2022

Telecommunications Installation Criteria for Facility Design & Renovation

HANDBOOK

Submit all recommended changes to 90 CS/SCX

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1) Purpose

The purpose of this Telecommunication Installation Criteria (TIC) handbook is to establish procedures for the installation of communications/cyber equipment/systems on F.E. Warren Air Force Base (AFB), the Missile Complex and Camp Guernsey. The standards referenced in this handbook will be followed by all base agencies and their contractors to plan, design, review, evaluate and install telecommunications cabling and distribution systems. This handbook contains standards for pre-wiring/re-wiring new, and remodeled facilities. Further, this handbook directly supports UFC 3-580-01 Telecommunications Interior Infrastructure Planning and Design by identifying minimum essential factors to be considered when telecommunications pre-wiring/re-wiring support is addressed.

2) Technical References

The TIC handbook is used to provide design criteria for planning telecommunications cabling and distribution systems. UFC 3-580-01 *Telecommunications Interior Infrastructure Planning and Design* states pre-wiring/re-wiring shall be included in all military facility construction projects accomplished with 3300 series funding. The Communications System Officer (CSO) has mandated that all pre-wiring/re-wiring must comply with UFC 3-580-01 Telecommunications Interior Infrastructure Planning and Design (TB) 95-03 and this TIC handbook. Compliance with this handbook will improve maintenance by establishing a standard for communications systems. Department of Defense (DoD) publications direct the use of commercial standards whenever they meet DoD needs. The commercial standards referenced in UFC 3-580-01 Telecommunications Interior Infrastructure Planning and Design and TB 95-03 shall be followed in conjunction with the standards outlined in this TIC handbook. References made to TB 95-03 are noted in square brackets.

3) General Scope

The 90th Communications Squadron (CS) utilizes this handbook to provide communications standards to the 90th Civil Engineer Squadron (CES), 90th Contracting Squadron (CONS) and Contractors who are writing proposals or implementing design packages on F.E. Warren AFB. The 90 CS Plans and Programs Flight (SCX) coordinates on design packages as requested to look for compliance with standards, forwards comments to the Office of Primary Responsibility (OPR), attends design meetings, and ensures appropriate 90 CS personnel are involved in design reviews.

4) Minimum Standards

To minimize the long-term cost of base infrastructure, standards are compiled from the attached references and are intended to minimize the necessity for excessive spare parts and variations in telecommunications equipment. Minimum standards are as follows:

a) Base Fiber Optic Backbone Building Connections: (Information Transfer Nodes-ITN's) – Will have a 36 Strand Single Mode (SM) Fiber 8.3/125 micron fiber cable installed.
b) Base Fiber Optic Satellite Building Connections: (Core Distribution Node-CDN & Access Node-AN) Switched Ethernet Connections – Will have a 12 Strand SM Fiber 8.3/125 micron fiber cable installed.
c) For Horizontal cable connections between the Main Communications Equipment Room (CER) and other CERs within the same building, a 4 Strand (min.) Multi-Mode (MM) Fiber 62.5/125 Micron fiber cable will be installed.
d) Base Copper Connections: 25 pair, CAT 6, 24 American Wire Gauge (AWG) copper service cable will be installed.
e) All non-CAT 6 copper cable conductors shall be 26 AWG in cable sizes above 2100 pair. All copper conductors for cables less than 2100 pair shall be 24 AWG. All splices for 26 AWG shall be spliced with crimp type connectors, not modular splicing methods.

f) For Horizontal cable connections between the Main Communications Equipment Room (CER) and other CERs within the same building, a 4 Strand Multi-Mode (MM) Fiber 62.5/125 Micron fiber cable will be installed.
g) Cable used for telecommunications outlets shall be 4 pair, 23 (AWG), solid copper conductor, CAT 6, unshielded twisted pair (UTP), UL tested and certified. Each cable shall be dedicated to one device or outlet only and will comply with CAT 6 Ethernet testing standards.
h) Whenever exposed in air circulation/plenum areas, and unless specifically approved in writing to the contrary, only plenum cable may be used. Plenum cable will be used in place of riser cable for situations that require extension cabling between floors.
i) At a minimum, all telecommunications outlets shall provide (2) RJ45 type jacks utilizing American National Standards Institute (ANSI)/Telecommunications Industry Association (TIA) 568-B wiring configuration (See Reference Figures 1 and 2).
j) Telecommunications duplex outlet spacing in office areas shall be based upon one duplex outlet for each 12 linear feet of useable perimeter wall space, or one duplex outlet for each 50 square foot of floor space, whichever provides greater outlet density.
k) Premise wiring will be based on the single-line instrument concept with individual cable running from the wall outlet, uninterrupted to the CER.
l) All wall mounted wall phone jacks shall be 630B, 8 pin, CAT 6, keystone, Jack Type receptacles.
m) All outdoor metallic Twisted Pair (TP) Cable will be filled core type and meet Rural Utility Service (RUS) PE-39 or PE-89 specifications.
n) These are MINIMUM standards. The standards may be deviated from only when the customer need is greater than what is listed in this document, so long as it exceeds the minimum requirement, and when agreed to in advance in writing.

5) Comprehensive requirements for Building Communications Distribution Systems

a) **Entrance Conduit, Duct Banks and Manhole (MH) Systems**

i) All primary backbone conduits shall be installed in locations as determined by the CSO. Conduits shall provide adequate size and quantity to meet current requirements and when economically feasible growth for future use, to preclude future digging to meet emerging requirements.
ii) Whenever new construction or remodeling takes place, the design, installation and all related costs necessary to extend the conduit and manhole system to the new location shall be included in the project in accordance with UFC 3-580-01 Telecommunications Interior Infrastructure Planning and Design. Multiple service entrance locations will be required for all facilities housing command and control systems to provide redundant, survivable service.
iii) A manhole with a minimum of (2) 4” conduit/duct bank lateral system with tracer Max-Cell style inner-duct and pull cord will be used for required service and distribution cables, plus a minimum of 3 pack inner-duct for expansion and maintenance in all primary duct banks.
iv) Manholes shall be installed for all connections to the existing cable plant as required to maintain a maximum manhole spacing of 475 feet. Additional manholes may be required to provide adequate control of connection and distribution of the cable plant. See attached detail sheet (Figure 4) for specific manhole construction criteria.
v) All manholes shall be designed and constructed to meet the requirements of TIA-758-B and provide a clear floor space of 8’x10’ measured inside the manhole. An alternate size of 6’x 8’ may be approved only when no primary backbone cable passes through the manhole (lateral or dead-end service only). All manholes shall provide a clear height of not less than 7' 0". Mandatory items include: grounding bus bar, grounding rod, related conductors and wiring, a ladder or steps, cable rack supports, a 50 Cubic Foot sump (French drain), pull in irons, frame, and a manhole cover cast with the word “COMMUNICATIONS” exposed to the surface. Conduits shall enter the MH’s 4 to 5 feet from the floor on the end and be perpendicular to the wall in approximate location as shown on attached sketch (Figure 4).

vi) Power and communications cables will be separated by 12 inches (30.48cm) of well tamped, fine earth protection. The cable at the top of the crossing, whether power or communications cable, will receive the same additional protection (see item 8 below). Gas and water mains will be separated and protected by 3" of concrete or 12" of fine earth. If the cable crosses over the main, extend additional cable protection 3 feet from each side of the crossing. Where highway and railroad crossings occur, cable at such crossings must be placed in underground metallic conduit. Polyvinyl Chloride (PVC) conduit may be direct buried at road crossings only if 24" of cover is provided. If steel pipe conduit is used, boring procedures will be followed that ensures the protection of existing resources. Where PVC conduits are installed, a metallic #10 AWG copper tracer wire will be installed within the conduit or 6" above the duct bank to assist in future location efforts, with bonding to occur inside each manhole and at CER grounding frame.

vii) Provide 36" minimum cover for all conduit duct banks and 36" minimum cover for laterals measured to top of conduit from finished grade. The 90 CS personnel will provide termination of cable connections in the manhole.

viii) When determined necessary to simplify installations, conduit will be curved to provide gentle sweeps, with a minimum radius of 25 feet, for a total bending radius not to exceed 180 degrees between manholes, hand holes or pull locations. All conduits shall be sloped toward each opposing manhole at a slope of 3" per 100' of run to promote drainage of any accumulated liquids.

ix) Hand holes, when utilized, will be 4'x 4' x 4' inner dimensions and will be provided with a grounding rod, cable rack supports, sump drain pulling irons and cover with the ability to secure using a keyed locking system.

