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2 BY ORDER OF THE COMMANDER HILL AIR FORCE BASE  
3 HILL AIR FORCE BASE INSTRUCTION 17-201

4 [30 March 2018]

5 *Communications and Information*

6 STANDARD COMMUNICATIONS INFRASTRUCTURE

7 COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

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14 PURPOSE:

15 This Hill Air Force Base Instruction implements Air Force Policy Directive (AFPD) 17-1,  
16 *Information Dominance and Cyberspace Governance and Management*. This instruction  
17 outlines responsibilities and procedures for 75ABW/CEG and SCXP. It sets forth requirements  
18 for personnel certification and establishes responsibilities and procedures for base agencies,  
19 architects, engineers, and contractors to plan, design, review, and evaluate telecommunications  
20 cabling and distribution systems. This instructions meets/follows through with Unified Facilities  
21 Criteria (UFC) 3-580-1, *Telecommunications Interior Infrastructure*. It provides policy,  
22 direction, and guidance for planning and implementation of communication infrastructure for  
23 Military Construction (MILCON) and building renovation projects. It contains base standards  
24 for pre-wiring new construction under Military Construction Program (MCP), Combined  
25 Defense Improvement Projects (CDIP), and remodeled facilities. Furthermore, it identifies  
26 minimum essential factors to be considered when telecommunications pre-wiring support is  
27 addressed. It applies to all units, assigned and/or associated with Hill Air Force Base (HAFB).  
28 Refer recommended changes and questions about this publication to the Office of Primary  
29 Responsibility (OPR) using the AF Form 847, Recommendation for Change of Publication; route  
30 AF Forms 847 from the field through the appropriate functional chain of command. Ensure that  
31 all records created as a result of processes prescribed in this publication are maintained in  
32 accordance with (IAW) Air Force Manual (AFMAN) 33-363, Management of Records, and  
33 disposed of IAW the Air Force Records Information Management System (AFRIMS) Records  
34 Disposition Schedule (RDS). The use of the name or mark of any specific manufacturer,  
35 commercial product, commodity, or service in this publication does not imply endorsement by  
36 the Air Force.

37 **1. General.**

38 **1.1. Purpose.** The purpose of this instruction is to provide design criteria for planning  
39 telecommunications cabling and distribution systems in building construction and renovation  
40 efforts. Pre-wiring shall be included in all military facility construction projects accomplished  
41 with 3300 series funding IAW the Air Force. All pre-wiring must comply with UFC 3-580-1  
42 and other applicable references listed in attachment 1. Compliance with these instructions will  
43 improve maintenance by establishing a standard for communications systems facilities.  
44 Department of Defense (DoD) publications direct the use of commercial standards whenever  
45 they meet DoD needs. The commercial standards referenced in UFC 3-580-1 shall be followed  
46 along with this instruction.

- 47 **1.2. Scope.** Project design packages will comply with:  
48 1.2.1. Local minimum communications standards.  
49 1.2.2. Building communications and distributions systems.  
50 1.2.3. Telephone/Local Area Network (LAN) entrance cables.  
51 1.2.4. Communications equipment rooms.  
52 1.2.4.1. Telecommunications cabling and termination.  
53 1.2.4.2. Telecommunications outlets.  
54 1.2.4.3. Testing requirements.

55 **2. Responsibilities.**

56 **2.1. 75 ABW/CEG Construction/Renovation Design Package Office of Primary  
57 Responsibility (OPR) will:**

- 58 2.1.1. Present all communications requirements to 75 ABW/SC NLT the 60% level Design  
59 Review for design-built projects.  
60 2.1.2. Present 75 ABW/SC a complete design package for review between 35to 65percent to  
61 include a draft of the requirements document and drawings, the DD Form 1391, Military Project  
62 Construction Data, and a list of any deviations from the Communications-Computer Systems (C-  
63 CS) criteria which must be approved by the Communications and Information Systems Officer  
64 (CISO) or his representative.  
65 2.1.3. Allow 15 business days for Communications Directorate review of all design packages.  
66 The Base Communications Systems Office (BCSO) and base telephone maintenance contractor  
67 may be needed to provide assistance with the incorporation of new infrastructure. The Base  
68 Cyberspace Systems Integrator (CSI-B) may also need to provide communications engineering  
69 assistance. Any assistance requested will be coordinated through 75 ABW/SCXP Plans and  
70 Programs Branch during the quarterly CSI-B site visit.  
71 2.1.4. Notify 75 ABW/SCXP Plans and Programs Branch within 48 hours of any changes in  
72 project scope.

