

**AT&T INTERNET SERVICES TECHNICAL PUBLICATION  
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**TABLE A-1 – SUMMARY OF CHANGES IN SECTION A**

<b>Change</b>	<b>Item in 09/08 Issue</b>	<b>Item in this Issue</b>
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**1. GENERAL**

**1.1. Introduction**

- 1.1.1 The Installation Suppliers (All listed parties responsible for installation activities defined in Section A 1.3) shall ensure, as part of the evaluation of the installation, that all equipment added, rearranged or modified is properly installed and conforms with AT&TIS T installation specifications.
- 1.1.2 The Installation Suppliers (All listed parties responsible for installation activities defined in Section A 1.3) 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 ATT-TP-76301, AT&TIS Installation Requirements, provides general requirements when doing equipment installation, modification, removals or building work activity in Pointof Presence (POP) internet, video and voice over internet protocol (VoIP) locations including collocations in AT&T offices. For the purpose of this document, all these locations are hereinafter referred to as "IS Sites".
- 1.1.4 Changes in this issue of Section A are summarized in Table A-1.
- 1.1.5 AT&TIS assumes no responsibility for any costs incurred by a given manufacturer or Supplier in conforming to the requirements of ATT-TP-76301. Further, conformance to all requirements delineated in this document does not constitute a guarantee of acceptance of a given Supplier's product/service for use in AT&TIS.
- 1.1.6 AT&TIS reserves the right, without prior notice, to revise ATT-TP-76301 for any reason.
- 1.1.7 AT&TIS reserves the right to audit Installation Suppliers for compliance to ATT-TP-76301. Questions concerning the audit process or quality results should be referred to:

a) AT&TIS Quality:

Installation Quality  
2623 Camino Ramon Rm 1S100B.  
Sam Ramon, Ca 94583  
Attention: Mike Cassidy  
mc8792@att.com

**1.2. Scope**

- 1.2.1 ATT-TP-76301 applies to all types of Information Services equipment installations, i.e., Electronic equipment that performs the telecommunications operations for the transmission of audio, video, and data, including technical support equipment (e.g. computers).
- 1.2.2 ATT-TP-76301 is applicable to all installation activities in IS Sites regardless of who performs the work. This includes AT&TIS personnel and all contracted installation suppliers, including sub-contractors.
- 1.2.3 The intent of ATT-TP-76301 is to familiarize the Installation Supplier with AT&TIS installation procedural requirements by:

- a) Covering the precautions to be taken to protect personnel and to prevent service interruptions and degradation during the installation activity.
- b) Outlining the basic standards to which the Installation Supplier's performance will be expected to conform for job acceptance purposes.
- c) Defining the necessary documentation used to detail the installation activity.
- d) Defining installation start, job completion and job acceptance procedures.
- e) Identifying AT&TIS involvement during the various aspects of the installation operation.

**1.3. Definitions**

**1.3.1** Definitions of certain terms used in ATT-TP-76301 are as follows:

- a) **AT&T CRE (Corporate Real Estate Management Representative)** - The AT&T real estate management representative (Design and Construction) who is directly responsible for the engineering and installation of the environmental and infrastructure job and who has overall responsibility for job completion.
- b) **AT&TIS** – AT&T Internet Services
- c) **AT&TIS Capacity Manager**: AT&TIS manager within NP&E responsible for space and power capacity management within AT&TIS POP/Video equipment environments.
- d) **AT&TIS Equipment Engineer** - the AT&TIS equipment engineering representative who is directly responsible for the installation in progress and who has overall responsibility for ensuring job completion and acceptance.
- e) **AT&TIS Operations Engineer** – The Operations manager accountable for site integrity, JSA, MOP sign off, daily coordination with the installation suppliers., and sign off on the JCR.
- f) **DESP** – Detail Engineering Service Provider
- g) **General Contractor** – CRE alliance partner and primary contractor responsible for performing and/or coordinating on site Electrical, Mechanical and Building Construction.
- h) **High Seismic Zone** – Earthquake zones 3 and 4 as defined by USGS (United States Geological Survey).
- i) **Installation activity** - Any activity provided by an Installation Supplier including, but not limited to, additions, modifications, removals, work performed on building infrastructure, and/or other contractual services performed within IS Sites.
- j) **Installation Supplier** - The provider of installation services, including information services equipment and building infrastructure installation service providers (e.g. trade vendors), as well as AT&TIS personnel who perform installation activities.
- k) **IS Sites**- AT&TIS owned or leased premises where network elements are located.
- l) **Low Seismic Zone** - Earthquake zones 0, 1, and 2 as defined by USGS (United States Geological Survey).