x) Stub up (2) 4" lateral conduits 6" above finished floor level in the corner of the CER adjacent to the ACX plywood back board, continuous from the nearest manhole. Provide one lateral (entrance) conduit with (4) 1" inner-duct from CER to the interconnect manhole location within the existing manhole conduit system for fiber optic cable connection and for future requirements. Building entrance terminals will be provided with 5-pin element, plug in, orange, gas tube protective modules and will provide equal protection to Rural Electrical Association (REA)-PE-80 specifications. Building Entrance Terminals (BET) used for the termination of outside TP cables, 300 pair or less in size, will have a built-in splice chamber with 710 type splice modules. Equipment side (House) of the BET will use 25 pair TELCO type connections to station equipment. BETs of this type will not be stacked more than 3 high. BETs used to terminate cable sizes greater than 300 pair, will be of the 24 AWG stubbed 355 series type blocks with 3BlE type gas protectors and be mounted in a vertical buss arrangement.

b) **Telephone Entrance Cable**

i) All underground exterior service cable will be Gel-Filled, in accordance with REA standard PE-39 and PE-89 and installed from main communications building entrance panel (BEP) to the nearest manhole tie in point or splice case which can provide sufficient vacant pairs to accommodate each facility with currently required circuits and spare pairs, as determined by the CSO.

c) **Communications Equipment Room**

i) A Primary CER (Min. 10' x 10') will be provided for communications equipment needed for termination of the building's interior wiring systems and to interface the local service equipment with the exterior base cable system. Adequate installation and maintenance space in a central location within the building must be provided to allow the total distance, measured along the routing path of the premise cable (CAT 6), to not exceed 100 Meters (see Figure 5). In addition, environmental control typical to an office environment shall be included. Power installed on the communications rack shall be included to support communications equipment and any necessary cable entry requirements (dedicated, two-gang, 20 amp, 4 outlets). Racks for CER's will be 2 post, 72", 45 rack unit (RU), metallic racks secured to the floor with

1/2" lag screws/concrete anchors. All racks will be secured at the top to ladder rack that extends across the CER to intersect where the incoming cabling enters the CER (Figure 5). Ladder rack will be secured to a minimum of 2 walls and each section will be grounded in accordance with ANSI/TIA 607 and the National Electrical Code. CER racks will be grounded separately with 6 GA. stranded and insulated (green) grounding cable that terminates to the grounding bus-bar within the CER. No other building support equipment, including mechanical equipment, gas lines, plumbing equipment, electrical panels, etc. will be placed in the CER unless approved by the 90 CS/CC. A moisture resistant plywood panel (4'x8') will be installed using ACX plywood mounted with smooth side out in all CERs.

ii) Special attention will be given to the space allocation required for placement of classified systems in accordance with applicable publications to ensure security countermeasures are met. All CERs will be secured with a lockable door keyed to the 90CS master CER key.

iii) Secondary CERs: A room, (Min. 10' x 10') will be provided with the same specifications as required for Primary CERs (See Figure 5) and will be so located that the total distance, measured along the routing path of the premise cable (CAT 6), will not exceed 100 Meters. This will maintain the integrity of the digital data signal as stipulated by CAT 6 wiring requirements. Where multiple CERs are required, attention will be given to their strategic placement to support inter-connection via 4" conduits or 6"x 2" cable trays between each CER, expressly for use in extending cabling from the main CER to any and all Secondary CER's. Cable tray may be used for extensible wiring to connect CERs provided it is a minimum of 6" wide by 2" deep and installed above the ceiling. The cable tray will be supported by proper independent support structures, using the most direct route between the secondary CER and the primary CER.

iv) Where it is necessary to interconnect a secondary CER to the primary CER, not less than 4-strand Multi Mode fiber optical cable will be used. Plenum inner-duct (1") will be installed inside the 4" conduit or conduit raceway, with pull cord as a dedicated direct path between each secondary CER and the primary CER. For telephone interconnection, provide not less than CAT 3, 24 AWG copper wire cable between the secondary and primary CER, of adequate quantity (Min. 25 pair) to provide connectivity for all voice circuits located within the CER and to accommodate data grade services (fax and modems) and phone connections.

v) CAT 6 cable connectivity from the communications jacks to the CER will be provided through ¾" (min) conduit using the most direct route available and complete with pull cords.

vi) Cable trays may be used to connect cable paths for rooms provided they are a minimum of 6" wide by 2" deep and installed above the ceiling. Where cable trays are used instead of home-run conduit, conduits will be extended to the cable tray and secured. The cable tray will run above the ceiling, supported by proper independent support structures, using the most direct route between the secondary CER and the primary CER. Conduit fill will not exceed the 40% rule as stipulated in the National Electrical Code (NFPA 70).

vii) Type 630B-8, CAT 6, Keystone, wall jacks will be provided for wall mounted telephones in the CER and secondary CER's mounted 60" to the top of the jack faceplate above the finished floor.

viii) Secured interior and exterior access to CERs should be provided to allow 24-hour access. Locking doorknobs shall be utilized with L4 keyways, locks keyed alike, to match the 90 CS Master Key System.

ix) Environmental controls will be provided in all CERs equal to that maintained throughout the building with a constant temperature of not less than 64 degrees For greater than 81 degrees ..

x) Telephone Service cables shall be punched down utilizing one service pair, to correspond to the **White-Blue/Blue** pair for each port on a dedicated telephone service patch panel in new installations. This will result in the first binding post correlating to the first patch panel port, the second to the second, etc.

xi) Two-gang 110 VAC power outlets on a dedicated 20 Amp circuit with isolated ground, will be provided on each wall in each CER. A Four-gang 110 VAC power outlet on a dedicated 20 amp circuit with isolated ground will be installed on each rack (within the bottom 12" of the rack) for use in powering government furnished equipment only. Switched lighting will be provided in all CER areas, adequate to promote work

with small fiber items and miniature lettering devices and will maintain 12" Min. Clearance between Fluorescent (ballasted) light fixtures and all cable runs and cable devices.

xii) Ground all devices, cable sheaths, protectors and other equipment in accordance with ANSI/TIA 607 and the National Electrical Code.

xiii) Base Cable shop personnel (unless otherwise specified) will terminate copper entrance cable inside the CER to Building Entrance Terminals (BET) in accordance with manufacturer's instructions and NEC. BETs will include 5-pin element, plug in orange gas tube protective modules, one per pair, and will provide equal protection to REA-PE-80 specifications. BETs used for the termination of outside Twisted Pair (TP) cables, 300 pair or less in size, will have a built-in splice chamber with 710 type splice modules. Equipment side (House) of the BET will use 25 pair TELCO type connections to station equipment. BETs of this type will not be stacked more than 3 high.

xiv) Fiber will be terminated by Base Cable shop (unless otherwise specified) to the Fiber Optic Distribution Panels (FODP) located on the rack (see Figure 3).

d) **Wiring and Termination**

i) Telephone service lines will be extended from the Main CER to all other CERs using a dedicated 66 or 110 type termination block that will be mounted to the backboard in the main CER and have the distant end terminated on a CAT 6 Patch panel located at the top of the 19" rack in the respective CER. An additional 60" of cable should be kept on either side of the cable run to accommodate an appropriate maintenance loop. Any required terminal blocks, BETs, and grounding buses will be mounted on the fire retardant coated, ¾" ACX plywood backboard (4'x8') mounted with smooth side out located in all CERs. They will not be located on any other surfaces located in the CER to include other backboards installed for separate and express purposes. Pairing and color-coding will be in accordance with ANSI/TIA 568-B standards (see Figures 1 & 2).

ii) CAT 6 premise wiring will be terminated in a 110 style, 19", rack mounted, CAT 6 patch panel, located in the CER, situated in a central location within the building (see Figure 6). If the premise cabling distance exceeds a total of 100 meters (including the maintenance loop at both ends), a secondary CER will need to be established. The secondary CER will have the same specifications as a Main CER and provisions will be made to interconnect each secondary CER to the primary CER for service cabling via 4" conduit, cable tray or inner-duct. Each jack on a duplex outlet shall be terminated on the same patch panel in consecutive order (White first, then Blue corresponding to port 1, 2 or 3, 4 or 5, 6, etc.).

iii) Consideration of total footage should include 18" for a maintenance loop at the jack and 60" for a maintenance loop in the CER when running CAT 6 cabling.

iv) Distribution frames, racks, cabinets, cable trays, and interior conduits shall be of sufficient size to allow for future expansion and not exceed the 40% fill rule stipulated in the National Electrical Code (NFPA 70).

v) All installation teams are responsible for the following:

(1) Cabling installers will perform all interior pre-wiring to include the primary CER and secondary CERs, with cross connects to the primary CER.

