SECTION K-- WIRING AND CONNECTING

CONTENTS

1. GENERAL ............................................................................................................................. K-2
   1.1. Introduction ..................................................................................................................... K-2

2. GENERAL REQUIREMENTS ............................................................................................... K-2
   2.1. General ........................................................................................................................ K-2
   2.2. Connecting ..................................................................................................................... K-2
   2.3. Reused Equipment ....................................................................................................... K-2
   2.4. Mechanical Connections ............................................................................................. K-2

3. SPECIFIC REQUIREMENTS ............................................................................................... K-3
   3.1. Wire and Cable ............................................................................................................. K-3
   3.2. Distributing Frame ....................................................................................................... K-3
   3.3. Soldered Connections ................................................................................................. K-3
   3.4. Coaxial Cable and Connectors .................................................................................... K-4
   3.5. Shield Connection ....................................................................................................... K-5
   3.6. Quick-Connect (Punch Type Terminals) .................................................................... K-5
   3.7. Solder-less Wire Wrapped .......................................................................................... K-6

4. CONNECTORS ..................................................................................................................... K-6
   4.1. 710, 711 and Similar Type Connectors ........................................................................... K-6
   4.2. Connectorized Cables ................................................................................................ K-7
   4.3. Terminal Type Connectors (#10 Awg And Smaller) ...................................................... K-7
   4.4. Power Connections (Also refer to Section M) .............................................................. K-8
   4.5. Compression Connections -- #8 AWG and Larger ....................................................... K-9
   4.6. Grounding Conductors .............................................................................................. K-11
   4.7. Lockwashers for Grounding Connections ................................................................ K-12
   4.8. DC Power - General Connecting .............................................................................. K-12

TABLE K-1 – SUMMARY OF CHANGES IN SECTION K

<table>
<thead>
<tr>
<th>Revision Date</th>
<th>Item</th>
<th>Action</th>
<th>Requirements Change Notification</th>
</tr>
</thead>
<tbody>
<tr>
<td>03/11/2016</td>
<td>Entire Document</td>
<td>Modification</td>
<td>N/A; March 2016 TP76300 Rewrite</td>
</tr>
<tr>
<td>09/01/2017</td>
<td>3.4.16</td>
<td>Deletion</td>
<td>ATT-TP-76300-384</td>
</tr>
<tr>
<td>06/03/2019</td>
<td>4.4.6</td>
<td>Modification</td>
<td>ATT-TP-76300-434</td>
</tr>
</tbody>
</table>
1. GENERAL

1.1. Introduction

1.1.1 The Installation Supplier shall ensure, as part of the evaluation of the installation, that all equipment added, rearranged or modified is properly installed and in conformance with AT&T installation specifications.

1.1.2 The Installation Supplier shall ensure, as part of the evaluation of the installation, that all work has been done in accordance with the detail specifications or approved changes to the detail specifications.

1.1.3 This section covers the requirements for wiring, fanning and forming switchboard cable, treatment of loose wires and the requirements for soldered, coaxial, ABAM, compression/crimp type, quick connect and solderless wrapped connections.

1.1.4 Changes in this issue of Section K are summarized in Table K-1.

2. GENERAL REQUIREMENTS

2.1. General

2.1.1 Un-terminated ends of switchboard cable (not connectorized) shall be protected and stored to prevent incursion into working equipment.

2.2. Connecting

2.2.1 Sufficient length shall remain in all wires after connecting operations are completed so that they may be re-skinned and reconnected if necessary.

2.2.2 All connections shall be made to ensure proper electrical operation of equipment.

2.2.3 All connections shall be torqued to the manufacturer’s specifications. If specifications are not available from the manufacturer, refer to ATT-P-05100-E drawing for NEMA torque information to be used.

2.2.4 Bus bar connections shall be marked to indicate that they have been tightened to recommended torque levels per drawing ATT-P-05100-E BATTERY, RETURN, AND BUS BAR CONNECTION HARDWARE REQUIREMENTS. The marking shall normally show on the bolt head (first choice) or on the nut (second choice), whichever is easiest for visible inspection, and carry through the washer and onto the connecting surface.