- m) **Shall** - Something that is mandatory and subject to audit.
- n) **Should** - Something that is recommended.
- o) **Trade Vendor** - A contractor restricted to performing work that they are licensed and insured to perform such as Electrical, Mechanical and Building Construction
- p) **Job Folder** - A standard accordion folder with cover, minimum size 9" X 12", in which job documentation is to be filed and is to remain at the job site.

**1.4. General Requirements**

- 1.4.1 Unless otherwise indicated on the Checklist of Current Sections, ATT-TP-76301 requirements become effective for jobs starting (JSA sign off) 5 days from posting of Requirement Change Notice (RCN) to ebiz web site. The Checklist of Current Sections at the front of ATT-TP-76301 indicates the issue date and the effective date of each section. Revisions may be issued on a section-by-section basis. Along with the revised section(s), an updated Checklist of Current Sections will be issued to indicate the current issue date and effective date for each section.
- 1.4.2 The Installation Supplier shall contact the AT&TIS Equipment Engineer to request any variance from ATT-TP-76301. The Equipment Engineer shall route the request to the proper Quality and Common System team member for variance ruling. The Installation Supplier shall provide documentation of approved variances in the job folder at the job site.
- 1.4.3 The Installation Supplier shall have the ATT-TP-76301 currently in effect available (may be electronic or paper copy) at the job site.
- 1.4.4 The Installation Supplier shall have the detail specification available (may be electronic or paper copy) at the job site.
- 1.4.5 The Installation Supplier shall have available (may be electronic or paper copy) at the job site a copy of the appropriate AT&TIS equipment and interconnect drawings.
- 1.4.6 The Installation Supplier shall have available, (may be electronically or paper copy), at the job site a copy of all furnished manufacturers' drawings as required in the detailed specification.
- 1.4.7 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.
- 1.4.8 The Installation Supplier shall refer questions pertaining to the detail engineering of the job to the appropriate detail engineer.
- 1.4.9 The Installation Supplier shall notify the Detail Engineering Service Provider (DESP) and the AT&TIS Equipment Engineer in writing, of any conditions or items that do not meet the job documentation and ATT-TP-76301 requirements.
- 1.4.10 The documents listed in Table A-2 support ATT-TP-76301 and provide additional details. The Installation Supplier shall have access to these documents and shall refer to them as needed.

1.4.11 The Installation Supplier shall obtain and pay for all permits and inspections required for the work. The Supplier shall comply with all ordinances pertaining to work, including local amendments and interpretations, local adopted Building Codes, and any special codes having jurisdiction over specific portions of the work.

1.4.12 The Installation Supplier shall correct all defects within 30 days of notification, unless otherwise specified.

**1.5. Quality Assurance Programs**

1.5.1 The Installation Supplier shall comply with all Quality Assurance Programs as specified by the AT&T IS Quality Assurance Organization in support of Common Systems requirements.

**1.6. Proprietary Information**

1.6.1 All proprietary documents referenced in ATT-TP-76301 are available to contracted Suppliers through signed nondisclosure agreements or as detailed in current contracts between AT&TIS and Supplier.

**1.7. Ordering Information**

1.7.1 Internet access is available to approved suppliers for downloading electronic copies of ATT-TP-76301 and other non-proprietary AT&TIS references. Information concerning internet access can be obtained from:

Vickie Jefferson  
[vj6542@att.com](mailto:vj6542@att.com)

1.7.2 Non-AT&TIS publications referenced herein should be obtained from the originator of the publication.

**1.8. Comments On ATT-TP-76301**

1.8.1 Comments on ATT-TP-76301 shall be submitted by e-mail to:

Lawrence Lyles  
Lead Network Engineering Manager  
675 W Peachtree St NW  
Atlanta, GA 30375  
[lq1376ll4546@att.com](mailto:lq1376ll4546@att.com)

**Table A-2 – references in ATT-TP-76301**

<b>Reference</b>	<b>Title</b>
ATT-TP-76901	AT&T Installation Testing Requirements
ATT-TP-76911	AT&T E911 Requirements
NFPA 701	National Fire Protection Assn.

