optical Fiber Backbone Cabling

27 13 23.01 General Requirements

A. All fiber optic cable, connectors, adapter panels, hardware, and fiber optic pre-terminated systems shall be of Corning Optical Communications to ensure network system compatibility, optimum performance, fit, function, appearance and warranty.

B. Specific requirements for each component of the infrastructure are included in the following sections contained within Division 27 13 23. Additionally, the manufacturer's manufacturing plants shall be ISO9001, TL9000 and/or ISO14001 registered, for quality assurance.

27 13 23.05 Optical Fiber

A. General Specifications

1. All fiber shall be manufactured using the Outside Vapor Deposition (OVD) process to ensure bandwidth consistency.

B. Multimode Fiber shall meet the specifications and standards listed in Table 1,

1. Manufacturer shall use minEMBc bandwidth measurement methods to ensure multimode fiber performance
2. 50um multimode fibers shall be bend-insensitive.

Table 1: Fiber Geometry, Optical Performance and Standards Compliance

	OM1	OM2	OM3	OM4
Core Diameter	62.5 ± 2.5 μm	50.0 ± 2.5 μm	50.0 ± 2.5 μm	50.0 ± 2.5 μm
Core Non-Circularity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Cladding Diameter	125.0 ± 2.0 μm	125.0 ± 1.0 μm	125.0 ± 1.0 μm	125.0 ± 1.0 μm
Cladding Non Circularity	≤ 1.0 %	≤ 1.0 %	≤ 1.0 %	≤ 1.0 %
Core-to-Cladding Concentricity	≤ 1.5 μm	≤ 1.5 μm	≤ 1.5 μm	≤ 1.5 μm
Coating Diameter	242 ± 5 μm	242 ± 5 μm	242 ± 5 μm	242 ± 5 μm
Point discontinuity (850 nm, 1300 nm)	≤ 0.2 dB	≤ 0.2 dB	≤ 0.2 dB	≤ 0.2 dB
Cabled Effective Modal Bandwidth[1)] (MHz•km), 850 nm	≥ 220	≥ 950	≥ 2000	≥ 4700
OFL Bandwidth (MHz•km)				
850 nm	≥ 200	≥ 700	≥ 1500	≥ 3500
1300 nm	≥ 500	≥ 500	≥ 500	≥ 500
Numerical Aperture	0.275 ± 0.015	0.200 ± 0.015	0.200 ± 0.015	0.200 ± 0.015
Standards Compliance	IEC 60793-2-10 A1b TIA/EIA 492 AAAA-A ISO/IEC 11801 type OM1	IEC 60793-2-10 A1a.1 ITU-T G.651.1 TIA/EIA 492 AAAB-A ISO/IEC 11801 type OM2	IEC 60793-2-10 A1a.2 ITU-T G.651.1 TIA/EIA 492 AAAC-B ISO/IEC 11801 type OM3	IEC 60793-2-10 A1a.3 ITU-T G.651.1 TIA/EIA 492 AAAD ISO/IEC 11801 type OM4

C. Single-mode fiber shall meet the specifications listed in Table 2

D. Single-mode fiber shall meet ITU G.652 (Table D), ITU G.657 (Table A1), IEC Specification 60793-2-50 Type B1.3

Table 2: Single-mode OS2 Fiber Geometry and Optical Performance

	OS2
Cladding Diameter (μm)	125.0 ± 0.7
Core-to-Cladding Concentricity (μm)	≤ 0.5
Cladding Non-Circularity (%)	≤ 0.7
Mode Field Diameter (μm)	
1310 nm	8.6 + 0.4
1550 nm	9.8 ± 0.5
Coating Diameter (μm)	242 ± 5
Fiber Curl radius of curvature (m)	> 4.0
Point discontinuity (dB)	
1310 nm	≤ 0.05
1550 nm	≤ 0.05
Macrobend Attenuation (dB)	
Mandrel OD Turns	
20 mm 1	< 0.50 at 1550 nm
20 mm 1	< 1.5 at 1625 nm
30 mm 10	< 0.05 at 1550 nm
30 mm 10	< 0.30 at 1625 nm
60 mm 100	< 0.01 at 1625 nm
Cable Cutoff Wavelength (nm)	< 1260
Zero Dispersion Wavelength (nm)	1304 ≤ λo ≤ 1324
Zero Dispersion Slope (So) (ps/(nm²•km))	≤ 0.089
Total Dispersion (ps/(nm•km))	
1550 nm	≤ 18
1625 nm	≤ 22
Cabled Polarization Mode Dispersion ($ps/\sqrt{km}$	
PMD Link Design Value	< 0.06
Max Individual Fiber	< 0.1

A. General Specifications
   1. Connectors shall be field-installable no-epoxy/no-polish LC, SC, or ST connectors and meet all requirements in this specification
   2. The following documents may be used as references.
      a. EIA/TIA-455-A Standard Test Procedures for Optical Fiber Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fiber Optic Components (FOTPs)
      b. TIA/EIA-604-2 Fiber Optic Connector Intermateability Standard, FOCIS-2 (ST Compatible)
      c. TIA/EIA-604-3A Fiber Optic Connector Intermateability Standard, FOCIS-3 (Type SC)
      d. TIA/EIA-604-10A Fiber Optic Connector Intermateability Standard, FOCIS-10 (Type LC)

B. Physical Specifications
   1. The connector shall provide a strain relief mechanism for installation on 900um buffered fiber or single fiber cable that contains strength elements. The fiber within the body of the connector shall be isolated mechanically from cable tension, bending and twisting.
   2. The connector shall be designed to comply with the appropriate TIA/EIA FOCIS document.
   3. The ST compatible, SC and LC connectors shall secure to the field fiber via a rotating cam which shall be situated on the connector body and the camming action shall be performed with the use of a connector terminating tool designed for that purpose. Upon rotation of the cam, the connector shall then be permanently secured to the fiber by the crimping of the connector lead in tube via the connector terminating tool.
   4. The connector ferrule shall be made from a homogenous polymer or ceramic material

C. Installation Specifications
   1. The ST compatible, SC, and LC connectors shall be installable upon 900 μm buffered fiber in one minute or less.
   2. The connector installation tool kit shall be able to be used to terminate all of the above connector types. The tool shall contain an integrated continuity test system, to provide immediate Go/No-Go feedback of successful connectivity.
   3. The connector shall not require polishing of the endface in the field. Connectors shall have a factory-polished fiber stub in the connector ferrule.
   4. The connector installation shall not require the use of epoxies.

D. Performance Requirements
   1. Connectors shall comply with the following insertion loss performance when testing in accordance with FOTP-171
      a. Singlemode: $\leq$ 0.2 dB (average) and $\leq$ 0.5 dB (maximum)
      b. Multimode : $\leq$ 0.1 dB (average) and $\leq$ 0.5 dB (maximum)

Connector: For new construction use LC connectors. In existing spaces match connector types from previous installs unless otherwise specified by MTS.

27 13 23.30 Fiber Optic Adapter Panels

A. General Specifications
   1. Rack and wall mountable connector housings shall accept an interchangeable connector panel. An adapter panel is defined as a modular removable plate containing optical fiber connector adapters.

B. Physical Specifications
   1. The adapter panel shall utilize a single mounting footprint and shall be interchangeable between the rack and wall mountable hardware used.
   2. The panel shall be attached with two push-pull latches to allow quick installation and removal.
   3. The adapter panel shall be available with industry standard single fiber and small form factor multi-fiber adapters, including the SC duplex, ST compatible, LC duplex and MTP.

4. The adapter panel shall accommodate OM1, OM2, OM3, OM4, and OS2 optical fiber.
5. Panels shall be manufactured from injection molded polycarbonate for structural integrity.
6. Panels shall be finished with a wrinkled black texture.