2.2.5 Any connector drilled with two fastening holes shall be secured using both holes.

2.3. Reused Equipment

2.3.1 Soldered wire wrap terminals on reused or relocated equipment which meet quality standards shall be cleaned of solder if new solderless wire wrapped connections are needed. Wires on these terminals will not require soldering if all other connecting requirements are met.

2.4. Mechanical Connections
2.4.1 For DC circuits, mechanical connections (thread pressure type) shall not be installed unless authorized by the AT&T Equipment Engineer. If the original factory equipment has mechanical connections, the connections shall be tightened to the manufacturer's specifications.

2.4.2 Per the NEC, mechanical connections are allowable and approved for use for AC circuits.

3. SPECIFIC REQUIREMENTS

3.1. Wire and Cable

3.1.1 For DC applications, only AT&T approved wire and cable shall be used as defined in the Minor Materials list, AT&T Drawings and Practices.

3.1.2 AC applications shall follow NEC and local jurisdictional requirements.

3.1.3 AC and DC wire and cable shall be dressed in such a manner as to:
   a) avoid excessive strain and congestion
   b) ensure accessibility for maintenance
   c) allow for future applications
   d) maintain clearance between terminals
   e) and secured to wiring brackets, if provided

3.1.4 Spare and unused wire shall be left long enough to reach the ultimate circuits being served, then placed in a PVC tube or folded back and sewn to the existing form.

3.1.5 For AC wiring, the Installation Supplier shall use color-coded wiring in accordance with the NEC.

3.1.6 Tip and ring conductors shall be paired. Single leads and split pairs are not acceptable for tip and ring applications.

3.1.7 The normal twist of wires (such as tip and ring pairs) shall be left in place between the butt and connection point. Because of various equipment configurations, it may not always be practicable to keep the twist in place to the actual connection point. In these cases, the last twist in the wire shall be as close to the connection point as possible or at a point where one of the wires leaves the form.

3.1.8 P-wire shall not be spliced.

3.1.9 Splices shall not be made within conduits.

3.2. Distributing Frame

3.2.1 Loose wires shall be banded at each point of breakout with cord and protected with fiber.

3.3. Soldered Connections

3.3.1 Solder shall be rosin core, 60 percent tin and 40 percent lead (or an equivalent lead free solder) having a melting range of 360-370 degrees F.
3.3.2 Soldered connections shall have a smooth bright appearance with the wire fused to terminal and completely covered with solder. Connections shall be checked for cold solder joints by means of visual inspection. Proper solder joints have a shiny appearance while cold solder joints have a dull or dirty appearance.

3.3.3 A minimum of one and one quarter turns shall be made on all soldered wrapped connections.

3.3.4 Wires connected at perforated terminals shall be brought through the hole from below or from the left, bent against the terminal and away from the apparatus.

3.3.5 Wire terminals with holes, notches and semi-tubular terminals shall be filled with solder.

3.3.6 Wire ends shall be cut off a maximum 1/16 inch from the terminal.

3.3.7 Minimum clearances between soldered connections and adjacent metal work shall be 1/32 of an inch.

3.3.8 Minimum clearances between adjacent soldered connections shall be 1/64 of an inch.

3.3.9 Shiner length between insulation and point of contact with the terminal shall not exceed 1/8 of an inch.

3.4. Coaxial Cable and Connectors

3.4.1 Coaxial cable assemblies shall not be spliced.

3.4.2 Only approved coaxial cable and connectors shall be used.

3.4.3 When field forming coaxial cable assemblies, only approved coaxial cable connector crimping tools with registered dies shall be used. Coax ferule crimps shall be positive-embossed with the vendor ID, except for Video Equipment installations whereas a longitudinal marker on each end of the field created coaxial run shall carry the vendor ID/TEO of the installed conductor.

3.4.4 When stripping individual 734C, 735C, 1505a, 1694a and 1855a coaxial cables for use with approved BNC type coaxial connectors, the Installation Supplier shall only use the connector’s manufacturer approved cable stripping device.