**INSTALLATION REQUIREMENTS  
ATT Internet Services**

**Section A, ATT-TP-76301  
September, 08**

Reference	Title
UL 214	Underwriter's Laboratories Test for Flame Pro
ASTM D1048-81	American Society for Testing and Materials
ASTM D1048-88a	American Society for Testing and Materials
NFPA 70	National Electrical Code
ATT IS-801-601-901	AT&T Common Systems Alarm Standards Practice for Information Services
ATT-812-000-032	Common Systems Through Penetration Fire stopping Requirements
ATT-TP-76202	Lumicool Lighting Fixture EF&I Methods and Procedures
ATT-TP-76403	Grounding and Bonding Requirements for Internet Services Facilities
ATT-C-98022-71	SNET Building Ground System (AT&T East)
ATT-W-98023-31	Building Ground & Equipment Ground System (AT&T East)
ED-97729-11	Protective Grounding Systems for Central Office Equipment
Quality Assurance Programs	Service Interruption Program
ATT-TP-76201	Common Systems Hardware Products and Materials Specifications
BSP 800-000-101	Anchoring Requirements
ATT 800-000-101	Anchoring Requirements
Quality Assurance Programs	Standards of Conduct
ATT-TP-76306	Electrostatic Discharge Control
ATT-TELCO-002-316-043	Fiber Distribution Frame M&P, Common System website under tab 6, M&P 9 Digit practices

**[END OF SECTION]**

**SECTION B -- GENERAL INSTALLATION REQUIREMENTS**

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**TABLE B-1 – SUMMARY OF CHANGES IN SECTION B**

Change	Item in 03/31/07 Issue	Item in this Issue
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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&TIS 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 general requirements related to safety, environmental, care of building facilities and premises, compliance with laws, rules and ordinances, and equipment preparation for installation.
- 1.1.4 Changes in this issue Section B are summarized in Table B-1.
- 1.1.5 Many of the items addressed in this section (e.g., building facilities, building conditions, etc.) will require joint AT&TIS/CRE/Installation Supplier review in advance of the actual installation activity. Sufficient time shall be incorporated into the total job schedule to allow for alterations, additions (prior to the equipment installation timetable) and/or the additional expense approval by AT&TIS Equipment Engineer.
- 1.1.6 For warranty purposes, the equipment manufacturer may have documented installation requirements pertaining to the "foot print of the equipment." If these requirements conflict with the requirements given in ATT-TP-76301, the manufacturer's requirements shall apply.
- 1.1.7 The Installation Supplier shall provide at a minimum, a Level 3 representative (see Section C) on-site to oversee any non-volatile work performed by the Installation Supplier's non-approved subcontractors.
- 1.1.8 The Installation Supplier shall provide a Level 4 representative (see Section C) on-site to oversee any volatile work performed by the Installation Supplier's non-approved subcontractors.

**1.2. Safety**

- 1.2.1 The Installation Supplier shall be entirely responsible for the safety and instruction of its employees or representatives.
- 1.2.2 All temporary installations shall adhere to the safety requirements for permanent installations.
- 1.2.3 The Installation Supplier shall take precautions to avoid harm to personnel, equipment and building (e.g., cutting installed threaded rod).
- 1.2.4 The Installation Supplier shall suspend work operations immediately when so instructed by AT&TIS.
- 1.2.5 The Installation Supplier shall immediately report to the AT&TIS Operations Engineer any accident, outside agency inspection or hazardous condition, including:

- a) Any accident or injury that occurs to employees or subcontractors of the Installation Supplier while on AT&T/AT&TIS premises.
  - b) Any OSHA inspection or citations issued to the Installation Supplier while on AT&T/AT&TIS premises.
- 1.2.6 Floors and work area shall be kept free of all potential hazards. The Installation Supplier shall avoid creating a slip or trip hazard.
- 1.2.7 Temporary storage of combustible materials during installation projects in non-fire suppressed Network Equipment and electrical/mechanical areas is not permitted without prior approval from the CO Manager/LFO and documented in the JSA/MOP.
- 1.2.8 If space is available, secured storage containers outside of the building should be provided by installation contractors for combustible storage. All installation materials and network equipment packaging or transport structures that may be considered combustible requiring storage on site shall be stored away from network equipment, in-service network equipment and energized electrical equipment areas. Package staging areas in the building protected by suppression systems may be used for temporary storage if available.
- 1.2.9 If there is no other option for the temporary storage of combustible packaging materials and transport structures except within equipment areas or non-fire suppressed staging areas, then a fire retardant and anti-static tarp shall be used. The tarp shall completely cover and be tucked securely under the material. The materials shall be stored a minimum of 10 ft. away from active network and electrical equipment. Temporary storage groups shall not exceed 100 sq. ft. in area. A minimum 10 ft. firebreak shall be provided between each tarped storage group.
- 1.2.10 The tarp shall meet NFPA 701 and ASTM E-84 Class A, be clearly marked as such and have a surface resistance between  $10^5$  and  $10^{12}$  ohms psi.
- 1.2.11 All combustible materials temporarily stored shall be provided with the date the material arrived at the temporary storage location. The material shall also be identified with the name and phone number of the installation contractor. The maximum time materials may be temporarily stored in an equipment area cannot exceed 7 calendar days. The temporary storage arrangement may be extended, if approved by the CO Manager/LFO, but for never greater than 30 calendar days from arrival without making other suitable arrangements for removing combustible materials from inside the building.
- 1.2.12 During a construction project, all combustible packaging shall be removed from all materials kept in communications equipment areas of a central office. When this is not possible, e.g. a wood cable reel, these materials shall be stored under an approved tarp (as outlined in 1.2.9) and shall not exceed 100 sq. ft. of floor space. These materials shall only be present while the job is in progress and shall be removed immediately upon completion of the job.
- 1.2.13 The Installation Supplier shall store flammable materials i.e. spray paint, solvents, etc., outside the building in a fire rated cabinet, if available, or remove the material from the AT&TIS property.