Fiber Optic Testing

TIA-568-C.0 states that there are two tiers of testing for fiber optic systems. The two tiers of testing are Tier 1 and Tier 2.

Tier 1 testing is the minimum level of testing that is required. This level of testing consists of link attenuation testing, link length and a polarity check. The fiber optic link attenuation is tested using an optical loss test set (OLTS) or a light source and power meter (LSPM). Testing of the fiber is to be performed at 850 nm and 1300 nm wavelengths for Multi-Mode and 1310 nm and 1550 nm wavelengths for Single-Mode. MTS requires that the fiber be tested bi-directionally. The link length can be obtained by recording the sheath distance found on the cable jacket or with the OLTS. Polarity verification is performed by either using a visual fault locator (VFL) or while performing the attenuation testing with the OLTS/LSPM.

Tier 2 testing involves the use of an optical time domain reflectormeter (OTDR) to provide a trace (visual picture) of the installed fiber optic network. Testing of the fiber is to be performed at 850 nm and 1300 nm wavelengths for Multi-Mode and 1310 nm and 1550 nm wavelengths for Single-Mode. The OTDR trace is to be used for cable acceptance, splice and connector loss, documentation, troubleshooting, fault location, optical return loss and to measure the length of the system. The OTDR trace provides a visual picture of the fiber link that the OLTS/LSPM cannot. Even though the OTDR is a powerful tool it does not replace the need for Tier 1 testing because OTDR testing results can vary as a result of the user setup. To get a true measurement of an event with an OTDR a trace needs to be shot from both directions and the average of the losses needs to be calculated.

Certain precautions should always be taken when performing any type of fiber optic testing. The use of appropriate mating adapters for launch cords is necessary to ensure reliable test results. All launch cords and adapters need to be clean and free of defects prior to and during testing. It is highly recommended that reference-grade launch cords be used for end-to-end attenuation testing. Launch cables should be used for OTDR testing to enable a stable launch and to ensure that the first event in the fiber link is visible in the trace. It should be a given that the fiber type of the launch cables/reference jumpers match the fiber link.

Before any fiber optic link loss testing begins, a link loss budget need to be calculated. A loss budget will aid in the determining whether the system was installed correctly, and the combined loss of all installed components is within allowable limits.

Contractor is to provide documentation back to MERCY MTS.

For OLTS testing provide test results with the date of the test, all test personnel, description of the field instrument used, test equipment calibration dated, type and length of the reference jumpers, fiber ID, test procedure and reference method used and link-loss results.

For OTDR testing provide test results with the date of the test, all test personnel, description of the field instrument used, test equipment calibration dated, type and length of the reference jumpers, fiber ID, trace file and tested wavelengths.

Communication Grounding and Bonding

Definitions

Bonding – The permanent joining of metallic parts to form an electrically conductive path that will assure electrical continuity and the capacity to conduct safely any current likely to be imposed.

Common Bonding Network (CBN) – The principal means for affecting bonding and earthing inside a building.

Ground – A conducting connection, whether intentional or incidental, by which an electric circuit or equipment is connected to earth, or to some conducting body of relatively large extent that serves in place of the earth.

Retrofit Rack Grounding – Racks where functioning equipment is already deployed in a way that impedes rack grounding system installation.

Overview

The purpose of the grounding system is to create a low impedance path to earth ground for electrical surges and transient voltages. Lightning, fault currents, circuit switching (motors turning on and off), and electrostatic discharge are common causes of these surges and transient voltages. An effective grounding system minimizes the detrimental effects of these electrical surges, which include degraded network performance and reliability and increased safety risks.

The grounding system must be intentional, visually verifiable, adequately sized to handle expected currents safely, and directs these potentially damaging currents away from sensitive network equipment. As such, grounding must be purposeful in its design and installation. Four issues require special consideration:

1. Although AC powered equipment typically has a power cord that contains a ground wire, the integrity of this path cannot be easily verified. Thus, many equipment manufacturers require grounding above and beyond that which is specified by local electrical codes, such as the National Electrical Code, etcetera. Always follow the grounding recommendations of the manufacturer when installing equipment.
2. While the building steel and metallic water piping must be bonded to the grounding system for safety reasons, neither may be substituted for the telecommunications bonding backbone (TBB).

3. Electrical continuity throughout each rack or cabinet is required to minimize safety risks. Hardware typically supplied with bolt-together racks is not designed for grounding purposes. Additionally, most racks are painted. Paint is an insulator. Unless rack members are deliberately bonded, continuity between members is incidental, and in many cases, unlikely.

4. Any metallic component that is part of the data center, including equipment, racks, ladder racks, enclosures, cable trays, etc. must be bonded to the grounding system.

All IDF's will adhere to the grounding guidelines set forth in ANSI/TIA-607-B (Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premesis), plus any applicable codes in Articles (250 – GROUNDING) and (800 - COMMUNICATIONS SYSTEMS) of the NEC 2011 Standards.

For an explanation of what constitutes a proper ground point for the telecommunications bus bar to which the equipment will be grounded, see NEC 2005Article 800-40. Below are three (3) general possibilities of acceptable ground points. These ground points must meet all the detailed requirements of the above mentioned ANSI/TIA-607-B (Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premesis), as well as any additional codes in Articles (250 – GROUNDING) and (800 - COMMUNICATIONS SYSTEMS) of the NEC 2011.

Acceptable ground points:
1. Attach to building or Structure grounding system.
2. Attach to metallic power service raceway or equipment enclosure.
3. Attach to an 8' ground rod properly installed in the earth.

The surface must be prepared to provide a proper path to ground. Any surface that is to be

grounded must be free of paint or other coating that might prevent an effective grounding. Paint should be scraped or filed away until a metallic surface has been exposed. Then the proper grounding component can be attached to complete the system.

All system components (i.e. ladder-style cable raceway, equipment racks, etc.) will be connected together and will eventually connect to the telecommunications room grounding bus bar with at least a #6 solid or stranded copper wire with a green insulation jacket.
The bus bar will be connected to the building ground system in such a manner so that it meets the above specified requirements set forth in ANSI/TIA-607-B (Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premesis) as well as any additional codes in Articles (250 – Grounding) and (800 – Communications Systems) of the NEC 2011. The telecommunications room grounding bus bar will attach to the specified grounding system by a wire that is a minimum of #6 solid or stranded copper wire with a green insulation jacket. (Reference ANSI-TIA-607-B Table 1 – TBB Conductor Size vs Length) for correct conductor sizing).

GROUNDING AND BONDING PROCEDURES
Workmanship

The ground system must be designed for high reliability. Therefore, the grounding system shall meet following criteria:

1. Local electrical codes shall be adhered to.
2. The grounding system shall comply with ANSI-TIA-607-B, IEEE Std. 1100, and the industry standard ANSI/TIA-942 Telecommunications Infrastructure for Data Centers.
3. All grounding conductors shall be copper.
4. Lugs, HTAPs, grounding strips, and busbars shall be UL Listed and CSA Certified and made of premium quality tin-plated electrolytic copper that provides low electrical resistance while inhibiting corrosion. Antioxidant shall be used when making bonding connections in the field.
5. Wherever possible, two-hole lugs shall be used because they resist loosening when twisted (bumped) or exposed to vibration. All lugs shall be irreversible compression and meet NEBS Level 3 as tested by Telcordia. Lugs with inspection windows shall be used in all non-corrosive environments so that connections may be inspected for full conductor insertion (battery rooms are an exception where windowless lugs may be used).
6. Die index numbers shall be embossed on all compression connections to allow crimp inspection.
7. Cable assemblies shall be UL Listed and CSA Certified. Cables shall be a distinctive green or green/yellow in color, and all jackets shall be UL, VW-1 flame rated.