Note: AT&T will not require the Switch Manufacturers (Alcatel-Lucent, Nortel, Siemens and Ericsson), to use 734C/735C cable in place of 734D/735A cable on Switch jobs. However, the Switch Supplier’s coaxial cable stripping tools and coaxial connector crimping tools must meet the approval standards of AT&T Common Systems on all Switch jobs in which 734D and/or 735A cable is to be installed. Furthermore, the Switch Supplier must continue to use only those connectors approved by AT&T on such jobs.

3.4.5 Pin height and continuity (for open and shorts) shall be verified on every installed coaxial connector. Pin height requirement does not apply to 45/90 degree type BNC as the pin height is set at the factory.

3.4.6 There shall be no cracks or evidence of double crimps on the outer sleeve.

3.4.7 The crimped outer sleeve shall exhibit six flat surfaces with no fins or excessive rounding at the 60-degree corner bends.
3.4.8 Coaxial cable leaving the rear of the BNC connector shall not be bent in such a manner as to cause kinking of the cable and shall not violate the established bending radius criteria.

3.4.9 The ferrule shall be butted against the connector body.

3.4.10 The braided shield shall not be exposed at either end of the ferrule.

3.4.11 The Installation Supplier shall ensure that all coaxial connectors are locked.

3.4.12 All "F" type connectors shall be installed onto properly prepared non-rigid coax cables, such as RG-6, RG-11, and RG-59 using manufacturer approved installation methods, instructions and tools unless superseded by specific ATT requirements. Installed F-Connectors must be torqued to the network equipment’s specification to prevent overtightening and damage to the termination port.

3.4.13 Waterproof connectors shall be used in applications where coaxial connections are exposed to outdoor elements and installed per the manufacture’s specification.

3.4.14 All rigid Coax connectors shall be installed onto properly prepared rigid cables, such as .500 and .625, using manufacturer approved installation and cable preparation methods, instructions and tools unless superseded by specific ATT requirements.

3.4.15 The Installation Supplier shall provide upon request both a copy of the coaxial connector manufacturer’s crimping documentation as well as a list of the approved tools used to connectorize both rigid and non-rigid coaxial cables. Additionally, the required end to end test records shall be placed in the Job Folder. If an installation is recorded in the Electronic Job Folder, EJF, the EJF BNC Form shall be used.

3.5. Shield Connection

3.5.1 The shields of shielded cables shall be cut, positioned and bonded to ground as specified in the job documentation. The shields of shielded cables shall be located as close as possible to the cable lead termination point.

3.5.2 Shielded cable and wire shall have the shield ground bonded at one end only. This bonding will be at the equipment (originating) end unless the product design specifies otherwise. Refer to Section T for requirements specific to synchronization.

3.5.3 Exposed shields of shielded cable shall be protected with two half-lapped layers of electrical tape or heat shrinkable sleeve.

3.5.4 On shielded switchboard cable, the drain lead shall be protected by applying a sleeve material.

3.6. Quick-Connect (Punch Type Terminals)

3.6.1 Only one wire shall be engaged in each terminal.

3.6.2 Only solder sleeve type splicing connectors shall be used for splicing individual leads.

3.6.3 Conductors shall not be placed on deformed terminals.

3.6.4 Previously terminated wire ends shall not be re-terminated. Cut them off and use new ends.
3.6.5 Wire ends shall protrude 1/16 inch beyond edge of clipped terminal.

3.6.6 Wire ends shall clear adjacent metallic parts by 1/32 of an inch minimum.

3.6.7 Textile-insulated wire shall not be terminated in slotted beam terminals.

3.7. **Solder-less Wire Wrapped**

3.7.1 Solder-less wire wrapped connections on square terminals shall conform to Figures K-2 and K-3 unless the length of the pin on the backplane does not allow for the minimum number of wraps. Common defects are illustrated in Figure K-4.