- 1.2.14 All waste materials, such as waste paper, foam, plastic, cloth bags, packing boxes, packing material and similar material supplied during the installation, shall be removed from the building by the Installation Supplier on a daily basis (or more frequently if required).
- 1.2.15 All walkways, entrance and exit routes through the equipment area shall be kept clear of tools, equipment, equipment packaging, cable, etc. Caution signs shall be posted where needed.
- 1.2.16 The Installation Supplier shall not obstruct doorways, equipment aisles, corridors, stairs, fire exits, fire extinguishers and fire fighting equipment, pull box alarms and electrical breaker/fuse panels.
- 1.2.17 If the Installation Supplier has any questions in regard to safety, contact AT&TIS Operations Engineer.
- 1.2.18 The Installation Supplier shall ensure the following during the installation:
  - a) That its employees are informed of any hazards that may exist on the job and the action required, minimizing the risk of personal injury, property damage, or service interruption. Furthermore, all Installation Supplier personnel shall comply with the safety guidelines and policies that are followed by AT&T in installation equipment areas (e.g., safety glasses).
  - b) That personal protective clothing and equipment, such as cotton gloves, heat resistant gloves, low-voltage rubber gloves, ear protection, safety eyeglasses, etc., are provided and used to minimize the risk of personal injury.
  - c) That combustible furniture is not brought into equipment areas.
  - d) That apparatus or materials are not stored in equipment aisles, corridors, stairs or fire exits.
  - e) That Installation Supplier's personnel adhere to AT&T's non-smoking policy.
  - f) That precaution is taken to prevent fire resulting from the use of temporary wiring, test wiring, lamps, soldering irons and other similar equipment.
  - g) That Installation Supplier personnel are familiar with the building's evacuation features.
  - h) That Installation Supplier personnel are familiar with the location and use of the fire extinguishing equipment in the installation area.

**1.3. Safety, Tools and Precautions**

- 1.3.1 The Installation Supplier shall provide its own tools.
- 1.3.2 Extension cords shall be NRTL listed, three conductor, 14 gauge or larger, commercial grade.
- 1.3.3 All tools used for installation activities on and adjacent to "hot power" environments, (e.g., the common battery supply and grounded battery return in the power room or area, and power distribution boards, cabinets or bays, BDFBs, PCFDs, UPSs, FDCs, PDUs and AC panels), shall be factory (OEM) double insulated. Only double insulated compliant single ended box

and open end wrenches, socket sets (including compliant ratchets, sockets, extension bars and torque wrenches), nut drivers, screwdrivers and hex (allen) type wrenches are approved for hot power installation.

- 1.3.4 All battery and AC powered tools shall be double insulated.
- 1.3.5 The Installation Supplier shall inspect all tools that are used for installation activity in AT&TIS equipment areas before the start of each shift.
- 1.3.6 The Installation Supplier shall remove all personal jewelry when performing any installation activities.
- 1.3.7 Safety goggles, face shields, appropriate protective clothing for the job being performed (i.e. battery apron and gloves) shall be worn when working with batteries. (ref OSHA technical manual Section 8 chapter 1)
- 1.3.8 Metal framed ladders, metal desks and metal chairs shall not be allowed in the immediate vicinity of Information Services and power equipment.
- 1.3.9 Non-conductive measuring devices shall be used in the vicinity of working equipment.
- 1.3.10 Insulating floor mats shall be used for personal protection from electrical shock while performing work on or adjacent to power equipment.
- 1.3.11 Caution shall be exercised when working in the vicinity of equipment and tools with rotating components. Loose clothing may become entangled in the equipment.
- 1.3.12 Insulated blankets that comply with ASTM D1048-93 or ASTM D1048-88a shall be used when working in or around primary and secondary power equipment.

**1.4. Environmental Issues**

- 1.4.1 The Installation Supplier shall follow the guidance provided in Sections G and V of ATT-TP-76301 when addressing Hazardous Materials and Waste management.