Grounding and Bonding

The Telecommunications Grounding Busbar (TGB) in each telecommunications space will be grounded to the Telecommunications Main Grounding Busbar (TMGB) located at the service entrance. The gauge of the connecting ground cable, known as the Telecommunications Bonding Backbone (TBB) will follow ANSI/TIA-607-B guidelines, as is shown in the table below.

Sizing of the TBB	
TBB Length in Linear meters (feet)	TBB Size (AWG)
Less than 4 (13)	6
4-6 (14-20)	4
6-8 (21-26)	3
8-10 (27-33)	2
10-13 (34-41)	1
13-16 (42-52)	1/0
16-20 (53-66)	2/0
20-26 (67-84)	3/0

26-32 (85-105)	4/0
32-38 (106-125)	250 kcml
38-46 (126-150)	300 kcml
46-53 (151-175)	350 kcml
53-76 (176-250)	500 kcml
76-91 (251-300)	600 kcml
Greater than 91 (301)	750 kcml

The TMGB will be bonded to building steel and grounded to the electrical service ground according to BICSI TDM Manual and ANSI/TIA-607-B guidelines. Local codes may supersede these requirements. In telecommunications spaces with only one rack, the rack jumper cable can be connected directly to the TGB.

Cable Sizes for Other Grounding Applications	
Purpose	Copper Code Cable Size
Telecommunications Equipment Bonding	#6 AWG or larger
Conductors	
Bonding conductor to each PDU or panel board serving the room.	Size per NEC 250.122 & manufacturer recommendations
Bonding conductor to HVAC equipment	6 AWG
Building columns	4 AWG
Cable ladders and trays	6 AWG
Conduit, water pipe, duct	6 AWG

All metallic racks, ladder ways and network/telecommunications equipment will be properly terminated per ANSI/TIA-607-B and NEC 2011 guidelines and procedures.
This equipment will eventually be connected to the telecommunication room (TR) grounding bus bar that, in turn, connects to the building's grounding system.

The TR's Grounding Bus Bar shall be equipped with a grounding conductor that is attached to the grounding bar of the AC electrical panel serving local equipment.

The wire jacket will be rated for the environment in which it has been installed. For example: if the wire runs back to a ground electrode in a path through a plenum return airway, then the cable should be plenum rated or a bare conductor adequately labeled with green electrician tape for easy identification as a ground conductor.

These contractor procedures are mandatory for the completion of required work in all new network/telecommunications installations.

In existing telecommunication rooms that are not up to the required grounding guidelines, Mercy will decide if the work will continue by the contractor or brought into compliance. Contractors will resolve this question with Mercy at the time of the project walk-thru.

Components, Kits, and Hardware

Use GB4 series BICSI/TIA-607-B telecommunications grounding busbars for the TMGB, which is ideally located at the AC service entrance. Use a GB2 series busbar for the TGB in each of the other telecommunications/equipment spaces throughout the building. Use LCC-W series lugs when connecting conductors to the TMGB and TGB.

Route the TBB to each TGB in as straight a path as possible. The TBB should be installed as a continuous conductor, avoiding splices where possible. Use HTAP kits, family HTWC, to provide a tap from the TBB to each TGB. When more than one TBB is used, bond them together using the TGBs on the top floor and every third floor in between with a conductor known as a grounding equalizer (GE). Use the TIA-607-B guidelines for sizing of the TBB when sizing the GE (shown in the table above).

Avoid routing grounding conductors in metal conduits. If the grounding conductor must be routed through a metal conduit, bond each end of the conduit to the grounding conductor. Use GPL series grounding clamps to bond to the conduit, a HTWC HTAP with clear cover to bond to the grounding conductor, and a #6
AWG copper conductor to connect the GPL grounding clamp to the HTWC HTAP.

Rack Grounding

Equipment and racks shall be bonded in accordance with the methods prescribed in ANSI/TIA-607-B as is shown in the figure below.

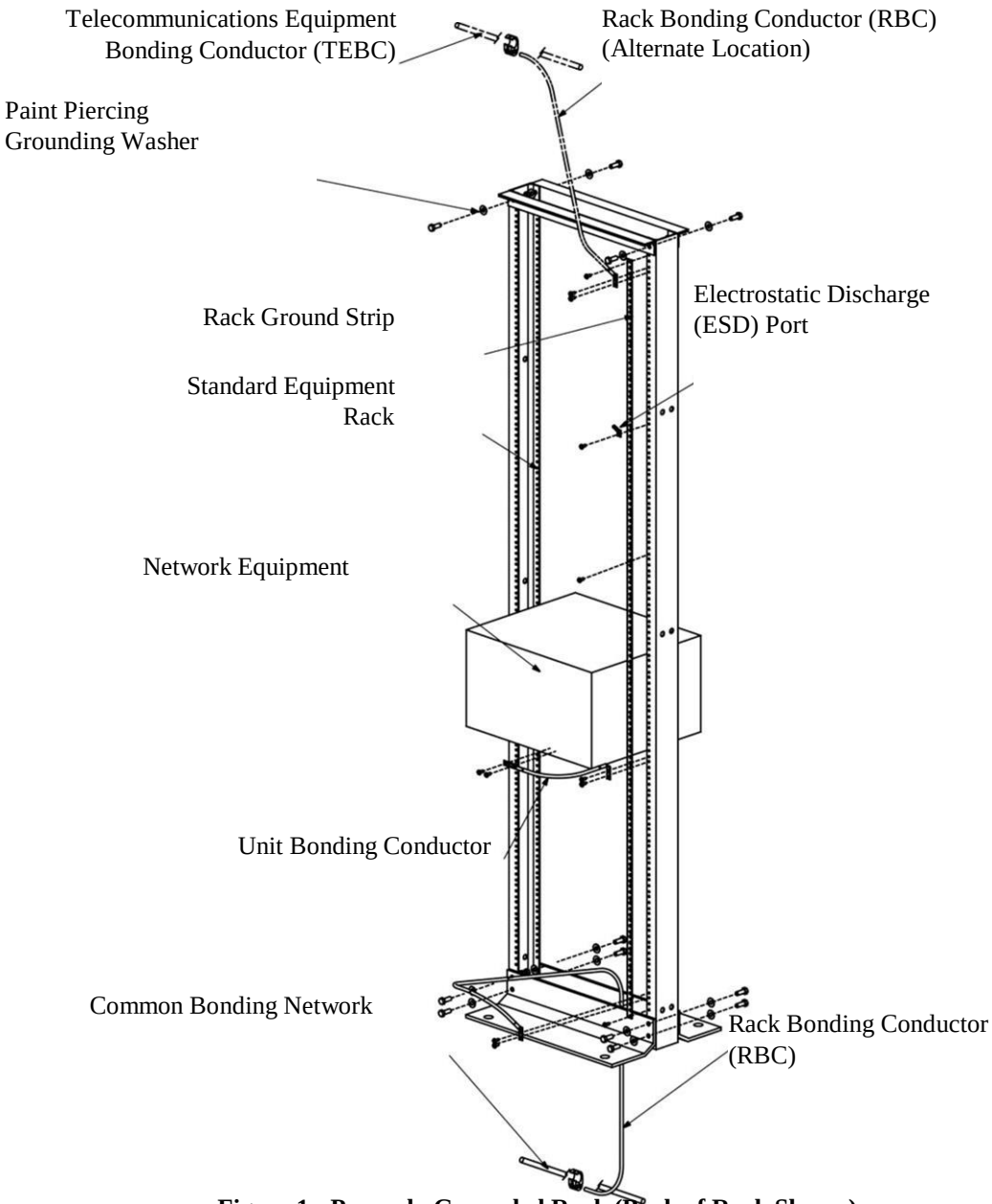


Figure 1 - Properly Grounded Rack (Back of Rack Shown)

To provide electrical continuity between rack elements, PANDUIT paint piercing grounding washers, series RGW, shall be used where rack sections bolt together, on both sides, under the head of the bolt and between the nut and rack.