3.7.2 Pigtail connections shall not exceed 3/32 of an inch. This distance is measured from the last contact of the bare portion of the wire with the terminal.

3.7.3 Wire wraps shall be made using the tool sized to the wire gauge.

3.7.4 On terminals that are not square, 26-gauge wire shall have a minimum of 8 turns.

3.7.5 Overlapped turns shall not be counted in the number of turns of a connection.

3.7.6 Wire of gauges 28, 30 or 32 shall have one wrap of insulation in addition to the required number of wraps.

3.7.7 All connections not meeting the requirements of Figure K-2 shall be re-skinned and reconnected. Connections that cannot be rewrapped shall have a minimum of one and one half wraps for 20, 22, 24 gauge and wire shall be soldered except on equipment backplanes.

3.7.8 When solderless wrap terminals are used for cross connections, a defective wire connection shall not be soldered. The defective connection shall be removed and replaced by a satisfactory solderless wrapped connection.

3.7.9 The Installation Supplier shall not solder 26 through 32 gauge wire.

3.7.10 Exposed un-insulated wire (shiner) shall not exceed 1/8 inch.

3.7.11 Clearance between connections and adjacent metal work shall be 1/32 of an inch minimum. The wire end projection shall not violate the minimum clearance.

3.7.12 Clearances between adjacent connections shall be 1/64 of an inch minimum. The wire end projection shall not violate the minimum clearance. Wire wrap terminals on blocks, backplanes, etc. shall be straight and not bent.

3.7.13 When adding a second wire-wrap connection to a wire-wrap terminal that has a soldered connection, the Installation Supplier shall also solder the new connection.

3.7.14 The first connection on a terminal that will support multiple wire wraps shall be placed to the rear of the terminal to allow for future connections.

4. **CONNECTORS**

4.1. **710, 711 and Similar Type Connectors**
4.1.1 Cable may be spliced using modular splicing apparatus. These splices shall be done in accordance with the manufacturer's specification. The AT&T Equipment Engineer shall approve any use of these connectors.

4.1.2 The index strip shall have two wires in each slot.

4.1.3 Both halves of the connector body shall be fully latched. If not self-latching, or fitted with locking screws or securing clips, the two halves shall be secured on each end with 9-ply polyester twine, except when they need to remain readily available for rapid opening (e.g., for dial-to-dial conversion activity).

4.1.4 The cap shall be fully latched to the connector body and index strip.

4.1.5 When connectors are placed on cable racks or pressed into adjacent cables they shall be covered with heat shrink tubing.

4.1.6 Cables fitted with connectors, but not connected, shall be secured with waxed fiber cord so that the cables will not protrude into the wiring aisle behind the bay.

4.1.7 When modular splicing connectors are used on a modular (Cosmic) or a conventional type distributing frame, the connectors shall be spaced as to allow for cable growth, maintenance work, etc.

4.2. Connectorized Cables

4.2.1 The ends of connectorized cables shall be positively secured to the corresponding mate connector or backplane connector. In the event the screw, clip, or other interlocking device designed for the specific connector cannot be used, the male and female ends shall be secured with waxed fiber cord or tie wrap.

4.2.2 Connectorized cables (such as with Amphenol connectors) shall not be connected together in cable troughs or on cable racks.

4.2.3 Connectorized cables connected to the rear of units shall be secured with waxed fiber cord so that the cables will not protrude into the wiring aisle behind the bay.

4.3. Terminal Type Connectors (#10 Awg And Smaller)

4.3.1 Connections made to screw type terminals with #10 through #26 gauge tinned copper wire shall be made using the correct color coded insulated type terminal as listed on the AT&T minor material list.

4.3.2 Only one terminal type connector shall be placed under a screw or bolt.

4.3.3 The proper size connector shall be used for the wire size being terminated, as detailed in the manufacturer’s specifications.

4.3.4 Only one wire end shall be terminated in a terminal type connector (lug).

4.3.5 Terminal type connectors (lugs), except #26 - #24 gauge, shall be NRTL (National Recognized Testing Laboratory) listed.