(2) Premise wiring for telephones (VOICE) and high-speed networking (LAN), will be UTP, CMP, CAT 6 cable, 23 AWG and will be Integrated Services Digital Network (ISDN) compatible. Wireless Access Points will also be CAT 6. Premise wiring will be installed by a CAT 6 certified installation team. All installations require compliance with EIA/TIA and the Institute of Electrical and Electronic Engineers (IEEE) standard 802.3 for baseband systems and any further stipulations mentioned in this document. VOICE cable jacket shall be White in color. LAN cable jacket shall be Blue in color. If Classified is necessary, cable jacket will be Red in color. Blue will be utilized in unclassified processing environments. Red will be utilized for classified processing environments. Multi-Mode 62.5 Fiber optic cable (orange) shall be installed and tested between all CER locations to support high speed multiplexing and be terminated in a properly sized Fiber Optic Distribution Panel (FODP) using

cassette type LC terminations mounted in the rack below all other patch panels and LAN Switches (unless otherwise specified) with room for future expansion.

(3) The 90 CS personnel may terminate the cross connect for the interior blocks, but only when agreed to in advance in writing. Testing, inspection, and documentation of all cable pairs is required by the installation team. If any deficiencies are discovered upon testing, the installer will make all corrective actions to bring deficiencies up to compliance with installation standards.

(4) The 90 CS personnel will install user systems, complete cross connects to user systems, and verify user systems operationally prior to occupancy by any tenants.

vi) Areas with equipment or construction items which can be easily moved, such as pre-wired workstations, building furniture and modular walls/offices, will be separately pre-wired by the installer and will provide sufficient flexibility to enable rearrangement without modifications to the permanent premise wiring system in the facility. Adequate quantities of suitable connectors and extension cables will be provided by the installer; permanent splices/connections to easily moved items **will not** be made. Permanent infrastructure will be mounted in the building wall and pigtails extended to the furniture, workstation, or modular walls.

vii) When installing CAT 6 in buildings with existing cabling, Plenum jacketed cables will be used where allowed by National building codes without the noted conduits, if properly supported (Min 2" wide nylon straps).

e) **Telecommunications Outlets**

i) In general office areas, a duplex modular telecommunications outlet plate, with 2 each RJ-45 type jacks, 1 for voice and 1 for LAN, will be provided approximately every 12' around the usable room perimeter, or for each 50 Square feet of net floor area, whichever provides greater outlet density. All wall outlet components will be certified as CAT 6 and jacks will be RJ-45 type wall jacks with a removable front bezel that is color coded with molded labeling to identify the outlet usage (see Figure 1). Planning will include areas that require greater port density than specified in this section as this is only the minimum standard.

ii) Where modular furniture is to be installed, duplex outlet jacks will be installed in each work area and in each area identified by the customer as an administrative area requiring communications connections. All permanent CAT 6 wiring will be installed on the permanent walls of the room and patch cords will be used to extend from the wall to or through any modular furniture. All duplex outlet jacks will be wired with 4 pairs (8 conductors) according to the wiring diagram for 568-B by the contractor (see Figures 1 & 6).

iii) Telecommunications outlets will be mounted 18" above the floor, to the top of the cover plate, unless noted otherwise.

iv) Wireless Access Points will be CAT 6 and wired above the ceiling level if possible.

f) **Grounding**

i) All equipment will be grounded in accordance with applicable publications listed in Attachment 2 of this TIC guide.

g) **Periodic, Final Inspections, Testing and Documentation**

i) All telecommunications cable will be certified and tested in accordance with ANSI/TIA standards and a copy of the results provided to the 90 CS using common electronic software (i.e. PDF, Word etc.). Where deficiencies of any type are discovered upon testing, the installer will make all corrective actions to bring deficiencies up to compliance with ANSI EIA/TIA cable specific installation standards.

ii) Revised drawings which reflect actual "AS-BUILT" conditions will be maintained throughout the construction phases and a final copy will be submitted to the 90 CS with the cable certification records

upon completion of the work, but prior to final acceptance of the work. This allows 90 CS to perform final review of drawings and inspect installation.

iii) Installation records will be provided to the 90 CS prior to final project acceptance. The drawings will show Primary and Secondary CERs, rack/cabinet location, cross-connect and termination points for each service cable pair/strand, locations and identification number for each modular outlet, and the location and value of each line amplifier and multi-port device throughout the cable system. Approximate cable routing will also be shown. Common electronic software copies of installation records will be provided.

iv) During construction, in-progress inspections by 90 CS personnel are required. For example, trenches will not be covered without an in-progress inspection to verify conduit size and quantity, cable type, earth cover compliance, and accuracy of "red line" base cable records or contract drawings. The installation activity/contractor is solely responsible for requesting in progress inspections before backfilling, installation of drywall, after installation of conduit or ladder rack, installation of grounds/racks/cabinets, etc.

v) All installed cable (fiber and copper) will be tested, corrected, and retested by the installer and baseline test records provided to the CSO using common electronic software. All CAT 6 cable will be tested and certified to ANSI/TIA standards. UL testing standard for new cable, including fiber optic testing of single-mode and multi-mode cable will be accomplished (UL standards for CAT 6 cable are attached at figure 7).

h) **Cable Trays**

i) Typical cable tray types for cable installation guide include telco-type cable ladder racks, center spine cable tray, or wire basket tray. Cable trays will be installed for continuous cable support IAW ANSI/TIA-569-D and ANSI/TIA-PN-942-B. All new installations or full rewires of a building will utilize cable tray or conduit. For additions to existing or expansions of building communications wiring where cable trays cannot be utilized, 2” Nylon Straps may be used with a maximum spacing of 4’ to not exceed cabling capacity.

i) **Sealing Ducts**

i) All ducts, vacant or occupied, will be sealed with fire rated material. Sealing is the operation of plugging or closing the ends of the duct run in accordance with 31W3-10-21.

j) **Labeling**

i) Each cabinet or rack shall be labeled on the front and rear in plain view. Preferred locations for labels are the top and bottom on a permanent part of the cabinet or rack in accordance with ANSI/TIA 606-C (see Figure 10).

ii) Labeling of Patch Panels shall be alphabetic and run consecutively, starting at the top of the rack with the letter “A” for the first patch panel and the letter B for the second and so on. Each patch panel installed in the rack will get a label regardless of usage (Horizontal Cable Organizers, switches, FODP, and UPS are not to be labelled).

iii) All ports on patch panels should already be factory labeled with a port number. Additionally, all positions on termination blocks (if used) shall be labeled with the corresponding port number or position number and optionally with additional identifier fields as practical in accordance with ANSI/TIA 606-C.

iv) To clearly identify cables and their usage, each cable will be marked with a self-adhesive strip marker at both ends which will clearly identify their patch panel/port designation. A permanent label to identify all cable and terminations will be affixed to the cable and outlet jack cover to preclude damage/loss due to age or other mechanical means. Handwritten or manually embossed labels are not permitted. Automated embossed labels will be used, such as Brothers P-touch systems utilizing 1/4-inch labels, with 1/8-inch lettering.

v) All duplex outlet cover plates shall be labelled in the top labelling window by CER #/Rack #/Patch Panel letter/Port # (ex. Rm. 132/1/A/1&2) Wiring Identification Standard. All Quad-Plex outlet cover plates shall be labelled top and bottom with the top label identifying the top 2 jacks and the bottom label identifying the bottom 2 jacks. If a 6-port outlet cover plate is utilized, the top label will reflect the left 3 jacks and the bottom label will reflect the right 3 jacks.

k) **Color-Coding identification**

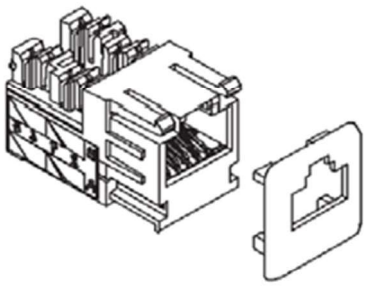
i) Color-coding of cables, connectors, cords, jumpers, termination fields, labels, pathways, and other components may be used to identify the type, application, function, or position of a component within the infrastructure in accordance with ANSI/TIA 606-C (see Figure 9).