**1.5. Vacuum Cleaners**

- 1.5.1 A vacuum cleaner equipped with a High Efficiency Particulate Arresting (HEPA) filter may be used for removing metal shavings and other debris, except debris that contains or is presumed to contain asbestos. The vacuum cleaner used shall conform to the following requirements:
  - a) The HEPA filters shall provide a particle collection efficiency of 99.97% or greater for particle size of 0.3 microns or smaller.
  - b) Hoses and any other vacuum cleaner components that may come in contact with electronic equipment shall be made with insulating material.
- 1.5.2 When it is necessary to use vacuum cleaners in the Information Services Equipment environment, the following procedures shall be followed:
  - a) Vacuum cleaners shall not be plugged into any receptacle located within an equipment rack or bay.

- b) Electrostatic discharge (ESD) protection procedures, per Section N of ATT-TP-76301, shall be followed when vacuuming electronic equipment.
- c) Bumping the vacuum cleaner into frames shall be avoided.
- d) The secondary air source (exhaust) coming from any vacuum cleaner shall be directed to previously cleaned surfaces. Exhaust air shall not hit unclean surface where the dust could be disturbed.
- e) When vacuuming on cable racks or other areas above frames, the Installation Supplier shall cover the frames with ESD-coated sheeting to prevent debris from dropping into the frames.

## **2. BUILDING FACILITIES AND CARE OF PREMISES**

### **2.1. Access**

- 2.1.1 Hours of access shall be specified in the Job Start Agreement before start of installation activity. Written agreement is not required when an AT&TIS employee accompanies the Installation Supplier for a site visit with no installation activity.
- 2.1.2 The Installation Supplier shall follow the directions from AT&TIS Equipment Engineer regarding the use of ID cards and electronic card keys and all metal keys.
- 2.1.3 Installation Supplier personnel shall wear his/her own approved company ID and their own AT&T approved Installation Supplier ID Card at all times while on AT&T premises. The cards shall be worn at or above the waist with the front side showing. AT&T Operations Engineer may issue access cards and restrict Installation Supplier personnel to the facilities and dates specified on the card. Installation Supplier personnel shall surrender the card when so requested by AT&TIS Operations Engineer.
- 2.1.4 Installation Supplier personnel shall sign AT&TIS building register, where required, upon entering and exiting the facility.

### **2.2. AC Power, Heat and Light**

- 2.2.1 AT&TIS shall provide electric power for all necessary purposes, with suitable outlets in areas in which work is to be performed.
- 2.2.2 Convenience outlets located overhead or in the base of the equipment bays are for general use. They shall be used to power test equipment, power tools or building maintenance apparatus (buffers, vacuums, etc.). They shall not be used to power Information Services equipment Heat and general illumination (of a permanent or temporary nature) in rooms in which work is to be performed or material stored, will also be provided by AT&T.
- 2.2.3 AC outlets located within equipment bays are for powering Information Services equipment only.
- 2.2.4 The Installation Supplier shall provide temporary lighting for specific work operations. Use of fluorescent lights or other lights requiring ballast shall be approved by the AT&TIS Operations

Engineer prior to their use. However, in no case shall fluorescent lights requiring ballast be used without an Alternating Current Equipment Ground (ACEG).

- 2.2.5 The Installation Supplier's personnel shall make no adjustments to controls, thermostats or venting of the heating or cooling plant. Any adjustments needed shall be directed to the AT&TIS Operations Engineer.

**2.3. Floor Space For Administrative And Equipment Storage Purposes**

- 2.3.1 An agreement shall be reached with representatives of AT&TIS and the Installation Supplier(s), and with LEC or local operations group in instances where the POP or VHO is located in a central office or T legacy building, as to the availability of suitable floor space at installation start and during progress of the installation work to be used for the following:

- a) Storing major items of material. Floor space in equipment buildings shall not be used as warehouse space. Material shall not be stored in such a manner as to exceed the safe floor load of the building. If storage space is not available for storing job material, the Installation Supplier shall provide temporary storage space in an AT&T approved area.
- b) Administrative space and luncheon facilities.
  - 1. Administrative space will only be provided at the location where the installation activity is occurring. Telephone services and office furniture are not included.
  - 2. Food or drink shall not be brought into the equipment areas.
- c) Storing tools and other property belonging to the Installation Supplier.
- d) Restroom facilities and supplies such as towels and soap at all locations in which work is in progress.