4.3.6 All terminal type connections shall be made of tin plated copper, have a welded seam and have an insulated barrel.
4.3.7 Use the following color coded terminals for the following size wire:

- Yellow/Amber terminal  #26-#24 wire*
- Red terminal  #22-#18 wire
- Blue terminal  #16-#14 wire
- Yellow terminal  #12-#10 wire

*Not NRTL rated or listed

4.3.8 The terminal shall have one (1) crimp applied. The crimping tool shall have a full cycle ratchet mechanism that provides a complete crimp before the tool can be removed.

4.3.9 Wire ends shall protrude a minimum 1/16 inch beyond the end of the barrel.

4.4. Power Connections (Also refer to Section M)

4.4.1 The Installation Supplier shall not modify connectors.

4.4.2 The preferred method of power connection is to use a non-interrupted conductor with connecting lugs at each end. Transitional devices shall only be used when no other solutions (such as narrow tongue lugs) are applicable.

4.4.3 Mechanical connections (thread pressure type) shall not be used unless the device is designed to utilize mechanical lugs only.

4.4.4 C-Taps shall not be used on power leads.

4.4.5 Mechanical "H" taps shall not be used for one to one DC power conductor transitions. "H" taps are permitted for one to many DC conductor transitions, such as in the case of (1) 750 MCM to (2) #4/0 AWG conductors.

4.4.6 In-line reduction or (barrel) splices shall be used for all one-to-one power cable connections or reductions. The manufacturer provided clear heat shrink shall be installed per the manufacturer's instructions to cover the in-line reduction splice.

**Exception:** When a particular size of in-line reducer is not listed on the DC Minor Materials List, an H-Tap may be used.

H-Taps shall be Burndy or T&B and be a compression connector type with a clear cover that has an LOI of 28% or better and have a UL 94-V1 rating or better.

4.4.7 All power cables shall be stitched in the following manner when power transition devices (H-taps, in-line reducing splices, etc.) are utilized:

a) The cables being transitioned shall have a banding Chicago stitch placed three to six inches from the transition device where two cables are coming out of the same side of the transition device.

b) All cable bends shall be made past the stitch and shall have a minimum bending radius of 7 times the diameter of the power cable.
c) All cable bends shall be made prior to crimping the transition device. If additional cable bends are required after the crimping is completed, an additional Chicago stitch shall be placed prior to any cable bends being made.

4.4.8 Transitional devices shall not be placed on vertical power cable runs, cable rack waterfalls or height transitions (such as shown in ATT-TP-76409 Fig 6G), cable rack turns (such as shown in ATT-TP-76409 Fig 6A and 6D), inside power bays, BDFBs or other power distribution bays. The intent is to not place stress on the connection by placing it in a cable bend or in a vertical position.

4.4.9 In-line reduction (barrel) splices shall be used for all one-to-one power cable reductions to reduce cable build-up on the cable racks; H-Taps shall be used for multiple cable splices.

4.4.10 The Installation Supplier shall inspect all contact surfaces for damage (nicks to cable, etc.) prior to any crimping operation. Refer to Section J, subsection 2.3, “Damaged Cable” in the ATT-TP-76300 for proper performance criteria.

4.4.11 All battery and battery return connections shall be torqued to battery manufacturer’s specifications.

4.4.12 The Installation Supplier shall verify proper polarity before landing cables (no battery reversals). Before establishing the connection, verify that less than 0.05 volts exists between the components being connected.

4.4.13 H-Tap compression connectors, where required, shall be protected using fire retardant, UL 94-V1 rated, clear covers as listed on the AT&T Minor Materials List. Clear H-Tap covers shall be secured on each end with multi-ply twine (see ATT-P-05405 Clear H-Tap Cover Drawing on WoodDuck for additional information).

4.4.14 All battery and battery return connections shall have a flat washer under the bolt head or screw head, and another flat washer under the nut in the through-bolt configuration.