Approving official:

MICKELSEN.JEFFREY.L.1272700156 Digitally signed by MICKELSEN.JEFFREY.L.1272700156 Date: 2022.08.16 13:43:07 -06'00'

JEFFREY L. MICKELSEN, Lt Col, USAF
Commander, 90th Communications Squadron

FIGURE 1
NOT TO SCALE

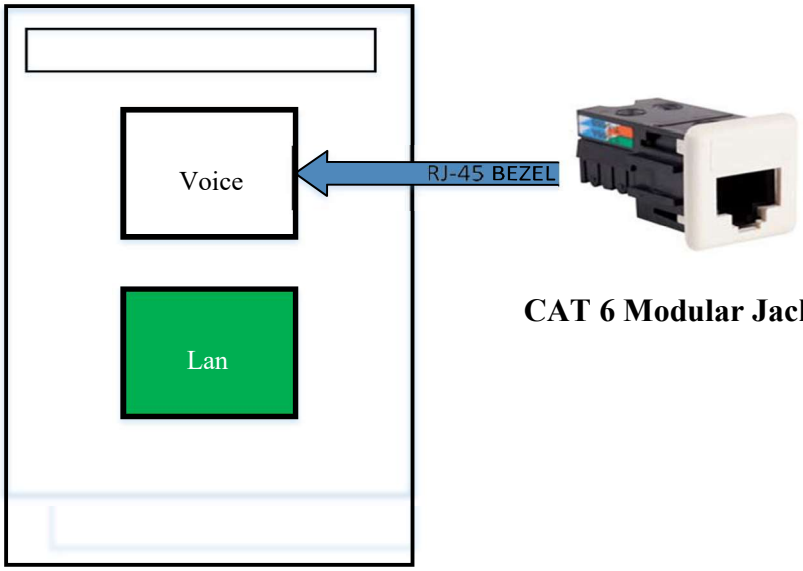


Jack Assembly Detail

CAT 6 Modular Jack

568 B Wiring Pattern

BEZEL COLOR CODING
VOICE = WHITE
LAN = GREEN

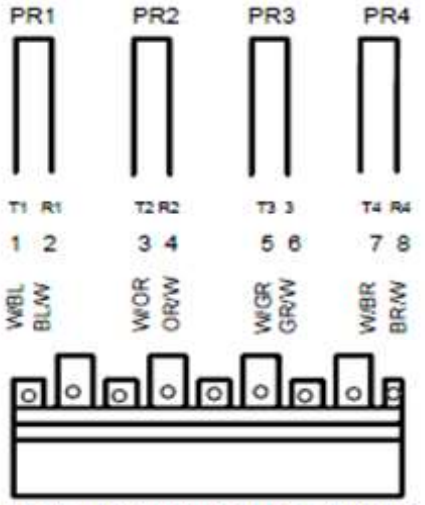


CAT 6 Modular Jack

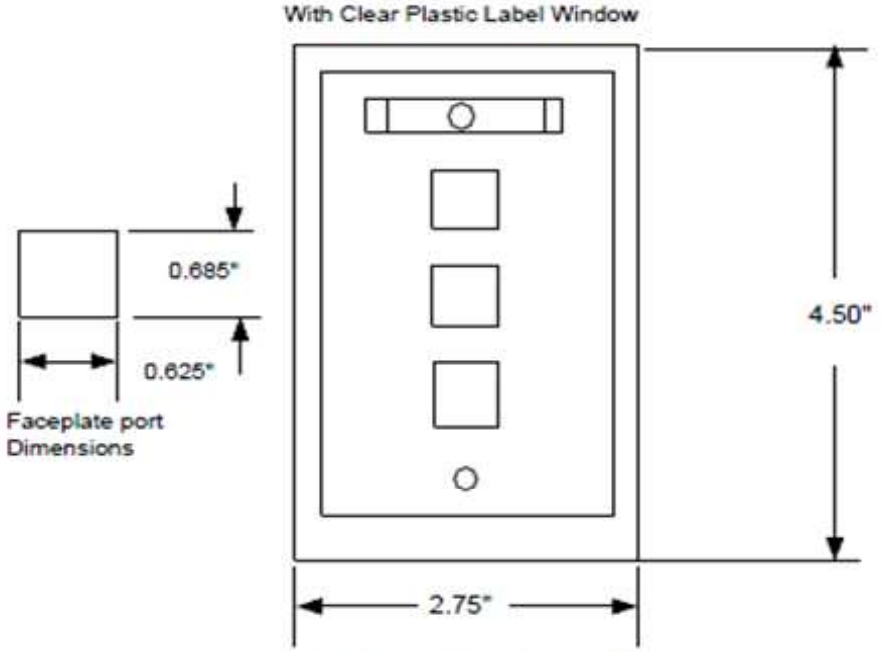
Duplex Single Gang Outlet
RJ45 Telecommunications Outlet