- 2.3.2 AT&TIS will not be responsible for:

- a) Providing parking facilities for Installation Supplier's vehicles without prior agreement.
- b) The personal possessions of Installation Supplier's employees (e.g., jewelry, tools, etc.).
- c) Mail or equipment delivery service arrangements for the Installation Supplier.
- d) FAX, internet access or telephone service without prior agreement. All toll calls or charges are the responsibility of the Installation Supplier. When telephone services are to be used only for equipment testing purposes, the AT&TIS Operations Engineer will arrange for the necessary services.
- e) Office Supplies

- 2.3.3 The Installation Supplier shall not use AT&T trash containers without approval.

- 2.3.4 Cell phones, PCSs, or a two-way radios (Family Radio service FRS) can be used in an IS POP/Video room within a central office with communications equipment when the POP/video room is separated and enclosed within one hour rated fire walls.

- 2.3.5 Cell phones, PCSs, or a two-way radios (FRS) shall be turned off when in transit through the telco equipment room.

- 2.3.6 Cell phones, PCSs, or a two-way radios (FRS) can be used in an IS POP/Video room in commercial leased space or telco space not designated for communication equipment unless otherwise posted.
- 2.3.7 The use of radio frequency devices in equipment rooms containing telecommunications equipment is strictly forbidden. (i.e. cell phone, PCS, etc.).
- 2.3.8 Prior to entering a central office telecommunications equipment room, cellular and PCS telephones shall be turned completely off. Operation of these devices within central office telecommunications equipment rooms in any mode is strictly prohibited.
- 2.3.9 The use of two-way radios in equipment rooms is forbidden without AT&T approval on a case by case basis.
- 2.3.10 Cameras and Photo Equipment are prohibited in any room or area housing electronic telecommunication equipment except for direct AT&T business purposes and with AT&T approval. AT&T approval shall only be given on a case by case basis.
- 2.3.11 Gas or electric welding/cutting equipment, torches or other open flame devices, and internal combustion engine-powered equipment shall not be allowed in AT&T buildings without permission of the AT&T Operations Engineer.
- 2.3.12 The employees of the Installation Supplier shall not be allowed to bring any powder actuated fastening devices, including exothermic welding devices, onto AT&T premises without prior approval.
- 2.3.13 The employees of the Installation Supplier shall not be allowed to bring firearms or explosive devices onto any AT&T premises.

**2.4. Openings, Alterations And Repairs To Buildings**

- 2.4.1 The Installation Supplier shall contact AT&TIS Equipment Engineer and AT&T CRE Representative if openings, alterations or repairs to buildings are required to allow material to be placed in position or to provide necessary openings and ducts for cables/conductors in the floors and walls.
- 2.4.2 Installation supplier shall contact AT&TIS Equipment Engineer if existing openings have not been previously closed properly, not fire stopped to requirements, too full of cables or opening requires attention.

**2.5. Equipment Protection and Building Security**

- 2.5.1 The Installation Supplier shall provide adequate protection of buildings and equipment. Such protection shall be of a nature to ensure against any possible damage, or wear and tear to, or degradation of operational, physical, chemical and/or electrical properties of buildings and equipment. The following are examples of protection and are not the only cases where protection is required:
  - a) An approved method of dust containment shall be used while drilling floors, walls, and ceilings. (See Section G of ATT-TP-76301 for floor drilling requirements.).
  - b) Fiberboard (e.g., Masonite) or approved floor mats shall be used to protect floors.

- c) Existing equipment shall be protected, horizontally and vertically, to prevent damage during installation activities, as identified in the pre-start job meeting. The need for protection within a 10 foot sphere surrounding the equipment shall be considered.
  - d) Fiberboard (e.g., Masonite) shall be used to protect equipment from physical damage.
  - e) Anti-static and fire retardant tarp shall be used to protect working equipment from dust and debris. The tarp shall meet NFPA 701 or UL 214 and have a surface resistivity between  $10^5$  and  $10^{12}$  ohms psi.
  - f) For protection of equipment that is cooled by either a forced air fan or a heat baffle, fiberboard, in the form of "pegboard" that is treated with approved flame-retardant shall be used. The pegboard shall be placed immediately before starting the daily activity and removed immediately after completion of the daily activity.
  - g) Stored cable reels shall be blocked or otherwise secured at all times to prevent their movement.
  - h) Cable shall not be dragged across unprotected flooring. The use of fiberboard or approved floor mats shall be used as floor protection while running cable in IS sites.
  - i) Electrostatic discharge protective devices necessary for handling and storing circuit packs and other sensitive equipment shall be provided and used by the Installation Supplier.
- 2.5.2 Installation Supplier personnel shall avoid climbing, standing, or performing any installation or removal activity while on cable racks. If an installation or removal operation cannot be performed from ladders, protection for the cables shall be provided. The protection provided shall be fire retardant and of sufficient size and thickness to spread the load of the installer's weight on the cables and prevent damage to sheathing of the top layer of cables.
- 2.5.3 The Installation Supplier shall post warning signage identifying overhead work activity in progress.
- 2.5.4 All frames waiting installation or transportation and not bolted in place shall be secured to auxiliary framing or a building column with webbed polyester/nylon or equivalent straps of at least 1 inch width. Straps and buckles shall be rated at a minimum 1000 pounds tensile strength. In low seismic locations, one strap can be used. In high seismic locations two straps shall be used.
- 2.5.5 The Installation Supplier is responsible for Installation Supplier caused damages. The Installation Supplier shall correct the damage or reimburse AT&TIS for repair of damage before final job acceptance.
- 2.5.6 The Installation Supplier shall not act as an agent of AT&TIS.
- 2.5.7 The Installation Supplier shall guard against and take the necessary steps to prevent unauthorized visitors from entering that portion of AT&TIS premise for which the Installation Supplier is responsible. Exterior openings (e.g. doors, windows, etc.) or interior security openings shall not be left open and unattended.