4.4.15 All bus bar power connections shall be installed per ATT-P-05100-E.

4.4.16 Star washer-nut or cup washer-nut combinations supplied by the equipment manufacturer may be used in place of individual lock washer and nuts. A separate flat washer shall be installed between the lock washer-nut combination and the connector. Once used, a star washer or cup washer-nut combination shall not be reused.

4.4.17 The exposed end of bolts or studs shall not exceed the diameter of the bolt or stud.

4.5. Compression Connections -- #8 AWG and Larger

4.5.1 All electrical contact surfaces shall be cleaned by using a non-metallic, abrasive pad, wiped clean with a clean, dry cloth and have a thin coat of NO-OX-ID “A” anti-corrosive compound applied.

4.5.2 The proper connector, wire, die and crimping tool shall be used as a system to make an acceptable circumferential (e.g., hex) crimp. Normally the same manufacturer’s equipment is utilized to form the system and maintain a Nationally Recognized Testing Laboratory (NRTL) listing. All crimping tools shall have a feature that ensures positive compression.
4.5.3 The Installation Supplier shall apply crimps in such a manner as to allow inspection of the compression type connectors such that:

a) The connector shall be marked to indicate:
   1. The NRTL listed wire size.
   2. The number of crimps.
   3. The proper die color code.
   4. The NRTL and the manufacturer’s trademark.

b) The completed crimp shall be available for inspection and shall exhibit the following:
   1. The crimp shall emboss the die code distinctly and legibly into the connector.
   2. The number of crimps shall exactly match the connector.
   3. If the die generates corners or flashing they shall be uniform and thin, with no sharp edges and excess flashing shall be removed.
   4. The connector shall not be covered with a heat shrink, unless the heat shrink is clear and rated V1 or better.

4.5.4 All connectors shall be constructed of tin plated copper, except as noted below. Aluminum connectors shall not be used.

4.5.5 When tinned plated connectors are connected to bus bars a thin coat of NO-OX-ID “A” anti-corrosive compound is required.

4.5.6 Lead coated connectors shall be used when connecting to vented lead acid (VLA, aka “flooded”) type batteries at the post or terminal plate. A thin coat of NO-OX-ID “A” anti-corrosive compound is required.

4.5.7 All connectors shall be the two (2) hole crimp type lugs except when connecting to a fuse post in a power bay or when the equipment specification drawing requires a single hole lug. Single hole lugs require an external tooth or split-ring lock washer between the bolt head and the connector, or with stud, between the nut or screw head and the connector, except when connected to a fuse post where a flat washer is also required. (Refer to AT&T Standard Drawing ATT-P-05100-E for assembly details.)

4.5.8 The proper size connector shall be used for the wire size being terminated as detailed in the manufacturer’s specifications:

a) Only one (1) wire end shall be terminated in a lug.

b) Larger wires shall not have strands removed to fit smaller connector.

c) Wires shall not be folded to fit connectors.

4.5.9 Compression type connectors shall not be attached to wire ends by soldering.

4.5.10 Wire/cable insulation shall be cut back so that, when inserted, the wire/cable extends to the full length/depth of the connector barrel or groove as viewable in the inspection hole. A small setback of the conductor from the inspection window is acceptable after the connector
is crimped, as long as the crimp(s) do not overlap or overhang the conductor in the connector barrel, and the conductor is easily viewable at the inspection window.

4.5.11 The skinner (bare wire) shall be inserted into H-taps the entire length of the H-tap.

4.5.12 The maximum shiner (space) shall be no greater than 1/16 inch between the end of the barrel and the cable insulation butt. If the shiner is greater than 1/16 inch and does not exceed ¼ inch, the space shall be covered with clear heat shrink tubing, except for grounding connectors. Where the shiner exceeds ¼ inch, the connection shall be remade. If battery and battery return cables have manufacturer applied clear heat shrink tubing, it is permissible for the connector inspection window and compression crimps to be covered.