73 **2.2. 75 ABW/SCXP Plans and Programs Branch will:**

- 74 2.2.1. Coordinate design packages with all appropriate communications agencies when design  
75 package is completed.  
76 2.2.2. Receive and maintain comments from applicable communications agencies on all design  
77 packages. Ensure design packages comply with standards in this document. Refer to References  
78 in Attachment 1 for a complete list of standards.  
79 2.2.3. Within 5 business days of receiving comments from all applicable communication  
80 agencies, forward Design Review comments to the 75 ABW/CEG and attend design meetings as  
81 required.  
82 2.2.4. Ensure the most efficient wire or cable distribution system is included in the facility  
83 design. This will be determined by Comm Project Manager (PM) in the design on a case by case  
84 basis.  
85 2.2.5. Check design packages during all design phases, to ensure current and projected  
86 communications requirements are considered for flexibility to accommodate future additions or  
87 changes.  
88 2.2.6. Ensure all 75 ABW/SCXP personnel are involved in all phases of the project.

89 **3. Personnel Certification Requirements.**

- 90 3.1. Personnel involved in design and construction shall have expertise in engineering and  
91 installation of telecommunications, cabling, and distribution systems. If requested by the CISO,

92 contract personnel shall provide adequate proof of their individual skill by demonstrating their  
93 technical expertise and methods of testing and documentation.

94 3.1.1. The contracting company shall have a minimum of five years' experience in the design,  
95 application, and installation and testing of the specified systems and equipment.

96 3.1.2 The contractor shall employ Registered Communications Distribution Designers (RCDD)  
97 to perform systems engineering and design.

98 3.1.3. All supervisors and installers assigned to the installation of a system or any of its  
99 components shall have industry training for each area of installation and have factory  
100 certification on all components used in the installation. General electrical trade staff  
101 (electricians) will not be used for the installation of the fiber optic and copper cables and  
102 associated hardware.

103 3.1.4. All technicians assigned to the installation of a system or any of its components shall have  
104 a minimum of one year experience in the installation of the specified fiber optic and copper cable  
105 and associated hardware. Lead installers shall be BICSI certified and have a minimum of three  
106 years' experience in the installation of the specified fiber optic and copper cable and associated  
107 hardware.

#### 108 **4. Manufacturers Minimum Qualifications.**

109 4.1. The equipment and hardware provided under all contracts will be from manufacturers that  
110 have a minimum of three years' experience in producing the types of systems and equipment  
111 specified.

#### 112 **5. Local Minimum Standards.**

113 5.1. To minimize the long-term cost of the infrastructure, the following local standards are  
114 established and may only be changed when approved in writing by the CISO. These standards  
115 are intended to promote common skills among maintenance personnel throughout the base and to  
116 minimize the necessity for excessive spare parts and variations in telecommunications  
117 equipment:

118 **5.1.1. Base Fiber Optic Cable (FOC) outside plant backbone connections in support of**  
119 **Information Transfer Nodes (ITN's):** Asynchronous Transfer Mode (ATM) or Switched/  
120 Gigabit Ethernet Connections 48-strand Single Mode (SM) FOC 8.3/125 micron.

121 **5.1.2. Base FOC Outside Plant satellite connection in support of End Building Nodes**  
122 **(EBNs):** Switched Ethernet Connections 12-strand (minimum) SM FOC 8.3/125 micron.

123 **5.1.3. New Construction:** Install a minimum of 25 pair #23 American Wire Gauge (AWG)  
124 copper Category (CAT 6) outside plant cable.

125 5.1.4. All cable used for telecommunications outlets shall be four pair, #23 AWG, solid copper  
126 conductor, Blue CAT 6, UL tested and certified. Each cable shall be dedicated to one device or  
127 outlet only.

128 5.1.5. Whenever exposed in air circulation areas, only plenum rated cable will be used.

129 5.1.6. All telecommunications outlets shall provide a minimum of four Universal Service  
130 Ordering Code (USOC) CAT 6 RJ-45 type jacks utilizing Telecommunications Industry  
131 Association (TIA) 568-B for voice/data/LAN. All 4 pairs within the cable shall be terminated to  
132 USOC CAT6 RJ-45 type jack. All CAT 6 patch panels shall have 110 interface on the back side.  
133 Panel width shall be as required to fit in a standard 19" equipment rack.

134 5.1.7. Information outlet spacing in office areas shall be based upon one duplex outlet for each  
135 eight (8) linear feet of useable perimeter wall space or one for each 100 square foot of floor  
136 space, whichever provides a higher outlet density. All other locations will be provided with  
137 outlet density as determined by the CISO or his representative.

138 5.1.8. Administrative telephone wiring will be based on the single-line instrument concept with  
139 individual cable running from the wall outlet to the Telecommunications Room (TR) via the  
140 cross connect cabinet if required. Each jack will be wired "homerun" from jack to the nearest  
141 TR. Splitting cable pairs to multiple jacks is not authorized.