Sleeves/Sealing Fire-Rated Partitions

All wall penetrations shall be sleeved with STI EZ-Path Series 44 self-sealing sleeves or RFG1 grommets. The contractor shall adhere to all fire and safety codes when installing any cabling through walls. The contractor shall be responsible for fire-stopping at the proper rating any and all holes made or used through any wall, whether a firewall or not, immediately after installation of the cabling.

Physical Appearance in the Telecommunications Room

All installed circuits terminating at the patch panel or punch down block shall be routed and dressed in a neat manner that will allow for easy tracing. Wire management panels shall be used on the racks for data cabling and D-rings for voice trunking. Cable dressing shall include all hardware necessary to comply with industry standards and safety codes governing grounding, strain relief and bend ratios. Cables should be loosely bundled with plenum-rated removable hook-and-loop-type ties. **Plastic cable ties are not allowed.** All wire cuttings, stripped insulation, paper and other installation debris shall be removed and racks wiped down.

Physical Appearance at the Desktop

The cabling contractor shall ensure that the user end of each installed circuit is aesthetic in nature and properly labeled. All cabling shall terminate in a jack in the faceplate; there shall be no cables coming out of or around a faceplate. Temporary or existing cabling exiting the faceplate through the side is not acceptable. All wire cuttings, stripped insulation, paper and other debris shall be removed. Testing of cabling shall be conducted after dressing in their final position.

Use of Surface-Mounted Raceway

In areas that have walls that are not "fishable", Panduit surface-mounted raceway products in a non-contrasting color to the wall color shall be used; the contractor should obtain the approval of the MTS Data Cabling Services representative before initiating installation of any raceways. The contractor should make every effort to route the Panduit raceway down the nearest corner of the room then horizontally to the desired location. Raceway installed off of the corner of the wall and terminated directly into the raised circuit box below the entry point into the room is not allowed.

The minimum Panduit raceway hardware required per location should consist of two pieces of raceway and one "L-shaped" coupler. The contractor should install the raceway down the nearest corner to no less than 16" from the floor then proceed 90 degrees to the final circuit location. The metal ceiling grid should be cut to the width of the raceway to allow the raceway to protrude above the ceiling tile so that no cabling is visible between the ceiling and the raceway. In cases where the contractor feels that the integrity of the ceiling will be reduced by cutting the grid, the MTS Data Cabling Services representative should be informed before initiating installation of that circuit.

Data Cabling Labeling

All data cabling shall be labeled in accordance with the following Mercy Naming Convention in the manner described below using a label maker instead of handwritten labels. Before an installation is started, the contractor shall contact the MTS Data Cabling Services representative to discuss the specifics of the Naming Convention for the particular facility being installed.

A. Naming convention for data cabling

The naming convention includes abbreviations for the facility, building, floor, closet, patch panel and port. For example,

Community	(2 letters) EC (East Community)
City	(3 characters) MHSTL (Mercy St. Louis)
Building	(up to 5 characters) HH (Heart Hospital)
Room type	(IDF, MDF)
Floor	(2 digit alpha-numeric) floors: 01, 02, 11; multiple basements: 0B, LL, GR
IDF	(1 letter) A = 1st room on floor, B = 2nd room on floor, etc.
Patch Panel	(up to two characters) start with A

Port (2 numbers up to 24 or 48)

B. Naming Examples

a. IDF example: **EC-MHSTL-HH-03A**
b. Patch panel example: **A07**
c. Faceplate example: **HH-A07**

1. The contractor shall label each end of the cable with the patch panel and port number using permanent marker, and supply the MTS Data Cabling Services group with accurate cable records (both hard and soft copies) upon completion of the project.

2. In a three-rack configuration, the first patch panel starts in the left (first) rack and shall be labeled A. The second patch panel starts in the right (third) rack and shall be labeled B. The third patch panel goes below the A panel in the left (first) rack and shall be labeled C. Continue with additional panels in a left-to-right and down manner and label by consecutive letter.

   In a four-rack configuration, the first patch panel of the fourth rack starts with U.

3. The faceplate shall be labeled using the Mercy naming convention and a machine-generated black-on-white label using a label-making device, such as the Brother "P-touch" labeler or equivalent (see Fig. 1 for exact placement). **Handwritten labeling on the faceplate is not allowed.** A non-serif font of sufficient size that is easily read should be used.

Fig. 1

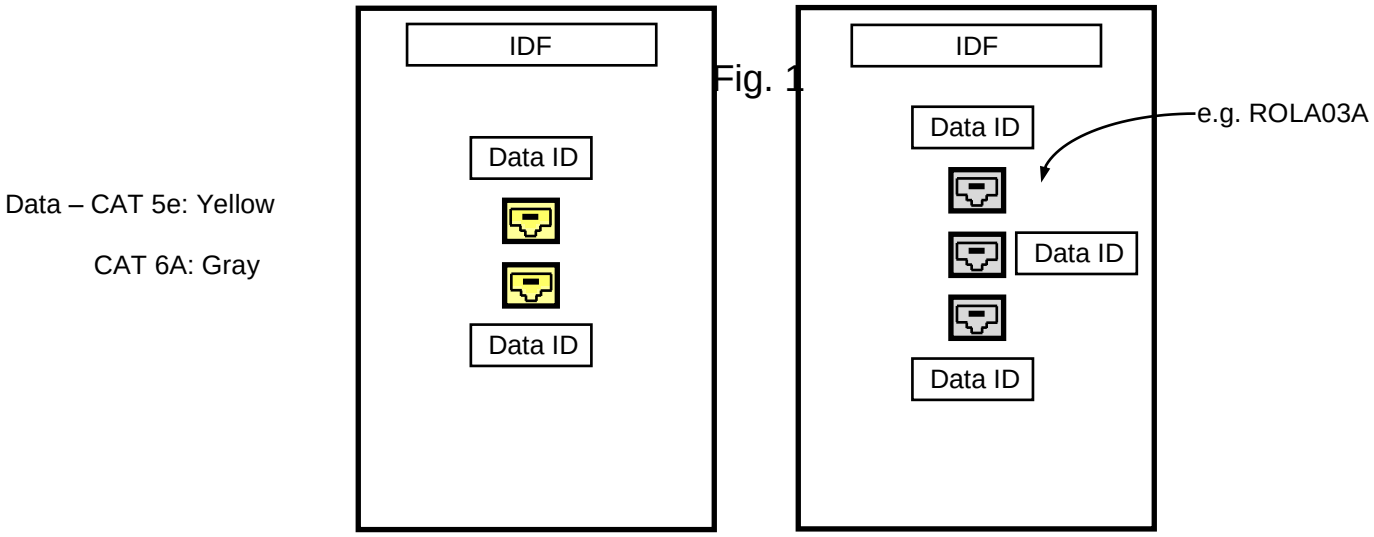


Table 1: VOICE/DATA Symbols

The following symbols should be used:

	Notes:
∇^{X} Data loc with X data jacks (up to 6)	As needed
▼ 3 Data loc at 18" AFF or as noted	Standard wiring configuration for non-IP phone locations
▼ 2 Data loc at 18" AFF or as noted	Standard wiring configuration for IP phone locations
▽ 1 Data loc at 18" AFF or as noted	Telephones in waiting areas, printers in exam rooms
∇^{W} Wall phone at 48" (ADA) AFF	Where indicated
∇^{WAP} Wireless access point loc in ceiling	Mount in biscuit jack on nearest support above ceiling grid
∇^{T} Time clock loc at 48" AFF	See Kronos mounting instructions
∇^{PM} Patient monitoring (orange jack)	Patient monitoring (orange jack) to 4th data rack
AFF = Faceplate center	For other heights, add +XX" superscript (eg., $\nabla^{+72"}$)

Testing and Reporting

All cabling is to be tested as defined in the ANSI/TIA/EIA-568-B-1 standard and the ISO/IEC 11801 standard. For all projects, the contractor shall return one soft copy on CD in AutoCAD 2012 format of the drawings with all routes and circuit IDs annotated on them. The contractor shall return one soft copy on CD in tab-delimited\or Excel spreadsheet format of test results for all Category 5e or Category 6A cabling installed. This information will be used by MTS Data Cabling Services Group to update their wiring databases.