4.5.13 Clear heat shrink tubing shall be applied per the manufacturer’s instructions (excessive heat shall be avoided).

4.5.14 Compression crimps shall not extend onto the tang area.

4.5.15 Compression crimps shall not overlap each other.

4.5.16 All compression connectors shall have an inspection hole between the tang and the barrel.

4.5.17 Connectors terminating on a flooded lead acid battery post or battery plate shall not have an inspection hole.

4.6. Grounding Conductors

4.6.1 Unless otherwise specified, all grounding and bonding conductors shall be connected by two-hole crimp type (compression) connectors with lockwashers between the lug and securing nuts.

4.6.2 Mechanical connectors, fittings, or connections that depend solely on solder shall not be used.

4.6.3 Connections to cold water pipe or conduit shall use a Burndy type GAR-TC or equivalent connector (Refer to Figure K-5).

4.6.4 Unplated metallic surfaces shall be prepared to a bare, bright finish before joining. A thin layer of corrosion preventive compound such as NO-OX-ID “A” anti-corrosive compound shall be applied to the unplated surface. If a connector is to be secured directly to a painted surface, the paint shall be removed down to bare metal and a thin layer of a corrosion preventive compound such as NO-OX-ID “A” anti-corrosive compound shall be applied to the bare metal surface. The bare metal shall be visible for inspection completely around the lug.

4.6.5 External tooth lockwashers will be allowed between the lug and contact surface on one-hole grounding lugs with conductor size No. 8 AWG and smaller. Under this circumstance, removing paint and application of NO-OX-ID “A” anti-corrosive compound is not required. A lockwasher is always required between the lug and screw head. Verification of a locking-type washer shall be by visual inspection. Refer to Figure K-1.

4.6.6 Two grounding connectors shall not be connected back-to-back on a ground bar unless:
a) The equipment served by both conductors will be completely de-powered before the securing hardware is loosened (e.g. connections at a bus bar or an equipment enclosure), or

b) A sufficient length of the conductor that will not be permanently disconnected is both available and accessible to attach a temporary bond around the securing hardware (e.g., connections at a CO ground bar or other bus bar).

4.6.7 Bolts, nuts, screws, threaded pressure devices, raceway fittings and every ground system connecting or securing device shall be free from corrosion, properly assembled, correctly tightened and accessible for inspection. Within buildings, exothermic welding may be used at water pipes, connections to grounding system bus bars and bonds to building steel. In occupied areas within a building, the use of exothermic welds shall be restricted to those methods that use “smokeless” or “low smoke emitting” processes, such as the EXOLON® process from Erico Products, Inc

4.6.8 At all bus bars, the end of every CO grounding system conductor whose far end termination is not readily apparent shall be equipped with a 145P tag (or equivalent) identifying the termination point of the opposite end of the conductor.

4.7. Lockwashers for Grounding Connections

4.7.1 This section applies primarily to the use of lockwashers with the securing hardware for connectors used to terminate the framework grounding conductor to equipment frameworks, cabinets and other enclosures.

4.7.2 These requirements apply when lockwasher information has not been furnished by another part of this document, a standard drawing, a manufacturer’s drawing or a detailed specification.

4.7.3 When a lockwasher is required, one of the following shall be used:

a) An external tooth type (ETLW) or A split ring (helical spring) type.

b) When required between the surface of a one-hole connector and the surface, to which the connector is secured, the lockwasher shall be an external tooth type. Refer to Figure K-1

c) Unless specified otherwise by the manufacturer, all types of lockwashers shall be Grade 2 or higher and shall have a zinc-chromium electroplate finish.

4.7.4 For a fastener and nut arrangement (through-bolt) or a nut only arrangement (when a stud is used), a lockwasher shall be placed between the nut and the surface to which it mates.

4.7.5 For a fastener only arrangement (tapped hole), a lockwasher shall be placed between the fastener head and the surface to which it mates. Refer to Figure K-1.

4.7.6 Additional hardware information may be found in ATT-TP-76201, Common Systems – Hardware Products and Materials Specifications.

4.8. DC Power - General Connecting

4.8.1 Equipment being installed with multiple loads (i.e. “A”, “B”, “C”, etc.):
4.8.2 Power lead connections shall not be stacked (piggy backed).