142 5.1.9. All outside plant copper cable conductors shall be #26 AWG in cable sizes above 2100  
143 Pair. All copper conductors for cables less than 2100 pair will not be less than #23 AWG.

144 5.1.10. All Outside Plant cable will be filled core type, and meet Rural Utilities Service (RUS)  
145 Professional Engineer 39 (PE-39) or PE-89 specifications. Outside Plant Cables (OSP)  
146 manufactured to PE-39 and those manufactured to PE-89 are functionally equivalent with  
147 identical scope and applications. Both products are intended for duct and direct buried  
148 installations where protection against water and moisture is required. These cables may also be  
149 installed aerially by attachment to support strand but air core cables are typically used for above  
150 ground applications.

151 **6. Comprehensive Requirements.** Comprehensive requirements apply to all  
152 telecommunications systems.

153 **6.1. Building Communications Distribution System.**

154 6.1.1. All primary backbone conduits shall be installed in locations as determined by the CISO  
155 or his representative and shall provide adequate size and quantity to meet current requirements  
156 plus 100% growth for future use to preclude digging at a later date to meet emerging  
157 requirements.

158 6.1.2. When new construction or renovation takes place, the design, installation, and all related  
159 costs necessary to extend the conduit and manhole (MH) system to the new location shall be  
160 included in the project IAW, UFC 3-580-01, and AFI 65-601V, Budget Guidance and  
161 Procedures. Multiple service entrance locations will be required for all facilities housing  
162 command and control systems to provide redundant survivable service.

163 6.1.3. A manhole with a minimum of two 4" conduit/duct bank lateral systems with tracer and  
164 pull rope will be used for required cables plus 100 percent spare ducts (not less than 1 spare) for  
165 expansion and maintenance in all primary duct banks.

166 6.1.4. Manholes shall be installed for all connections to the existing cable plant as required and  
167 maintained at a maximum spacing of 600 feet. Additional manholes may be required to provide  
168 adequate control of connection and distribution of the cable plant.

169 6.1.5. All manholes and handholes shall be designed and constructed to meet the requirements  
170 of Technical Order (T.O.) 31W3-10-22, Telecommunications Engineering Outside Plant  
171 Telephone. Manholes shall provide a clear inside floor space measurement of 8' x 10'. An  
172 alternate size of 6' x 8' may be approved only when no primary backbone cable passes through  
173 the manhole (lateral or dead end service only). All manholes shall provide a clear height no less  
174 than 7 ft. Conduits shall enter the MH 4 to 5 inches above finish floor on the end and be  
175 perpendicular to the wall in approximate location. Mandatory items include grounding busbar  
176 and rod and related conductors and wiring, a ladder or step, cable rack support, a 50 cubic foot  
177 sump (French drain), pull in iron/anchor, frame and a manhole cover cast with the word  
178 "COMMUNICATIONS" exposed to the surface. All manhole covers will be round and provided  
179 with a locking bar or other locking device to allow use of a padlock or other restriction to  
180 unauthorized entry.

181 6.1.6. Power and communications cables will be separated by 12" of well tamped, fine earth  
182 protection IAW T.O. 31W3-10-12, Outside Plant Cable Placement. The cable at the top of the  
183 crossing, whether power or communications cable, will receive the same additional protection

184 (see paragraph 6.1.8). In addition, if the cable crosses over the main, extend additional cable  
185 protection 3' from each side of the crossing. Where highway, railroad and runway crossings  
186 occur, cable at such crossings must be placed underground using a metallic conduit or Schedule  
187 80 Polyvinyl Chloride (PVC) conduit. Polyvinyl Chloride conduit may be direct buried if 30-36"  
188 of cover is provided. If steel pipe conduit is used, boring procedures will be followed to ensure  
189 protection of existing utilities or resources. Where PVC conduits are installed, a metallic #10  
190 AWG copper tracer wire at minimum will be installed within the conduit or 6" above the duct  
191 bank to assist in future location efforts, with bonding to occur inside each manhole and at  
192 Communications Equipment Room (CER) grounding frame.

193 6.1.7. Stub up a minimum of two 4" lateral conduits no less than 6" above the finished floor  
194 level adjacent to the telephone punch down board continuous to the nearest splice or service  
195 point as determined by the 75 ABW/SC if both fiber and copper are available from a single  
196 location. The two lateral entrance conduits will each have three 3-cell Maxcell innerduct to be  
197 used for fiber. If a diverse path is required for both fiber and copper, a minimum of four 4"  
198 conduits is required (two for fiber and two for copper). All conduits will have three 3-cell  
199 Maxcell innerducts. Conduits are to be sealed or capped air tight to prevent water from entering  
200 the TR.

201 6.1.8. Provide 36" minimum cover for all conduit duct banks and 36" minimum cover for  
202 laterals measured to top of conduit. The 75 ABW/SC will provide termination of cable  
203 connections in the manhole.