Payment for Work Performed

Final payment will not be made until all inspections have been completed and deliverables, such as maps and test results have been provided by the contractor. In addition, a final site visit will be coordinated with the general contractor and wiring contractor to ensure that ALL circuits have been installed as requested before final signoff.

Compliance

Mercy requires installers to comply with the standards and practices set forth above and to be in full compliance with all local building, electrical, fire, safety or other pertinent codes. Contractors failing to follow these guidelines may be restricted from providing cabling installation services to Mercy in the future. Installations should be warranted for quality and performance for a minimum of one year; contractors will be held accountable for correcting improper installations, code violations and any physical damage that might occur during installation.

MTS has negotiated special pricing with Anixter, Graybar and French Gerleman. All Mercy projects should be priced only through these Mercy-MTS authorized distributors.

Graybar Contact: David Stekmacki (314).573.1040
Anixter Contact: Chris Fabick (636).326.6830
French Gerleman Contact: Bridget Venghaus (314).213.5979

Table 2

General Cable Data Cabling			
General Cable P/N	**Pull-Pac II**	**Spool-Pac**	**Spool**
GenSPEED 5350, CAT 5e, CMP Blue	6131690	6131688	6131686
GenSPEED 5350 w/17 FREE, CAT 5e, CMR, Purple	6133508-17F	6133548-17	6133568-17F
GenSPEED 10 MTP, CAT 6A, CMP, White	—	—	7132850
GenSPEED 10 MTP w/17 FREE, CAT 6A, CMR, Pink	—	—	7133857-17F
GenSPEED 5350. CAT-5E, CMP Orange	6131761		
GenSPEED 5000, CAT-5E, OSP (Non Armored)			5136100

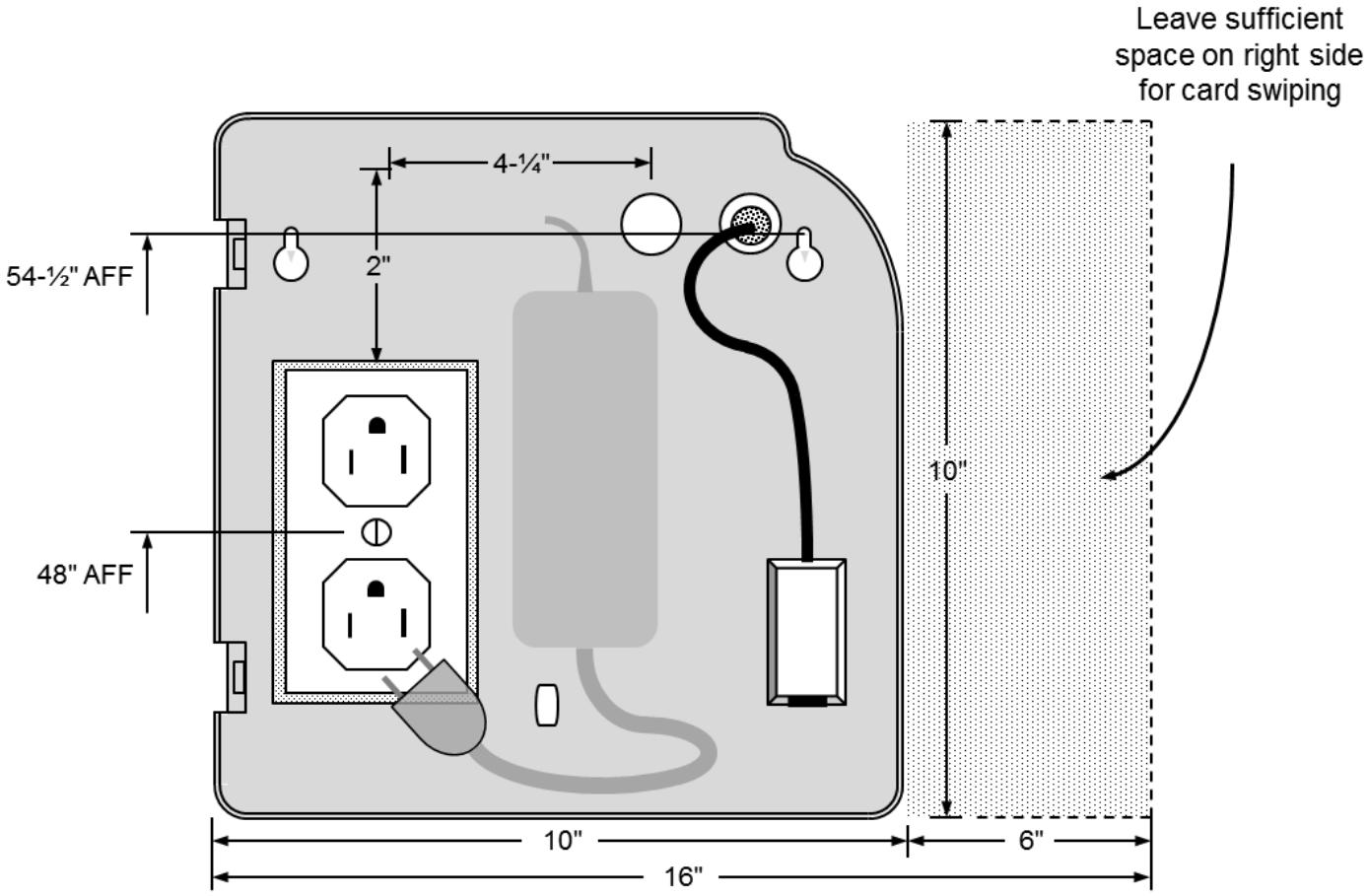
Wall Plate and Jack Parts	
Part Number	**Part Description**
KWP5EY	Wall phone plate, stainless steel, CAT 5e Keystone jack
KWP6Y	Wall phone plate, stainless steel, CAT 6A keystone jack
CFPE1WHY*	Mini-Com Executive Series single-gang faceplate, 1 module-White
CFPE2WHY*	Mini-Com Executive Series single-gang faceplate, 2 module-White
CFPE4WHY*	Mini-Com Executive Series single-gang faceplate, 4 module-White
CFPE6WHY*	Mini-Com Executive Series single-gang faceplate, 6 module-White
CMBWH-X*	Module, blank insert-White
CBX1AW-A*	Surface-mount box, Slim, 1-port
CF1064WH*	4-port “106” frame adapter--White
CJ5E88TGYL	Yellow CAT 5e Jack-Universal - 568A/B (wire as 568B)
CJ5E88TGYL-24‡	Yellow CAT 5e Jack-Universal, 24 Pack‡
CJ5E88TGOR	Orange CAT 5e Jack-Universal - 568A/B (Patient monitoring) (wire as 568B)
CJ5E88TGOR-24‡	Orange CAT 5e Jack-Universal, 24 Pack‡ (Patient monitoring)
CJ5E88TGVL	Violet CAT 5e Jack-Universal - 568A/B (Private Data) (wire as 568B)
CJ5E88TGVL-24‡	Violet CAT 5e Jack-Universal, 24 Pack‡ (Private Data)
CJ6X88TGIG	International Gray CAT 6A Jack-Universal - 568A/B (wire as 568B)
CJ6X88TGIG-24‡	International Gray CAT 6A Jack-Universal, 24 Pack‡
CJ6X88TGOR	Orange CAT 6A Jack-Universal - 568A/B (Patient monitoring) (wire as 568B)
CJ6X88TGOR-24‡	Orange CAT 6A Jack-Universal, 24 Pack‡ (Patient monitoring)
CMFIG	International Gray F-Type coupler Jack (Video)
Fiber	
Part Number	**Part Description**
FAPB	Fiber Blank Panel - without Fiber Adapters
024TUC-T4180D20	Corning Loose Tube, Armored Outdoor Multi Mode OM3 Fiber
024TUC-T4190D20	Corning Loose Tube, Armored Outdoor Multi Mode OM4 Fiber
CCH-CP12-E4	Corning 12 Strand Duplex LC Panel - 50 micron OM3/OM4 Fiber
CCH-CP12-A9	Corning 12 Strand Duplex LC Panel, Single Mode OS2 Fiber
CCH-CP24-E4	Corning 24 Strand Duplex LC Panel, 50 micron OM3/OM4 Fiber
CCH-CP24-A9	Corning 24 Strand Duplex LC Panel, Single Mode OS2 Fiber
95-200-99	Corning Unicam LC Connector, Single Mode OS2 Fiber
95-050-99-X	Corning Unicam LC Connector, Multi Mode OM3/OM4 Fiber
CCH01U	Corning 1RU Rack Mount Fiber Enclosure
CCh04U	Corning 4RU Rack Mount Enclosure
050502T512000(X)M	Corning fiber patch cord, LC-LC duplex 50um (X=length)
Patch Panels Parts	
Part Number	**Part Description**
CPPLA48WBLY	Panduit 48 Port Angled Patch Panel, 2U, modular w/insert faceplates
CPPL48WBLY	Panduit 48 Port Patch Panel, 2U, modular, w/insert faceplates w/o labels
CPPL24WBLY	Panduit 24 Port Patch Panel, 1U, modular, w/insert faceplates w/o labels
DP245E88TGY	Panduit 24-port RJ45-to-110 back 8 wire, 8 position (Used for copper backbone)