INFORMATION OUTLET WALL PLATE DETAIL

FIGURE 2
Not To Scale

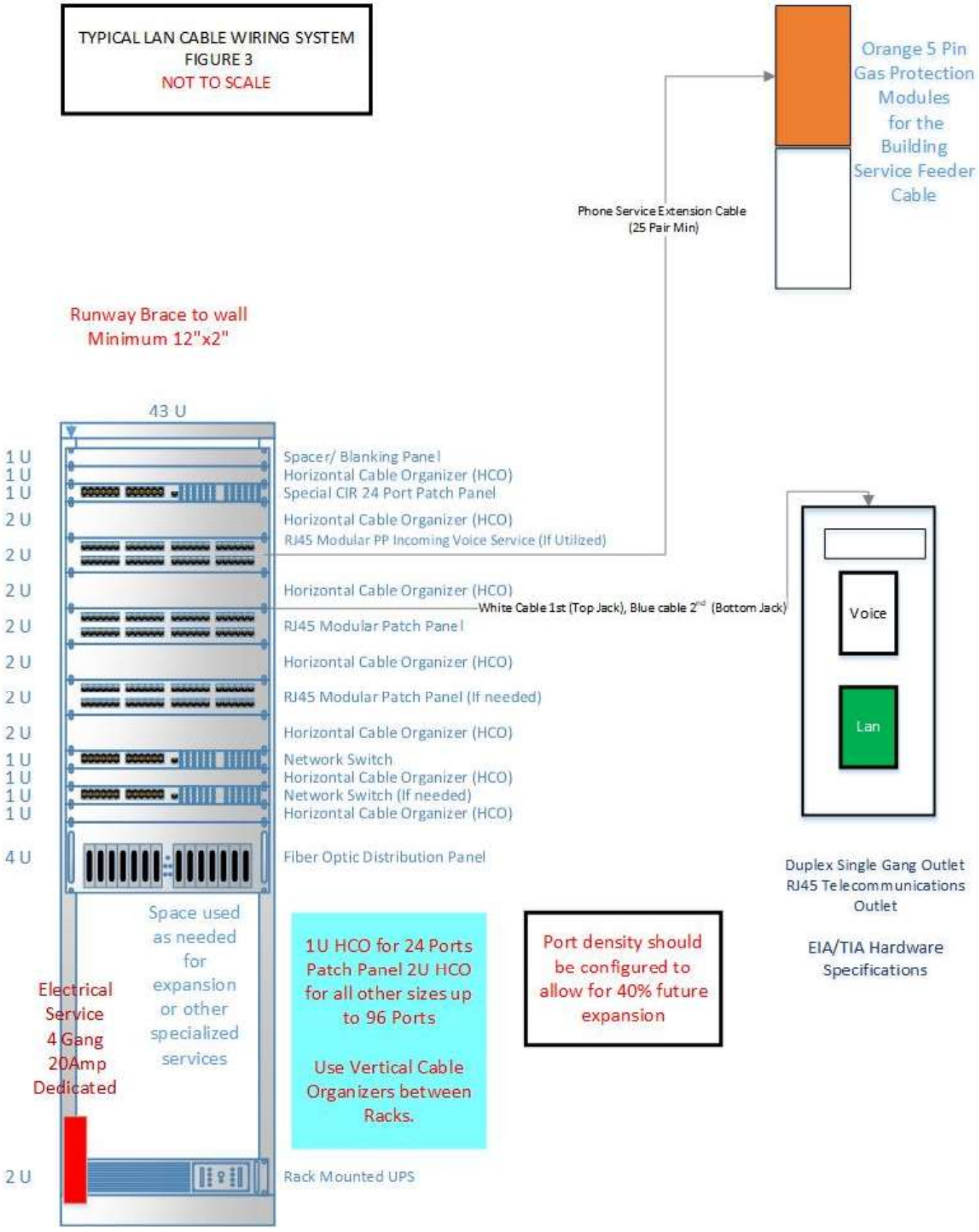


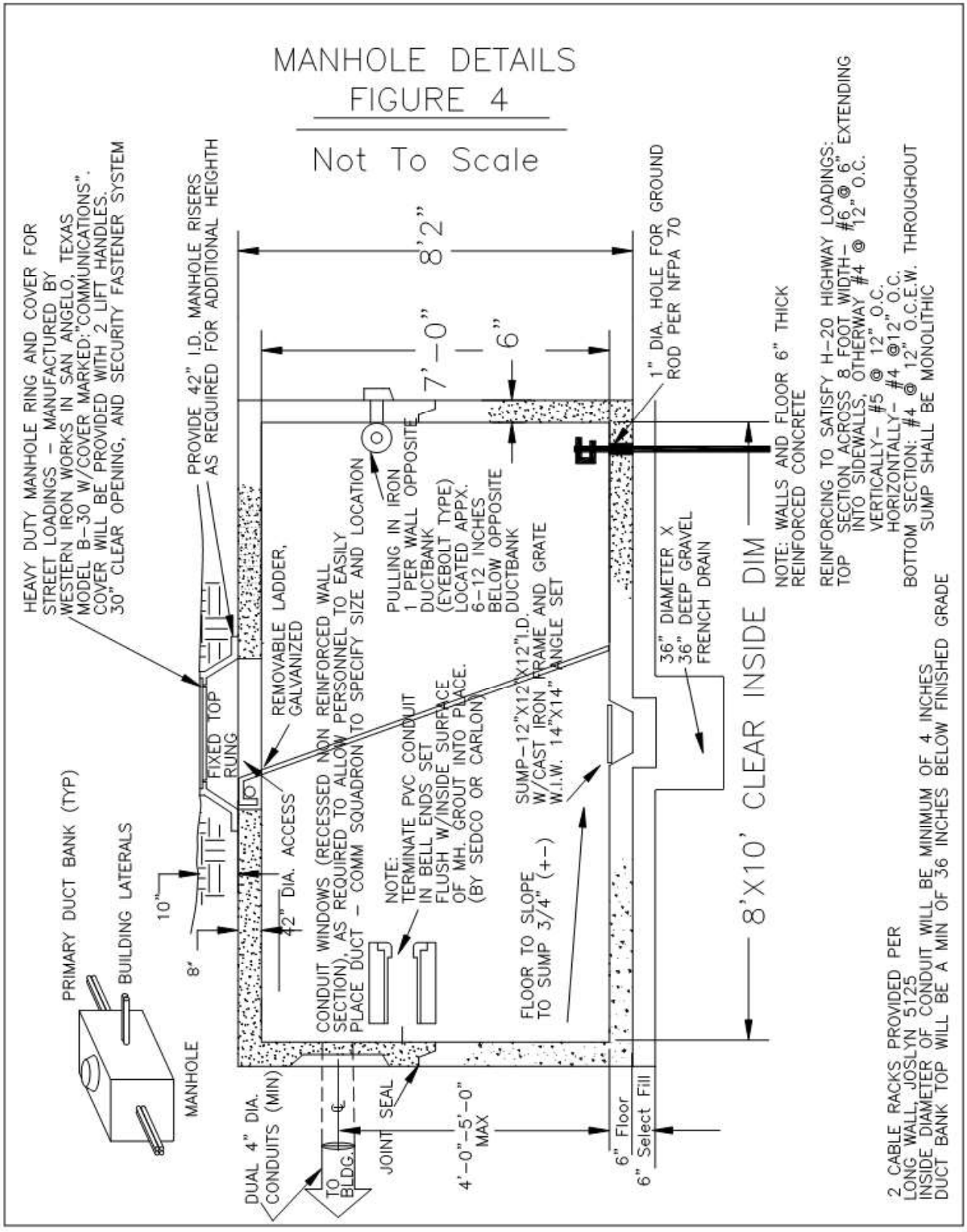
568B-110 CONNECTION WIRING PATTERN



Standard Three Gang Wall Plate
(Single and Dual Outlet Plate Similar)
INFORMATION OUTLET WALL PLATE DETAIL

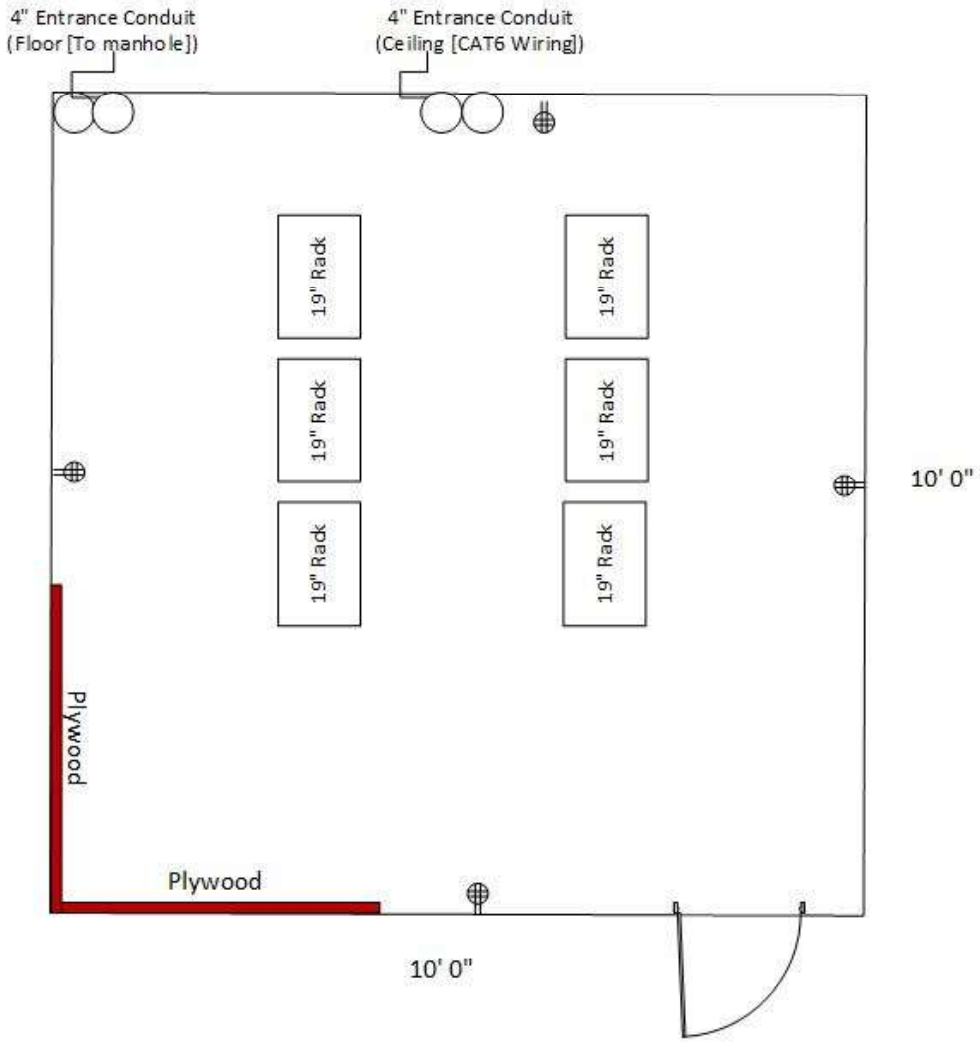
All Category 6 Patch Panels shall have 110 interface On Back Side
Panel width shall be as required to fit Standard 19" Equipment racks
48 PATCH PANEL DETAIL


TYPICAL LAN CABLE WIRING SYSTEM
FIGURE 3
NOT TO SCALE
Orange 5 Pin Gas Protection Modules for the Building Service Feeder Cable
Phone Service Extension Cable (25 Pair Min)
Runway Brace to wall Minimum 12"x2"
43 U
1 U Spacer/ Blanking Panel
1 U Horizontal Cable Organizer (HCO)
1 U Special CIR 24 Port Patch Panel
2 U Horizontal Cable Organizer (HCO)
2 U RJ45 Modular PP Incoming Voice Service (If Utilized)
2 U Horizontal Cable Organizer (HCO)
White Cable 1st (Top Jack), Blue cable 2nd (Bottom Jack)
2 U RJ45 Modular Patch Panel
2 U Horizontal Cable Organizer (HCO)
2 U RJ45 Modular Patch Panel (If needed)
2 U Horizontal Cable Organizer (HCO)
1 U Network Switch
1 U Horizontal Cable Organizer (HCO)
1 U Network Switch (If needed)
1 U Horizontal Cable Organizer (HCO)
4 U Fiber Optic Distribution Panel
Space used as needed for expansion or other specialized services
Electrical Service 4 Gang 20Amp Dedicated
2 U Rack Mounted UPS
1U HCO for 24 Ports Patch Panel 2U HCO for all other sizes up to 96 Ports
Use Vertical Cable Organizers between Racks.
Port density should be configured to allow for 40% future expansion
Voice
Lan
Duplex Single Gang Outlet RJ45 Telecommunications Outlet
EIA/TIA Hardware Specifications