204 6.1.9. When determined necessary to simplify installations, conduit will be curved to provide  
205 gentle sweeps with a minimum radius of 25 feet for a total bending radius not to exceed 180  
206 degrees between manholes, hand holes, or pull locations.

207 6.1.10. All conduits shall be sloped toward each opposing manhole at a slope of 3" per  
208 100' of run to promote drainage of any accumulated liquids.

209 6.1.11. When specified, hand holes will be nominally 6'W x 8'L x 7'H inner dimensions or a  
210 standard 36" x 60" x 36" substructure box. Mandatory items include grounding busbar and rod  
211 and related conductors and wiring, a sump hole (French drain), and a traffic rated cover with a  
212 locking bar or other locking device to allow use of a padlock or other restriction to unauthorized  
213 entry.

## 214 **6.2. Telephone Entrance Cable.**

215 6.2.1. The contractor will provide underground exterior service cable, gel filled, IAW RUS PE-  
216 39 or PE-89 from the main communications panel to the nearest manhole tie-in or service point  
217 with sufficient vacant pairs to provide each facility with currently required circuits plus 50  
218 percent spare pairs as determined by the CISO or his representative.

219 6.2.2. Splice cases used to splice copper cable into the base infrastructure will be stainless steel.  
220 A transition splice will be made between the exterior copper gel-filled cable and dry-filled intra-  
221 building cable in the TR IAW TIA/EIA 569A standard.

222 6.2.3. IAW Underwriters Laboratories (UL) 497, all Building Entrance Terminals (BET's) will  
223 be provided with three-electrode gas tube or solid state type 5-pin rated for the application.  
224 Provide gas tube protection modules IAW RUS Bulletin 345-83 and shall be heavy duty,  
225 A>10kA, B>400A, C>65A where A is the maximum single impulse discharge current IAW  
226 National Electrical Manufacturers Association (NEMA) C62.61. The gas modules shall shunt  
227 high voltage to ground, fail short, and be equipped with an external spark gap and heat coils,  
228 IAW Underwriter's Laboratory (UL) 497. Provide the number of surge protection modules  
229 equal to the number of pairs of exterior cable of the building protector assembly.

230 6.2.4. Building Entrance Terminals (BET) used for the termination of outside cables, 300 pair or  
231 less in size, will have a built in splice chamber with 710 type splice modules. Equipment side  
232 (house) of the BET will use 25 pair Telco type connections to station equipment. BETs of this  
233 type will not be stacked more than three high.

234 6.2.5. Building Entrance Terminals (BET) used to terminate cable sizes greater than 400 pair  
235 will be a #23 AWG stubbed 355 series type blocks with gas type protectors and be mounted in a  
236 vertical buss arrangement.

237 6.2.6. The contractor shall conduct appropriate testing and provide 100% continuity test results  
238 to 75 ABW/SCOIN Base Telephone Systems Office (BTSO). Use Optical Time-Domain  
239 Reflectometer (OTDR) to perform the test.

### 240 **6.3. LAN Fiber Optic Entrance Cable.**

241 6.3.1. Single Mode Fiber Optic (SM FOC) will be used for inside and outside premise. At a  
242 minimum, 48 strands SM FOC (8.3/125 micron) will be designed as part of a new facility  
243 construction project. Facility use and user requirements will dictate whether more fiber optic  
244 cable is required. Refer to Paragraph 5 of this document for local minimum standards.

245 6.3.2. All FOC will be home run from the closest primary or secondary Information Transfer  
246 Node (ITN) to the new facility. Fiber optic cable will not be spliced in any manholes.

247 6.3.3. All FOC entering the building will terminate in the TR in a 19" rack floor mounted FOC  
248 patch panel with LC connectors.

249 6.3.4. Fiber optic cable terminations at the far end (primary or secondary ITN) will be  
250 performed by the base. The contractor shall provide manufacturer test results and conduct  
251 industry standard OTDR testing on cable and provide 100% continuity test results to 75  
252 ABW/SC Base Telephone Systems.

### 253 **6.4. Telecommunication Rooms (TR).**

254 6.4.1. A TR will be provided for Communications-Computer System (C-CS) switching and  
255 transmission equipment, private branch exchanges ( gateways, power supplies, etc.) main  
256 distribution frame(s), LAN equipment racks, fiber optic cable termination, patch panels and other  
257 equipment needed for termination of the building's interior wiring systems and to interface the  
258 local service equipment with the exterior base cable system. The primary TR will be located on  
259 the first floor with an exterior door only to provide uninterrupted access by authorized personnel.  
260 The TR must have a lockable door and keyed to 75 ABW/SC specifications. As a minimum, the  
261 TR should have ¾ inch plywood backboard from no greater than 1 foot above the finished floor  
262 level to no less than 7 feet above the finished floor level. Plywood will be sealed and fire rated.  
263 BETs are required for all primary TRs. Install telephone distributing posts (mushrooms) as  
264 required by number of connecting blocks in all TRs. The size of the TR will not be less than the  
265 specifications found in Table 1.