VP24382TV25Y	Panduit 24-port RJ45-to-50 pr Telco, pins 4-5 (Female)
Racks and Wire Management	
Part Number	**Part Description**
R2P	Panduit 7' Equipment rack 19"X84", 2-post, black rack
R2P4	Panduit 7' Equipment rack, 19"x84"x29", 4-post, black rack
PEHFX (X=RU)	Panduit Horizontal Wire Mgt, XU x 19" x 9.8" (Front only) use w/PEVX & PRVX vertical w/mgt.
SRB19D7BL	Panduit wire management bracket, Use with PEHFX horizontal wire management
PRVX (X=width)	Panduit Vertical Wire Mgt, 45U, Double sided (Not High Capacity)
PEVX (X=width)	Panduit Vertical Wire Mgt, 45U, Double sided (High Capacity)
PEDXB1 (X=width)	Panduit Vertical Wire Mgt, 45U, Door (goes w/PEVX and PRVX Vertical w/mgt.)
35522-703	CPI Vertical Wire Mgt., 45U, Double Sided (High Capacity) Evolution Series
3009X-703 (X=width)	CPI Vertical Wire Mgt., 45U, Double Sided (Not High Capacity) MCS Series
12419-724	CPI Wall Mount Enclosure, 12U, 24"H X 24"W X 30"D (Tinted Door)
12419-736	CPI Wall Mount Enclosure, 18U, 36"H X 24"W X 30"D (Tinted Door)
12419-748	CPI Wall Mount Enclosure, 26U, 48"H X 24"W X 30"D (Tinted Door)
EWMW242825-G3270	Hoffman Wall Mount Enclosure w/Vertical WM, 24"HX28"WX30"D
EWMW362825-G3271	Hoffman Wall Mount Enclosure w/Vertical WM, 36"HX28"WX30"D
EWMW482825-G3272	Hoffman Wall Mount Enclosure w/Vertical WM, 48"HX28"WX30"D
ESH1915V	Hoffman 3.75"X19"X15" vented shelf
EMSV1922	Hoffman 5.25"X19"X22" vented shelf
EWMF2	Hoffman 4" fan w/plug (Use w/Hoffman wall mount enclosures)
Miscellaneous Material	
Part Number	**Part Description**
HLM-15RO	Hook & Loop (Velcro) Cable Ties, 0.33" x 15 ft
HLS-15RO	Hook & Loop (Velcro) Cable Ties, 0.75" x 15 ft
804025PP0XX-1GY (XX=Length)	Ortronics cable assembly (Male-Male)
PNET1GB	APC Standalone Surge Protection for 1gb Ethernet Connections
DPFP1	Filler Panel - one rack space
TLBP1R-V	1U Tool-less Blanking Panel
Grounding	
Part Number	**Part Description**
GB4B0624TPI-1	Panduit TMGB (Telecommunication Main Grounding Busbar)
GB2B0312TPI-1	Panduit TGB (Telecommunication Grounding Busbar)
RGRB19U	Panduit Grounding Busbar Kit
RGCBNJ660P22	Panduit Common Bonding Network Jumper Kit
RGRKCBNJY	Panduit Rack Grounding Kit
GACBJ68U	Panduit Cable Bracket Jumper for Bonding Pathway Sections
GACB-2	Panduit Auxiliary Cable Bracket
ACG24K	Panduit Armored Cable Grounding Kit up to .84" Cable
ACG24K-500	Panduit Armored Cable Grounding Kit .85" TO 1.03" Cable
LCC6-14AW-L	Panduit 2 Hole Lug #6 Cable
LCC4-14AW-L	Panduit 2 Hole Lug #4 Cable
LCC2-14AW-Q	Panduit 2 Hole Lug #2 Cable
LCC1/0-38DW-X	Panduit 2 Hole Lug 1/0 Cable
LCC2/0-38DW-X	Panduit 2 Hole Lug 2/0 Cable
LCC3/0-38DW-X	Panduit 2 Hole Lug 3/0 Cable
LCC4/0-38DW-X	Panduit LCC4/0-38DW-X
LCC250-38DW-X	Panduit 2 Hole Lug 250 KCMIL Cable
Ladder Rack	
Part Number	**Part Description**
10250-7XX (XX=width	CPI 10' ladder rack sections (black)

10595-7XX (XX=width)	CPI Rack to runway mounting
11421-7XX (XX=width)	CPI Wall angle support kit
11302-001	
11301-001	CPI Butt splice kit (gold)
12100-7XX (XX=Width)	CPI Cable Runway Radius Drop, Cross Member
10724-7XX (XX=width)	CPI Cable Runway Radius Bend (black)
10822-7XX (XX=width)	CPI Cable Runway E-Bend (black)
11959-024	CPI Cable Runway Corner Bracket (gold)
Patch Cords	
Part Number	**Part Description**
UTPCHXBUY (X=lentgth)	Panduit CAT-5E Patch Cord (Blue)
UTP28X* (*=length)	Panduit CAT-6A Patch Cord (White-Small Diameter)

* For Off White, change WH to IW; for Electric Ivory, change WH to EI ‡ Jacks are about 10% cheaper in 24 packs vs. singles

KRONOS Time Clock Installation Guide
2012



Install the duplex electrical outlet at 48" AFF to center and at least 15" to the left from door frames or cabinetry to allow for card swiping.