2.5.8 AT&T may designate the particular gate and/or entrance to be used by the Installation Supplier to enter and leave the premises during installation activity.

2.5.9 The Installation Supplier shall comply with AT&T security policies by ensuring that the premises are locked and secured at all times. All security devices such as windows, screens, fences, doors, gates and other similar equipment shall be in place at all times, except when temporary removal is necessary for the installation of equipment. Any security equipment temporarily removed or disabled by the Installation Supplier shall be replaced at the end of each working day.

**2.6. Drilling in Ceilings and Walls**

2.6.1 The Installation Supplier shall not install ceiling inserts unless authorized by AT&TIS Equipment Engineer or an AT&T CRE representative.

2.6.2 Precautions shall be in place to protect equipment and personnel below, from falling debris.

2.6.3 Tools used for drilling holes into concrete ceilings shall be supplementally supported to avoid the craftsperson from having to hold tool unassisted.

2.6.4 A HEPA vacuum cleaner or drilling equipment equipped with a vacuum attachment shall be utilized when drilling holes in ceiling or walls.

2.6.5 If the drilling of holes in the ceiling or walls is within a 10-foot sphere or over working equipment, additional methods shall be utilized to isolate dust, debris or other air borne contaminants from Information Services equipment. These methods may include but are not limited to:

- a) Anti-static, fire retardant sheeting or canvas may be used to contain dust and masonry from Information Services equipment.
- b) Drilling with various containment devices designed to control dust, debris or other air borne contaminants from Information Services equipment (i.e. cone, plunger or sphere surrounding shaft of drill).

2.6.6 Methods utilized to isolate dust, debris or other air borne contaminants from Information Services equipment shall be addressed in a Job Start meeting.

**2.7. Penetrating Waterproof Environments**

2.7.1 Before drilling into any basement floor, basement wall, or power environment, the Installation Supplier shall determine from AT&T Equipment Engineer and AT&T CRE Representative whether waterproofing has been provided and the special requirements for anchoring equipment.

2.7.2 Concrete slabs on grade that have been unintentionally drilled all the way through the slab shall be sealed with silicon caulking at bottom of hole prior to installation of floor anchors.

**2.8. Cutting, Filing or Drilling of Metal and Plastic**

- 2.8.1 The Installation Supplier shall strictly control the cutting, filing or drilling of metal or plastic to prevent the introduction of metal filings and other contaminants in all Information Services equipment areas.
- 2.8.2 Any work activity that requires cutting, filing or drilling of metal or plastic shall be performed outside Information Services equipment area. The Installation Supplier shall have AT&TIS Representative designate the location for this work activity.
- 2.8.3 The Installation Supplier shall maintain a clean work area by cleaning up the metal shavings and other contaminants as the work progresses.
- 2.8.4 Methods for cutting, filing or drilling of metal or plastic outside of Information Services equipment areas may include but are not limited to:
- a) A HEPA Vacuum cleaner shall be utilized to control metal filings and other contaminants.
  - b) Cutting, filing or drilling activity shall be performed in a manner that will prevent metal filings and other contaminants from entering Information Services equipment areas (i.e. cutting, filing or drilling activity performed over and into boxed area outside of walkways)
  - c) All surface areas of this material shall be wiped clean of all metal filings and contaminants before material is brought into Information Services equipment areas.
  - d) Materials used for cleaning metal filings and other contaminants shall be disposed of outside the Information Services equipment area.
- 2.8.5 In unusual circumstances, where cutting, filing or drilling of metal or plastic can not be performed outside the Information Services equipment area, the following precautions shall be taken to prevent the introduction of metal filings and other contaminants into Information Services equipment.
- a) A HEPA vacuum cleaner and/or cutting, filing or drilling equipment equipped with HEPA vacuum attachments shall be utilized.
  - b) Anti-static, fire retardant sheeting or canvas shall be utilized to control and contain metal filings and contaminants from Information Services equipment. Various methods of deployment of anti-static, fire retardant sheeting or canvas are acceptable depending on the work activity to be performed. Precautions shall be taken in all methods of deployment not to restrict airflow to Information Services equipment. Examples:
    - 1. Placing or draping anti-static, fire retardant sheeting or canvas adjacent to Information Services equipment in cutting, filing or drilling work area.
    - 2. Taping and forming anti-static, fire retardant sheeting or canvas in the cutting, filing or drilling work area to prevent metal filings or other contaminants from entering Information Services equipment.
    - 3. Placing an anti-static, fire retardant sheeting or canvas curtain around the cutting, filing or drilling work area to prevent metal filings or other contaminants from entering Information Services equipment.