266 **Table 6.1. TR Size Requirements.**

| Building Usable Area (Square Feet) | TR Size (Square Feet) | Number of 4" Entrance Conduits |
|------------------------------------|-----------------------|--------------------------------|
| <20,000                            | 400                   | 3                              |
| 20,000 to 100,000                  | 500                   | 4                              |
| 100,000 to 200,000                 | 900                   | 5                              |
| Every additional 200,000           | 600+                  | +1                             |

267 **NOTE:** Room size will have a 2:1 ratio in length to width.

268 6.4.2. Adequate installation and maintenance space, environmental control and power typical to  
269 an office environment (heated and cooled), shall be included to support equipment and any

270 necessary cable entry requirements. No other building support equipment including mechanical  
271 equipment, plumbing equipment, and electrical panels will be placed in the TR. Maintenance  
272 space and access space will not be utilized for any other purpose and will be free and clear of all  
273 obstructions to a height of 8 feet to allow for adequate cooling and servicing of equipment.  
274 Storage of any type is prohibited in the TR.

275 6.4.3. The TRs will be provided with space as required and will be so located that the distance  
276 measured along the routing path of the cable will not exceed 295 feet including vertical distances  
277 to wall telecommunications outlets to maintain the integrity of the digital data signal. Where  
278 multiple TR rooms are required, attention must be given to their strategic placement to support  
279 interconnection via 4 inch conduit or 6 inch wide by 2 inch deep minimum cable trays between  
280 each room as well as to the primary TR in which the cable head/fiber connections are to be  
281 located. Where it is necessary to interconnect more than one TR, Single-Mode (SM) fiber  
282 optical cable will be used. A 1 inch innerduct will be provided inside the 4 inch conduit or  
283 conduit raceway with pull cord ensuring a direct path between each TR. For telephone  
284 interconnection, provide #23 AWG copper wire cable between the TRs.

285 6.4.4. Circuit connectivity from the telecommunications outlet jacks to the TR will be provided  
286 through 1¼ inch minimum conduit stubbed to 12 inches above the finished ceiling using the  
287 most direct route available, complete with pull cords. A 6 inch wide by 2 inch deep minimum  
288 above the ceiling cable through/raceway may be used to connect rooms provided plenum type  
289 cable is used or provided. Where cable trays are provided, conduits will be extended to the cable  
290 tray and be terminated. The through/raceway will run above the ceiling on the top of proper  
291 support structures using the most direct route between the TRs. Conduit fill will not exceed the  
292 40% rule as stipulated in the National Fire Protection Association (NFPA) 70 and TIA/EIA-569-  
293 C-1.

294 6.4.5. Wall jacks will be provided for wall-mounted telephones in the TR, electrical and  
295 mechanical rooms mounted 60 inches above the finished floor that supports CAT 6 cabling.

296 6.4.6. A controlled and secured access to the TR is required to allow 24-hour uninterrupted  
297 access by authorized technicians. The TR on the first floor will have exterior access only.

298 Locking door knobs shall be utilized with key ways and locks keyed alike to match the 75  
299 ABW/SC master key. Only authorized personnel by the CISO will possess key to the TRs.

300 6.4.7. Temperature in the TR will be maintained between 65-78 degrees Fahrenheit.

301 6.4.8. A minimum of two-gang 120 VAC power outlets on a separate 20-Amp power outlet  
302 circuit with isolated ground will be provided. Additionally, a minimum of two- gang 220-240  
303 VAC 30-Amp power outlet circuit with isolated ground for use in powering uninterrupted power  
304 supply (UPS) will also be provided. An additional duplex convenience outlet will be located  
305 away from the telecommunications outlets to provide power to operate service and maintenance  
306 equipment. Sufficient lighting will be provided in all TR areas to promote a safe and acceptable  
307 work area.

308 6.4.9. Ground all devices, cable sheaths, protectors and other equipment IAW T.O. 31W3-10-  
309 22, ANSI/EIA/TIA 607, MIL Standard 188-124B, and the NFPA 70. Provide a single-point  
310 ground for all communications/electronic equipment for the building within the TR. Provide a  
311 Telecommunications Main Grouping Busbar (TMGB) at a minimum of 6 inches high by 24  
312 inches long. The ground riser from the ground plate to the single main electrical service entrance  
313 ground must be a #1 AWG or larger copper conductor directly connected to the ground plate  
314 with no taps. The resistance of the ground riser must be 5 ohms or less measured from the main  
315 building ground point. All connections of wire-to-wire and/or wire-to-ground rod must be

316 exothermic-welded. Extend #6 AWG or larger copper ground wires from the TR ground plate to  
317 each secondary TR within the building and connect a Telecommunications Grounding Busbar  
318 (TGB) in the TR. Bond each TMGB and TGB to non-current-carrying metal building parts such  
319 as metal framing in the TR as required by the National Electric Code (NEC).