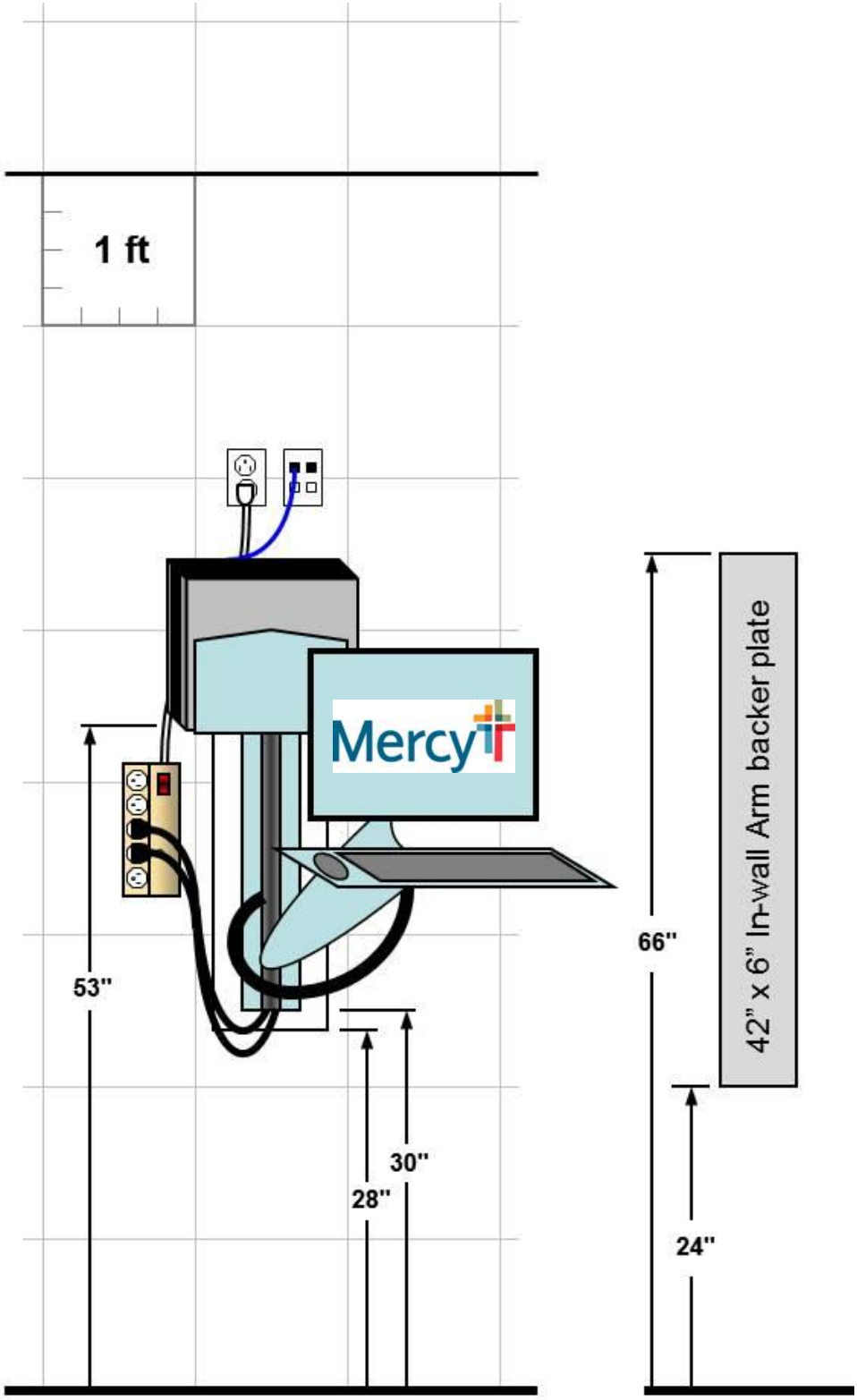
Using an STI Ready Firestop© RFG1 grommet at 4-¼" to the right of the knockout center and 2" above the top of the knockout, bring in 8" of data cable and terminate in a Panduit **Mini-Com**© jack. Provide a Panduit CBX1AW-A surface-mount box at the jack for installation after the time clock back plate is mounted.

Feed the data cable and **Mini-Com**© jack through the data hole of the back plate and mount the back plate with 3 screws. Snap the **Mini-Com**© jack into the surface-mount box and attach to the right of the back plate, leaving space for the power module. Place the jack number label on the surface-mount box.

Note: The Kronos time clock case is designed to be surface-mounted only. Do not recess into wall.

HD Combo Arm Mounting Installation Guide

New Construction



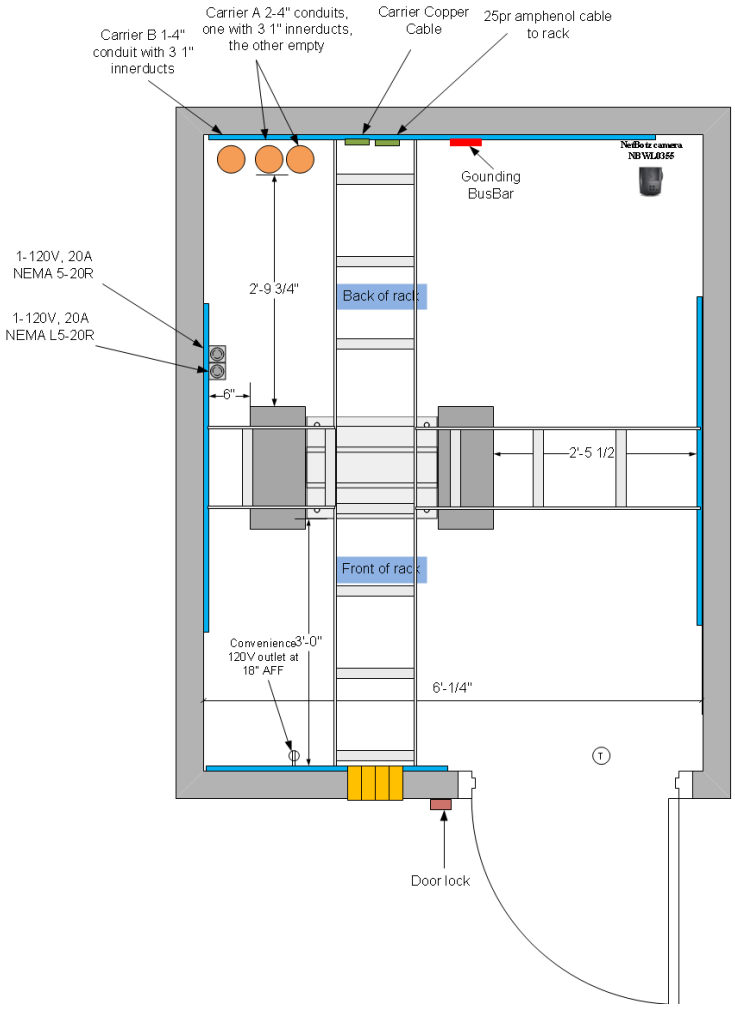
Data & electric installed at 72"