4.8.3 For a single network element (bay) with multiple feeds, it is acceptable to attach the battery return leads to the return bus bar back to back (sandwiching the return bus bar between the two return lugs). The individual bay returns shall be paired to ensure that the removal of one bay will not affect another. In the event a bay has three returns, the third return shall be stand-alone on the return bar. Returns from separate bays shall not share the same return bar position unless authorized in writing by the AT&T engineer.

4.8.4 Battery return leads shall be connected to the battery return bus bar associated with the same BDFB/SPDU FB, etc., as the related battery leads.

4.8.5 Secondary power distribution cable connections to BDFB/SPDU fuse posts shall be up to the maximum power cable size (based on circuit ampacity and voltage drop requirements) allowed by the Fuse Disconnect/BDFB Manufacturer.

4.8.6 Secondary power distribution cabling to a 1/4-20 connection stud on a 15800 (TPS) or other type Fuse Disconnect shall be up to (≤) #2AWG. Power cabling to a 5/16-18 connection stud on a TP158HC (TPL) or other type Fuse Disconnect shall be up to (≤) 2/0AWG. Manufacturer provided torque requirements shall be used unless a specific requirement is outlined in the equipment specific Wood Duck drawing, including the ATT-E-00151-E-01 drawing for fuse panels. ATT-P-05100-E provides torques values based on NEMA-CC1-1984 for use when neither the manufacturer nor the equipment drawing provides specific requirements.

4.8.7 The Installation Supplier shall apply a thin coat of NO-OX-ID “A” anti-corrosive compound to all connections of dissimilar metals to inhibit future corrosion. Cable ends shall be coated with the anticorrosive compound before making a crimp connection. All unplated connectors, braid straps, bus bars, etc., shall be brought to a bright finish and then coated with the anticorrosive compound before they are connected.
FIGURE K-1 - APPLICATION OF LOCKWASHERS

- Lug
- ETLW
- Split Ring
- Stud

Framework, bus bar, etc.

- Lug
- ETLW
- Split Ring

Framework, bus bar, etc.
FIGURE K-2-- SOLDERLESS WIRE WRAPPED CONNECTIONS

20 GA = 0.032"
22 GA = 0.025"
24 GA = 0.020"
26 GA = 0.016"
28 GA = 0.013"
30 GA = 0.010"
FIGURE K-3 – SOLDERLESS WIRE-WRAPPED CONNECTIONS

Physical Turns of Bare Wire

Start Of Turn

REFERENCE CORNER

ONE SOLDERLESS CONNECTION

TWO SOLDERLESS CONNECTIONS

THREE SOLDERLESS CONNECTIONS

Connection Near Base of Terminal When Odd Number of Terminals are Connected

Note: When surface strapping is specified, connect the incoming lead at the base of the terminal and use a similar strapping arrangement.
FIGURE K-4—SOLDERLESS WIRE WRAPPED CONNECTIONS—DEFECTS

- **A** Insufficient Turns
- **B** Excessive Shiner Length
- **C** Separation Exceeds .010"
- **D** More Than One Bulged Turn
- **E** No 4 Adjacent Turns
- **F** Overlapping Turns Discounted
- **G** Separation Exceeds .005"

NOTE: A scaled sketch depicting typical solderless wrapped connection of 24 gauge defects "A" thru "F." 28 gauge defect shown in "G"
FIGURE K-5 - Pipe Ground Connector

- #6 AWG to 750 kcmil max. Ground Wire
- Two Hole Lug (3/8" Bolts on 1" Centers)
- Burndy Type GAR-TC Ground Connector
- Conduit or Pipe

- Two Hole Compression Lug
- #6 AWG to Ground Wire
- Conduit or Pipe

- Flat Washer
- Lock Washer
- Hex Nut
INSTALLATION REQUIREMENTS
AT&T | March, 2016

Section K, ATT-TP-76300
Revised June, 2019

Method to Connect Two-Hole Grounding Lug to Conduit or Pipe
(Section 5.20.13)