320 **6.5. Telecommunications Room (TR).**

321 6.5.1. The primary TR will be provided as required to serve approximately every 10,000 ft<sup>2</sup> of  
322 usable floor space. Other TRs will serve as a secondary interconnection point between the  
323 telephone/LAN modular jack outlets and the main communications frame in the TR. Wall and  
324 floor space will be provided for installation and maintenance of equipment such as frames or  
325 backboards. Such equipment will be concealed and secured as required for TRs and will not be  
326 installed in common use areas. It must be fully accessible and maintainable as outlined for TR  
327 room equipment.

328 6.5.2. All cable in the TR will be tagged according to room and jack number to indicate its  
329 associated jack number and location. All LAN runs must be continuous from wall outlet to patch  
330 panels in the TRs. Installation of plugs and plugging house cable into active electronic  
331 equipment is strictly prohibited.

332 **6.6. Cabling and Termination.**

333 **6.6.1. Horizontal Cables (Telephone and LAN).** Connect individual subscriber telephone  
334 and LAN outlets to their respective 110-type patch panels in the TR. Horizontal cable for both  
335 telephone and LAN must be 4-pair #23 AWG solid copper, 100 ohm, CAT 6 plenum rated  
336 Unshielded Twisted Pair (UTP) cable. Use only cable that has passed UL network certification  
337 program and is UL-listed and labeled. Blue CAT 6 cables will be used for voice, LAN, and data.  
338 Tag and label cables at least 6 inches at both ends.

339 **6.6.2. Telephone Riser Cables.** Provide connection between the telephone patch panel in the  
340 TR and the telephone patch panels or distribution frame in the TR. Telephone riser cable must  
341 be multi-pair (sized as required to support all horizontal cables terminated in the TR plus 50%  
342 spare pairs) #23 AWG solid copper, 100 Ohm, CAT 6 UTP cable. They must meet the  
343 requirements of EIA/TIA-568-B or latest standard.

344 6.6.3. CAT 6 wiring will be terminated in a standard 19" rack mounted CAT 6 patch panel  
345 located in the TR situated in a central location within the building. Cable length will not exceed  
346 295 ft.

347 6.6.4. Pairing and color-coding for jacks will be IAW EIA/TIA-568B standards in Table 6.2.

348 **Table 6.2. TIA 568-B LAN/DATA Wiring Standard.**

| PIN # | COLOR    | PIN # | COLOR   |
|-------|----------|-------|---------|
| 1     | W/ORANGE | 5     | W/BBLUE |
| 2     | ORANGE   | 6     | GREEN   |
| 3     | W/GREEN  | 7     | W/BROWN |
| 4     | BLUE     | 8     | BROWN   |

349 6.6.5. The 75 ABW/SC contractor will have a minimum of ten working days to complete the  
350 cross connects, install equipment, and verify the system prior to occupancy by the tenant starting  
351 from receipt of the work order.

352 6.6.6. To clearly identify cables and their usage, each cable will be labeled at both ends by  
353 identifying their room and outlet number. Each outlet cover plate will also carry the outlet  
354 designation, as shall the termination jack on the patch panel or termination block. A permanent  
355 type label affixed to the cable or outlet jack cover to preclude damage due to age or other



356 mechanical means will identify all cable and terminations. Automated embossed labels are  
357 required. Pen and ink label is not authorized.

### 358 **6.7. Telecommunications Outlets.**

359 6.7.1. In general office areas, a duplex modular telecommunications outlet plate with four each  
360 USOC RJ-45 or latest standard type jacks will be provided every 8 linear feet around the usable  
361 room perimeter or one for each 100 square feet of net floor area whichever provides greater  
362 density. All wall outlet components will be certified as CAT 6 and jacks will be USOC RJ-45 or  
363 higher type wall jacks with a removable outer bezel. Blue jacks will be used to identify all CAT  
364 6 jacks.

365 6.7.2. Telecommunications outlets will be mounted at 18" above the floor to the centerline of  
366 the cover plate unless noted otherwise.

## 367 **7. Periodic, Pre-Final, Final Inspections to include Testing and Documentation.**

368 **7.1. Telecommunication Cable.** All telecommunications cable will be certified and tested  
369 utilizing the Optical Time Domain Reflectometer (OTDR) test equipment IAW EIA/TIA 568-C  
370 standards with written test result to be provided to the 75 ABW/SC not later than (NLT) 48 hours  
371 of the final inspection. Where deficiencies of any type are discovered upon testing, the  
372 contractor will make all necessary repairs, including any necessary replacement, at no cost to the  
373 government.