Telecom Room Templates

Diagram 2

Small Clinics

Minimum 6' W X 8' room



Notes: Walls to deck
No drop ceiling
Seal concrete floor
Bolt racks to floor

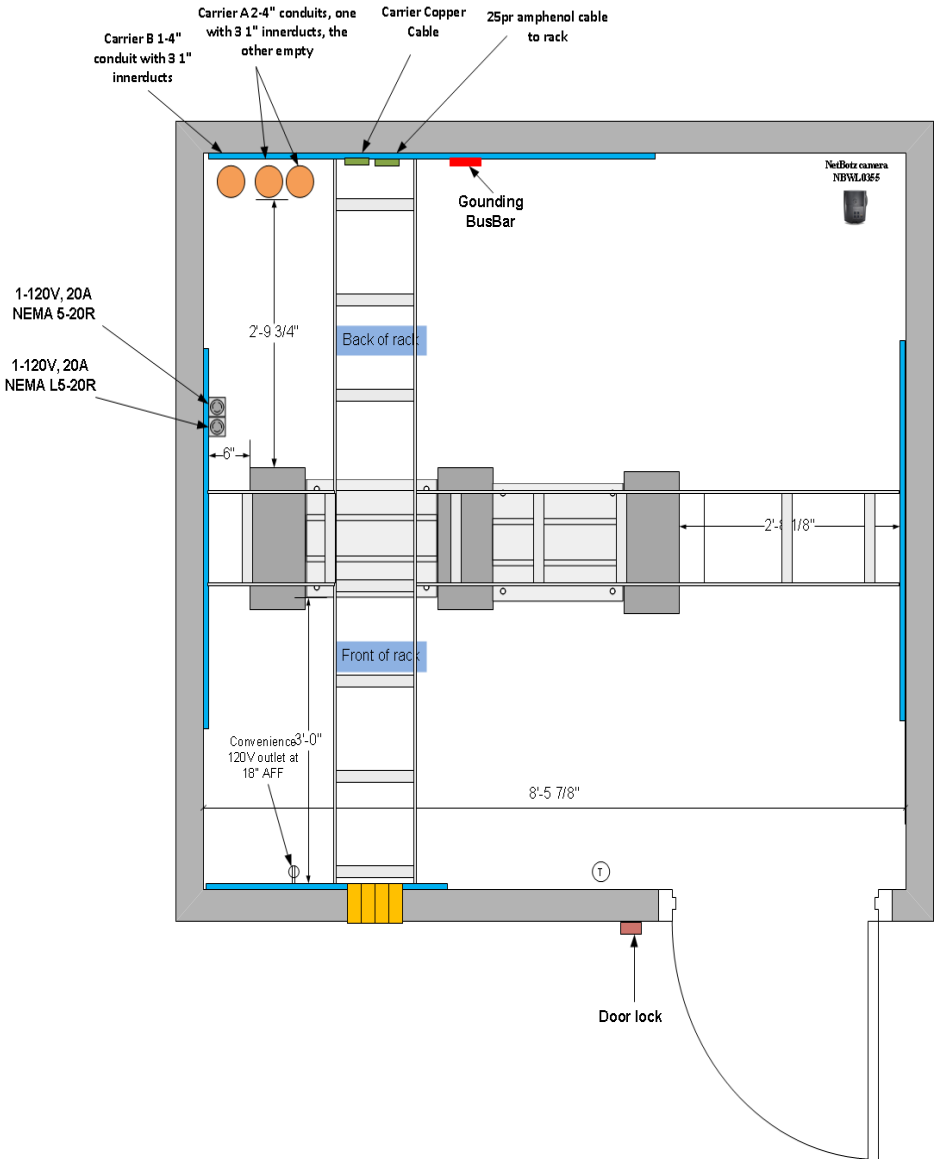
Location of EZ Paths are subject to location of hallway pathways

12" Ladder Rack W/8" Cable Retaining Posts every 8"

Provide adequate lighting in front and in back of rack/s

2 POD Clinic

Minimum 8' X 8'6" room



Notes: Walls to deck
No drop ceiling
Seal concrete floor
Bolt racks to floor

Location of EZ Paths are subject to location of hallway pathways

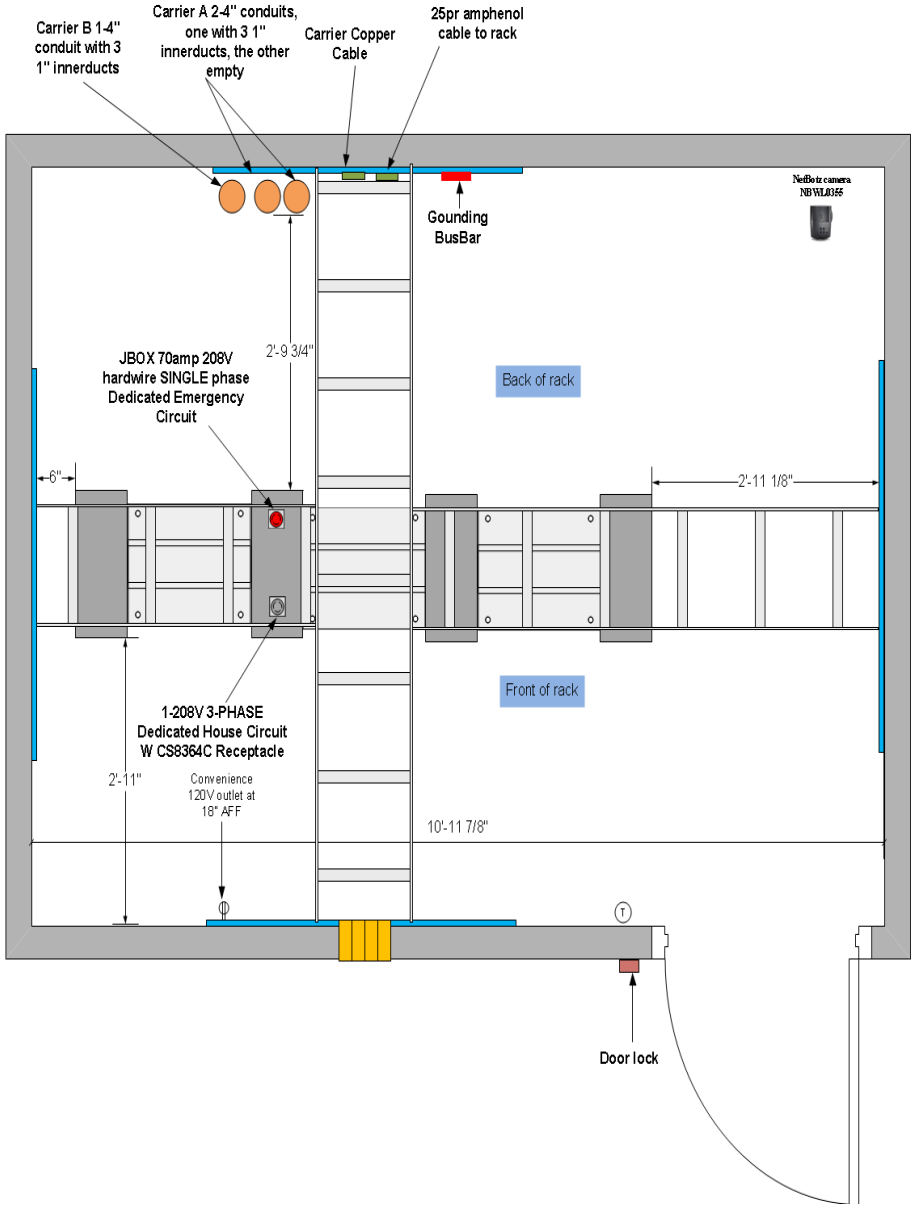
12" Ladder Rack W/8" Cable Retaining Posts every 8"

Provide adequate lighting in front and in back of rack/s

Power will vary depending on UPS/PDU being installed

3-4 POD Clinic

Minimum 8' X 11' room



Notes: Walls to deck
No drop ceiling
Seal concrete floor
Bolt racks to floor

Location of EZ Paths are subject to location of hallway pathways

15" Ladder Rack W/8" Cable Retaining Posts every 8"

Provide adequate lighting in front and in back of rack/s