MANHOLE DETAILS
FIGURE 4
Not To Scale
HEAVY DUTY MANHOLE RING AND COVER FOR STREET LOADINGS – MANUFACTURED BY WESTERN IRON WORKS IN SAN ANGELO, TEXAS MODEL B–30 W/COVER MARKED:"COMMUNICATIONS". COVER WILL BE PROVIDED WITH 2 LIFT HANDLES. 30" CLEAR OPENING, AND SECURITY FASTENER SYSTEM
PROVIDE 42" I.D. MANHOLE RISERS AS REQUIRED FOR ADDITIONAL HEIGHTH
8'2"
7'–0"
6"
1" DIA. HOLE FOR GROUND ROD PER NFPA 70
PULLING IN IRON 1 PER WALL OPPOSITE DUCTBANK (EYEBOLT TYPE) LOCATED APPX. 6–12 INCHES BELOW OPPOSITE DUCTBANK
REMOVABLE LADDER, GALVANIZED
FIXED TOP RUNG
42" DIA. ACCESS
CONDUIT WINDOWS (RECESSED NON REINFORCED WALL SECTION), AS REQUIRED TO ALLOW PERSONNEL TO EASILY PLACE DUCT – COMM SQUADRON TO SPECIFY SIZE AND LOCATION
NOTE: TERMINATE PVC CONDUIT IN BELL ENDS SET FLUSH W/INSIDE SURFACE OF MH. GROUT INTO PLACE. (BY SEDCO OR CARLON)
SUMP–12"X12"X12"I.D. W/CAST IRON FRAME AND GRATE W.I.W. 14"X14" ANGLE SET
FLOOR TO SLOPE TO SUMP 3/4" (+–)
36" DIAMETER X 36" DEEP GRAVEL FRENCH DRAIN
8'X10' CLEAR INSIDE DIM
NOTE: WALLS AND FLOOR 6" THICK REINFORCED CONCRETE
REINFORCING TO SATISFY H–20 HIGHWAY LOADINGS:
TOP SECTION ACROSS 8 FOOT WIDTH– #6 @ 6" EXTENDING INTO SIDEWALLS, OTHERWAY #4 @ 12" O.C.
VERTICALLY– #5 @ 12" O.C.
HORIZONTALLY– #4 @12" O.C.
BOTTOM SECTION: #4 @ 12" O.C.E.W. THROUGHOUT SUMP SHALL BE MONOLITHIC
2 CABLE RACKS PROVIDED PER LONG WALL, JOSLYN 5125
INSIDE DIAMETER OF CONDUIT WILL BE MINIMUM OF 4 INCHES
DUCT BANK TOP WILL BE A MIN OF 36 INCHES BELOW FINISHED GRADE
PRIMARY DUCT BANK (TYP)
BUILDING LATERALS
10"
8'
MANHOLE
DUAL 4" DIA. CONDUITS (MIN)
TO BLDG.
JOINT SEAL
4'–0"–5'–0" MAX
6" Floor
6" Select Fill

Sample CER

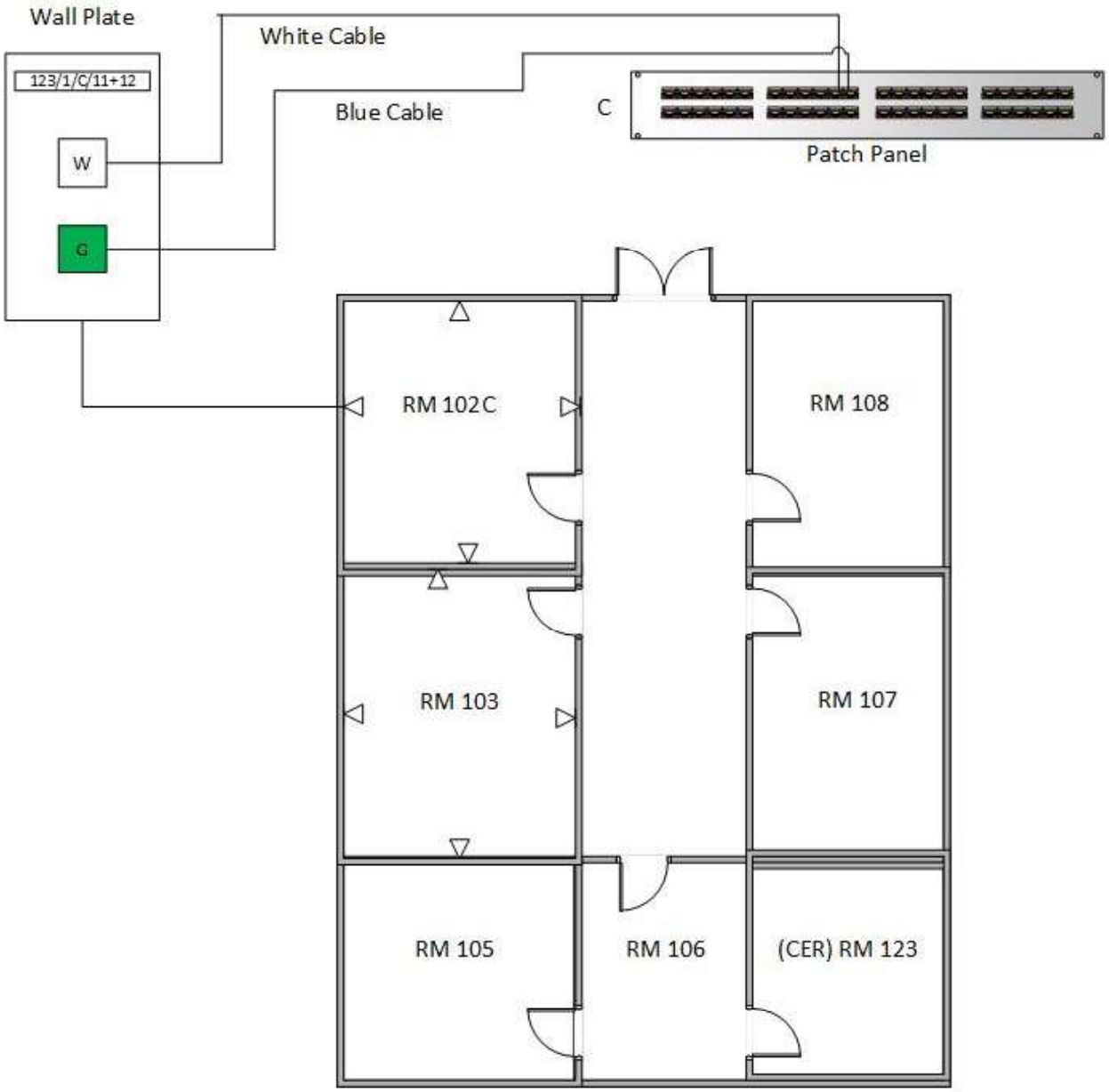
Figure 5



Communications Equipment Room (CER)

1. CER shall be 10'0" x 10'0" minimum.
2. Floor shall be hard surfaced and moisture resistant.
3. A fourplex, 110v, 20 amp, dedicated outlet provided on each wall of the CER and each rack installed.
4. CER shall be provisioned with environmentally controlled temperature and lighting as required for office space
5. CER access shall be lockable with access limited to 90CS personnel.
6. Grounding and bonding shall comply with EIA 607/NFPA 70.
7. An approved building ground shall be extended to the CER and attached to a ground bus that is affixed to the plywood backboard.
8. Documentation of installations shall comply with EIA 606.
9. Plywood for backboards shall be 4'x8'x ¾" ACX, fire retardant treated, vertically mounted, and attached to the wall. No vertical conduits in this area.
10. Provide 1 (More if needed) EIA/TIA standard 19", 45U, 2-Post rack mounted to the floor and grounded. (Picture above show maximum number of racks for a 10' x 10' CER). Refer to figure 3 for rack configuration and population.
11. All 2-Post racks shall be connected at the top to 2" x 12" Ladder Rack cable tray. Ladder Rack cable tray shall be mounted to a wall at both ends and be oriented near CAT6 entrance conduit.
12. 2-Post racks shall have a minimum side clearance of 18" and a minimum back clearance of 36" from any wall. Racks may be mounted within 5" of each other (Enough space for a Vertical Cable organizer to be mounted between them).

Sample Cable Numbering Plan
FIGURE 6



Sample Floor Plan

Mark each cable at each end for cable identification. Label each faceplate with the CER Number, Rack Number, Patch Panel Letter, and Port Number(s): (123/1/C/11+12). Jacks installed on the same faceplate will be punched down and numbered consecutively on the patch panel (11+12). White cable will terminate on a faceplate using a modular jack with a removable white bezel; blue cable on a modular jack with a removable green bezel. Post the drawing with the identification of outlets and room numbers in the CER upon completion.