374 **7.2. Drawings.** Revised drawings which reflect the actual "as built" conditions will be  
375 maintained throughout the construction phase. A copy will be provided to the 75 ABW/SC with  
376 the cable certification records upon completion of the work but prior to final acceptance of the  
377 work to allow 75 ABW/SC to perform a final review of drawings and inspect installations.

### 378 **7.3. Cyberspace Infrastructure Planning System (CIPS) Visualization Component (CVC).**

379 The CVC is the basis of "as built" cable records and will be provided to the 75 ABW/SC upon  
380 final project acceptance. The drawings will show cross-connect and termination points for each  
381 cable pair, locations and identification number for each modular outlet, and the location and  
382 value of each line amplifier and multi-port device throughout the inside plant cable system. The  
383 outside plant drawings will be geospatial referenced and include the conduit, innerduct, cable  
384 types, cable count, cable size, and length. All manholes, handholes, and pull boxes will have  
385 complete butterfly details to include geospatial referenced location, entry points, grounding,  
386 bonding, racks/ladders, or other equipment installed. Three copies of these drawings will be  
387 updated to final "as built" conditions by the construction contractor and turned over to the 75  
388 ABW/SC along with one electronic copy of outside plant drawings utilizing Visio. As-built  
389 drawings will be provided to 75 ABW/SC NLT 30 days after facility is accepted by the base.

390 **7.4. In-Progress Inspections.** In-progress inspections by 75 ABW/SC personnel are required  
391 during construction. Trenches may be inspected to verify conduit size and quantity, cable type,  
392 earth cover compliance, and accuracy of "red line" base cable record or contract drawings. The  
393 general contractor performing the work is solely responsible for requesting in progress  
394 inspections to the base before backfill or installation of walls during cable certifications.

395 **7.5. Installed Cables (Fiber and Copper).** All installed cables (fiber and copper) will be tested  
396 by the installer and may be in the presence of 75 ABW/SC personnel or its representatives.

397 Baseline test records will be provided to the 75 ABW/SC in printed and digital format. All CAT  
398 6 cables will be tested and certified to 155 Megabits per second (Mbps) (500 Megahertz (MHz))  
399 to ensure they are usable at higher data transmission speed. UL testing standard for new cable  
400 including fiber optic testing of single mode cable will be followed.

## 401 **8. Other Considerations.**

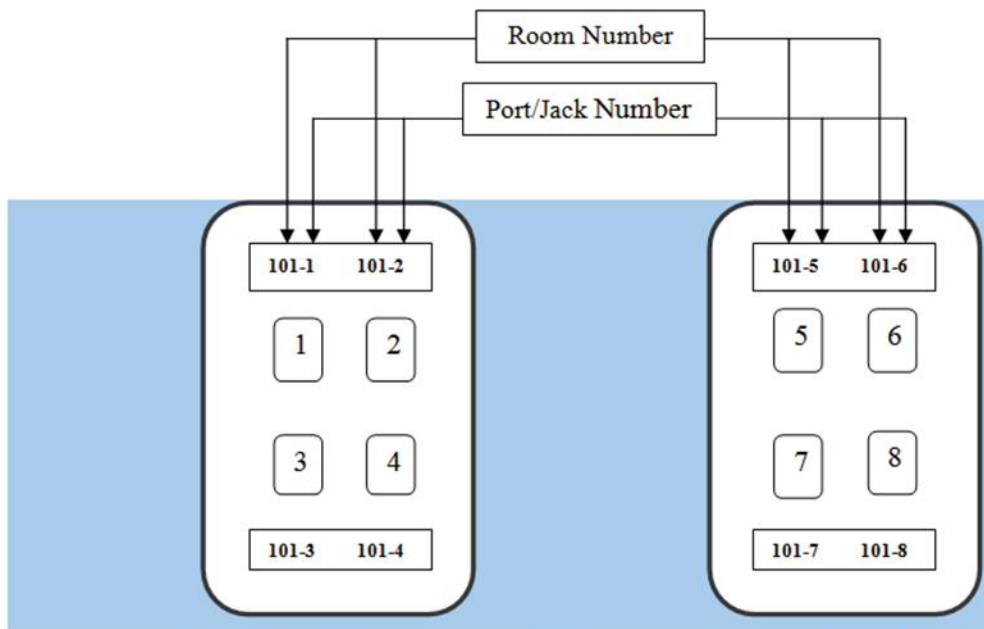
402 **8.1. Classified Systems (Secure Internet Protocol Router Network (SIPRNET) and Defense**  
403 **Red Switch Network (DRSN)).**

404 8.1.1. Classified requirements may vary and will be taken on a case-by-case basis. Customer  
405 units must identify classified LAN and telephone requirements to the 75 ABW/SC during  
406 preliminary design planning. Due to the specific nature of the security and Communications  
407 Security (COMSEC) requirements for these systems, it is difficult to address these requirements  
408 in generalized terms.