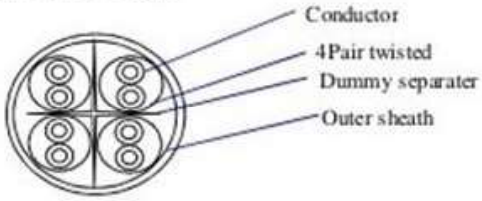
FIGURE 7

TIA Cat 6 Channel

Wire Map	Res.	Length	Prop. Delay	Delay Skew	Freq.	Insertion Loss	NEXT	RL	ACR-N	ACR-F	PS NEXT	PS ACR-N	PS ACR-F
	Ω	Max.	nS	nS	MHz	dB	dB	dB	dB	dB	dB	dB	dB
12345678	i	100 m	555	50	1	3	65.0	19.0	62.0	63.3	62.0	59.0	60.3
12345678					4	4	63.0	19.0	59.0	51.2	60.5	56.5	48.2
					8	5.7	58.2	19.0	52.5	45.2	55.6	49.9	42.2
12345678S					10	6.3	56.6	19.0	50.2	43.3	54.0	47.7	40.3
12345678S					16	8	53.2	18.0	45.2	39.2	50.6	42.6	36.2
					20	9	51.6	17.5	42.6	37.2	49.0	39.9	34.2
					25	10.1	50.0	17.0	39.9	35.3	47.3	37.2	32.3
					31.25	11.4	48.4	16.5	37.0	33.4	45.7	34.3	30.4
					62.5	16.5	43.4	14.0	26.9	27.3	40.6	24.1	24.3
					100	21.3	39.9	12.0	18.6	23.3	37.1	15.8	20.3
					200	31.5	34.8	9.0	3.3	17.2	31.9	0.3	14.2
					250	35.9	33.1	8.0	-2.8	15.3	30.2	-5.8	12.3

DATA SHEET

Cat-6 UTP 23AWG 4Pair Cable



Sr. No.	Parameter	Unit	Specified Value
1	Conductor		
1.1	Material		Annealed Bare Copper
1.2	No. of Strands	nos	1
1.3	Conductor diameter	mm(nom)	0.56 +/- 0.02
1.4	Cross sectional area	AWG	23 AWG
2	Insulation		Halogen Free low capacitance Polyolefin
2.1	Insulation Colr		Wire 1 / Wire 2
			White/Blue / Blue
			White/Orange / Orange
			White/Green / Green
			White/Brown / Brown
3	Inner Sheath		
3.1	Material		PVC
3.2	Thickness	mm (approx)	0.6
3.3	Diameter	mm (nom)	6
3.4	Color		Grey
4	Printing		Mfr Name, Cat-6 UTP Cable 23 AWG Date Lot
4.1	Marking distance		at every one meter
5	Electrical tests		
5.1	Conductor resistance at 20deg C	Ohm/km	93.8(max)
5.2	DC Resistance unbalanced	%	2.5
5.3	High Voltage	kV	1.2 kV for 1 minutes
5.4	Impedance	Ohm	100 +/- 5
5.5	Insulaton Resistance	Gohm/km	5
5.6	Mutual Capacitance at 1000 Hz	nF/km	56
5.7	Delay Skew	ns	44
5.8	Operating temperature	deg C	-20 to +70

Figure 8 – Example of termination field color-coding

Termination Type	Color	Pantone #	Typical Application
Demarcation Point	Orange	150C	Central office connection
Network Connection	Green	353C	User side of central office connection
Common Equipment	Purple	264C	Connection to PBX, mainframe computer, LAN, multiplexer
Cabling Subsystem 1	Blue	291C	Terminations of Cabling Subsystem 1 cable in TS's
Cabling Subsystem 2	Gray	422C	Terminations of Cabling Subsystem 2 cable connecting IC to HC's
Cabling Subsystem 3	White	-	Terminations of Cabling Subsystem 3 cable connecting MC to IC's
Cabling Subsystem 4	Red	-	Terminations of Cabling Subsystem 4 cable (High-Side)
Campus Cabling	Brown	465C	Terminations of campus cable between buildings
Miscellaneous	Yellow	101C	Alarms, security, or energy management

Figure 9 – Example of color-coding termination fields

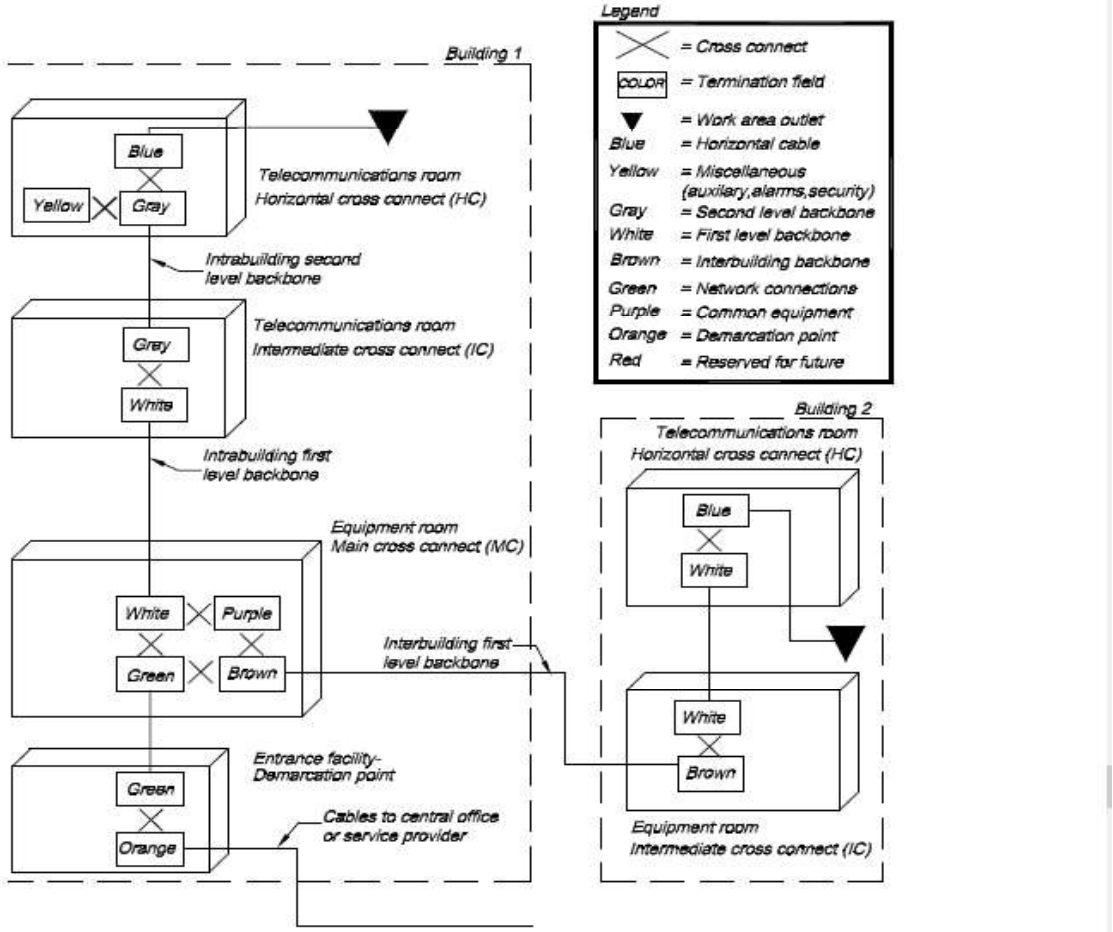
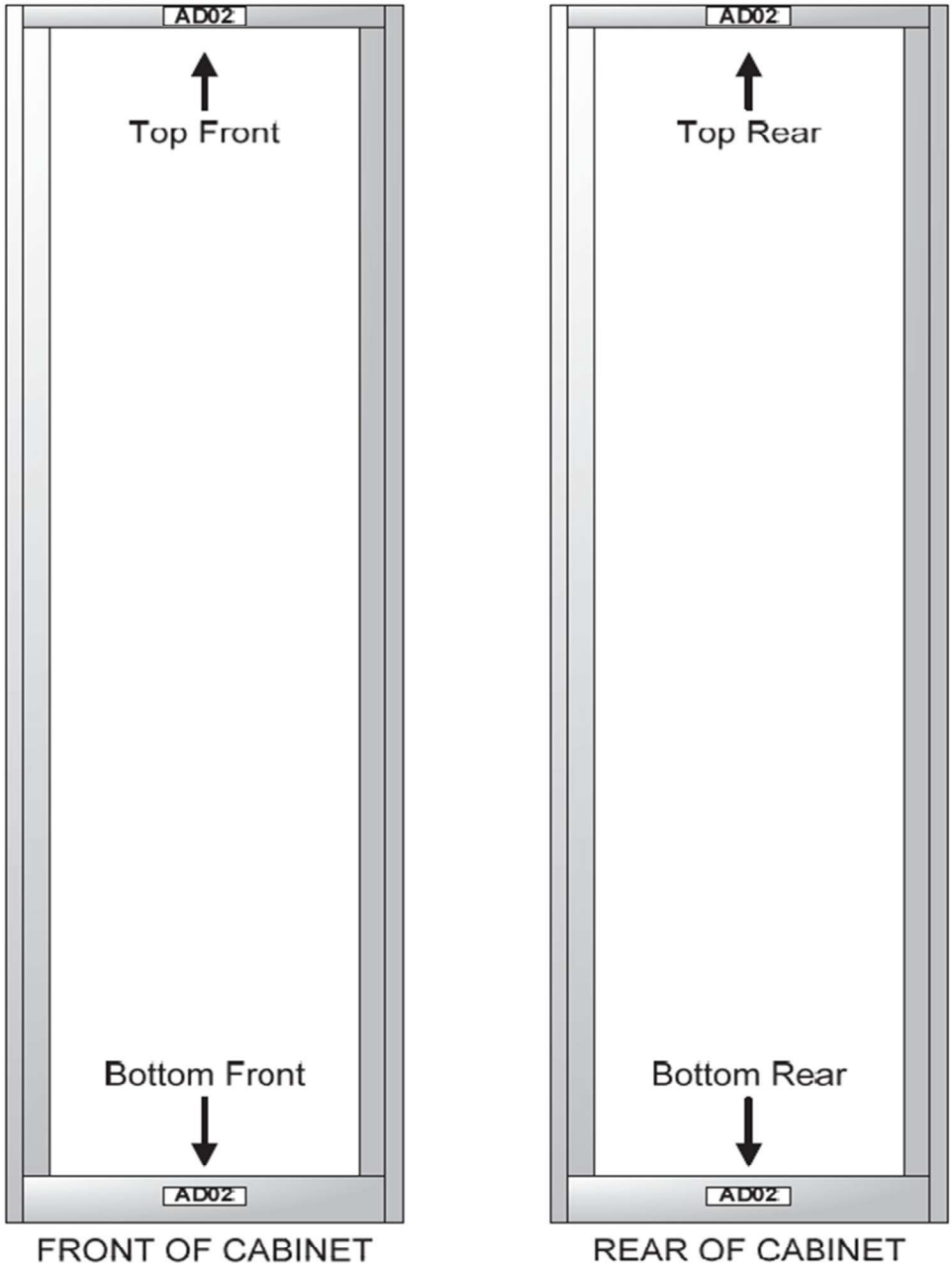


Figure 10 – Sample rack and cabinet labeling



ATTACHMENT 1
Acronyms

AFNIC	Air Force Network Integration Center
AFI	Air Force Instructions
ANSI	American National Standard Institute
AWG	American Wire Gauge
BCE	Base Civil Engineering
BITSEP	Base Information Transport System – Engineer Planning
CER	Communications Electronic Room
CS	Communication Squadron
CSO	Communications-Computer Systems Officer
DOD	Department of Defense
EBN	End Building Node
FEWAFB	Francis E. Warren Air Force Base
FODP	Fiber Optic Distribution Panel
IEEE	International Electrical and Electronics Engineers Association
ISDN	Integrated Services Digital Network
ITN	Information Transfer Node
LAN	Local Area Network
Mbps	Megabits per second
MH	Manhole
MHz	Megahertz
MIL-HDBK	Military Handbook
MM	Multi-Mode
MPTO	Methods and Procedures Technical Order
MW	Missile Wing
NAF	Non-Appropriated Funds
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
OPR	Office of Primary Responsibility
O&M	Operations and Maintenance
PVC	Polyvinyl Chloride
REA	Rural Electrical Association
RUS	Rural Utility Service
SM	Single Mode
SOW	Statement of Work
TIA	Telecommunication Industry Association
TIC	Telecommunication Installation Criteria
T.O.	Technical Order
TP	Twisted Pair
UFC	Unified Facility Criteria
UL	Underwriter's Laboratories
USAF	United States Air Force
UTP	Unshielded Twisted Pair

ATTACHMENT 2
Reference Documents

The following documents are referenced within this document or are hereby recognized as a standard of good practice to be followed during the performance of all work.

National Fire Protection Association	**NFPA 70** *National Electrical Code*
Underwriter's Laboratories	*UL Standards for CAT 6 UTP Wire*
Rural Utility Service	**PE-39** *Specifications for Filled Telephone Cable*
	PE-80 *Specifications for Gas Tube Surge Arrestors*
	PE-89 *Specifications for Filled Telephone Cable with Expanded Insulation*
National Electrical Manufacturer's Association	**NEMA**
Air Force Documents	**AFR 88-15** *Criteria for AF Construction*
	AF TB 95-03 *Cabling and Distribution Systems*
	AFSSI 7010 *Emission Security Assessment*
	AFSSM 7011 *Emission Security Countermeasures* Review
	UFC 3-580-01 *Telecommunications Interior Infrastructure Planning and Design*
	MIL-HDBK-419A (Vol. 1 & 2) *Grounding, Bonding, and Shielding for Electronic Equipment and Facilities*
	MIL-STD-188-124B --- Grounding, Bonding and Shielding for Common Long Haul/Tactical Communications Systems Including Ground Based Communications-Electronics Facilities and Equipment
	FAA-STD-019 REV E --- Lighting and Surge Protection, Grounding, Bonding, and Shielding Requirements for Facilities and Electronic Equipment
	UL467 --- Grounding & Bonding Equipment
ANSI/TIA Standards	**ANSI/TIA-526-7-A** Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, Adoption of IEC 61280-4-2 edition 2: Fiber-Optic Communications Subsystem Test Procedures – Part 4-2: Installed Cable Plant – Single-Mode Attenuation and Optical Return Loss Measurement
	ANSI/TIA-526-14-C Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant; Modification of IEC 61280-4-1 edition 2, Fiber-Optic Communications Subsystem Test Procedures- Part 4-1: Installed Cable Plant-Multimode Attenuation Measurement
	ANSI/TIA-568-B *Commercial Building Telecommunications Cabling Standard*
	ANSI/TIA-568-C.O *Generic Telecommunications Cabling for Customer Premises*
	ANSI/TIA-568-C.0-1 *Generic Telecommunications Cabling for Customer Premises – Addendum 1, Updated References for Balanced Twisted Pair*
	ANSI/TIA-568 *Generic Telecommunications Cabling for Customers Premises – Addendum 2, General Updates*

	ANSI/TIA-568 *Commercial Building Telecommunications Cabling Standard* **ANSI/TIA-568** *Commercial Building Telecommunications Cabling Standard (Addendum 1 – Pathways and Spaces* **ANSI/TIA -568** *Commercial Building Telecommunications Cable Standard-Addendum 2, General Updates* **ANSI/TIA-568** *Balanced Twisted Telecommunications Cabling and Components Standards* **ANSI/TIA-568-***Errata Sheet* **ANSI/TIA-568** *Optical Fiber Cabling Components Standard* **ANSI/TIA-568** *Optical Fiber Cabling Components Standard – Addendum 1, Addition of OM4 Cabled Optical Fiber and Array Connectivity* **ANSI/TIA-568** *Broadband Coaxial Cabling and Components Standards* **ANSI/TIA-569** *Telecommunications Pathways and Spaces* **ANSI/TIA-569** *Telecommunications pathways and Spaces Addendum 1 – Revised temperature and Humidity Requirements for telecommunications Spaces* **ANSI/TIA-569-***Errata Sheet* **ANSI/TIA-570** *Residential Telecommunications Infrastructure Standard* **ANSI/TIA-598-***Residential Telecommunications Infrastructure Standard* **ANSI/TIA-606** *Administration Standard for Telecommunications Infrastructure* **ANSI/TIA-607** *Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises* **ANSI/TIA-758** *Customer-owned Outside Plant Telecommunications Infrastructure Standard* **ANSI/TIA-942** **TSB 36** *Cable Requirements for Digital Systems* **TSB 40** *Termination Components* **TSB 67** *Cable Testing* **SP2840** *CAT 6 Component Specifications*
International Electrical and Electronics Engineers Association	**IEEE 802.6** *MAN System requirements* **IEEE 802.8** *Fiber Optic Advisory Board Standards* **IEEE 802.9** *Integration of Voice and Data Systems* **IEEE 802.10** *LAN Security Measures* **IEEE 802.3U** *100BaseT and 100BaseX Standards*
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Additional information may be obtained from the base C-CS activity or the applicable EI activity.