409 **8.2. Modular Furniture.**

410 8.2.1. Modular furniture configuration will be supported by the standard wall jack. Telephone  
411 and LAN wiring systems in areas with pre-wired workstations, furniture systems or modular  
412 walls must have sufficient flexibility and connectivity to enable rearrangement without  
413 modification to the permanent communications wiring in the facility. Suitable patch cords and  
414 connectors must be provided. Permanent splices/connections are prohibited. Patch cords will be  
415 permanently labeled with the corresponding outlet number and will be at the expense of the  
416 customer.

417 **Figure 8.1. CAT 6 Four-Gang Wall Plate Numbering Example**



**Note:** Starting from the main room entrance location, use room number followed by ascending numeric for each telecommunications outlet and move clockwise around the room perimeter. Mark each cable end, each wall outlet on the face of the cover plate and at the patch panel under the corresponding panel jack. Post the drawing with the identification of outlets and room numbers in the TR upon completion.

418 BEGIN SIGNATURE  
419 JENNIFER HAMMERSTEDT, Colonel, USAF  
420 Commander, 75th Air Base Wing  
421 END SIGNATURE  
422  
423

424 **Attachment 1**

425 **GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION**

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- 456 **AF Form 847**, *Recommendation for Change of Publication*
- 457 **Adopted Forms**
- 458 **AF Form 1768**, *Staff Summary Sheet*
- 459 **DD Form 1391**, *Military Project Construction Data*
- 460 **Abbreviations and Acronyms**
- 461 **AFI**-Air Force Instruction
- 462 **AFPD**-Air Force Policy Directive
- 463 **AFMAN**-Air Force Manual
- 464 **AFRIMS**-Air Force Records Information Management System
- 465 **ANSI**-American National Standards Institute
- 466 **ATM**-Asynchronous transfer Mode
- 467 **AWG**-American Wire Gauge
- 468 **BCSO**-Base Communications Systems Office
- 469 **BET**-Building Entrance Terminals
- 470 **BTSO**-Base Telephone Systems Office

471 **BICSI**-Building Industry Consulting Service International  
472 **CAT**-Category 6  
473 **CER**-Communications Equipment Room  
474 **C-CS**-Communications-Computer Systems  
475 **CDIP**-Combined Defense Improvement Projects  
476 **CIPS**-Cyberspace Infrastructure Planning System  
477 **CISO**-Communication Information systems Officer  
478 **COMSEC**-Communications Security  
479 **CSI-B**-Base Cyberspace Systems Integrator  
480 **CVC**-CIPS Visualization Component  
481 **DoD**-Department of Defense  
482 **DRSN**-Defense Red Switch Network  
483 **EBN**-End Building Nodes  
484 **EIA**-Electronic Industries Alliance  
485 **FOC**-Fiber Optic Cable  
486 **HAFB**-Hill Air force Base  
487 **IAW**-In Accordance With  
488 **ITN**-Information Transfer Nodes  
489 **LAN**-Local Area Network  
490 **MCP**-Military Construction Program  
491 **MH**-Manhole  
492 **MHz**-Megahertz  
493 **MILCON**-Military Construction  
494 **Mbps**-Megabits per Second  
495 **NEC**-National Electric Code  
496 **NEMA**-National Electrical Manufacturers Association  
497 **NFPA**-national fire Protection Association  
498 **OPR**-Office of primary Responsibility  
499 **OSP**-Outside Plant  
500 **OTDR**-Optical Time Domain Reflectometer  
501 **PE 39/89**-Professional Engineer 39/89  
502 **PM**-Project Manager  
503 **PVC**-Polyvinyl Chloride  
504 **RCDD**-Registered Communications Distribution Designers  
505 **RDS**-Records Disposition Schedule  
506 **RUS**-Rural Utilities Service  
507 **SIPRNET**-Secure Internet Protocol Router Network  
508 **SM**-Single Mode  
509 **SMFO**-Single Mode Fiber Optic  
510 **UFC**-United Facilities Criteria  
511 **TGB**-Telecommunication Grounding Busbar  
512 **TIA**-Telecommunication Industry Association  
513 **TMGB**-Telecommunications Main Grouping Busbar  
514 **TO**-Technical Order  
515 **TR**-Telecommunications Room  
516 **UL**-Underwriters Laboratories  
517 **USOC**-Universal Service Ordering Code  
518 **USP**-Uninterrupted Power Supply  
519 **UTP**-Unshielded Twisted Pair