4. When extensive cutting, filing or drilling activities are required, an anti-static, fire retardant sheeting or canvas partition wall shall be utilized to prevent metal filings or other contaminants from entering Information Services equipment.

### **3. COMPLIANCE WITH LAWS, RULES AND ORDINANCES**

#### **3.1. Permits And Rights-of-Way**

- 3.1.1 The AT&TIS/AT&T CRE Representative will provide the right-of-way, permits and authority for installation of equipment where the Installation Supplier is restricted from obtaining such right-of-way, permits, etc.

#### **3.2. Laws, Rules And Ordinances**

- 3.2.1 The Installation Supplier shall comply with all applicable federal, state, county and local laws, ordinances, regulations and codes.
- 3.2.2 The Installation Supplier shall comply with all applicable Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) regulations when dealing with hazardous materials and other work place hazards.
- 3.2.3 Where applicable, all work performed by the Installation Supplier shall meet or exceed the technical requirements of the National Electrical Code (NEC) and all state, county and local codes.
- 3.2.4 In the job start meeting, the Installation Supplier shall discuss with AT&TIS Operations Engineer any hazardous materials existing in the IS Site and/or hazardous materials to be used on the job and handled per the requirements of Section V.

### **4. EQUIPMENT**

#### **4.1. Cross-Connections**

- 4.1.1 AT&TIS personnel will normally be responsible for installing/removing cross-connect terminations before, during and following all installation activities.
- 4.1.2 If the Installation Supplier is instructed to install cross-connections as part of the installation activity, the cross-connect termination lists shall be furnished by AT&TIS.

#### **4.2. General Cleaning**

- 4.2.1 The Installation Supplier shall perform general cleaning of the installed equipment and storage areas (e.g., cleaning floors of debris, packing material, etc.) daily during the entire installation period and at job completion for all types of installations.
- 4.2.2 The Installation Supplier shall ensure that all equipment is free of dust and foreign substances before being brought into an equipment area.
- 4.2.3 Cleaning shall be scheduled and performed consistent with local requirements. The frequency of required cleaning is affected by the type of ventilation and the presence of

filtering systems. The Installation Supplier shall post the Material Safety Data Sheet (MSDS) form for chemicals used in cleaning operation.

**WARNING 1:** All cleaners and polishes used on Information Services equipment shall be silicone free.

**WARNING 2:** Spray cleaners shall not be used unless specifically authorized by AT&TIS.

**4.3. Test Equipment**

4.3.1 The Installation Supplier shall use properly calibrated test equipment.

4.3.2 Test equipment owned by AT&TIS for equipment maintenance will not be available for installation purposes except in specific cases where prior arrangements are made with AT&TIS.

4.3.3 Any test equipment and/or spare equipment provided, as part of the job is the responsibility of the Installation Supplier. In most instances, the test equipment will not be turned over to AT&TIS until the associated equipment installation is completed. However, upon request, AT&TIS personnel may have access to the test equipment to permit the checking of circuit features or to allow the testing of added equipment to which test circuits can access.

**4.4. Installation Supplier Inventory and Inspections**

4.4.1 The Installation Supplier shall make a visual inspection of all equipment and apparatus shipped to the job site (prior to installation) to identify any physical damage, defects or problems that may prevent its proper installation, maintenance and/or operation. The Installation Supplier shall notify AT&TIS Operations Engineer verbally as soon as practical and in writing within 24 hours of the verbal notification for resolution when damaged or defective equipment is discovered.

4.4.2 The Installation Supplier shall inventory all equipment and material shipped to the job site post Job Start Agreement meeting and prior to job start. Equipment and material received after job start shall be inventoried as well. Questions and/or shortages shall be directed to the appropriate AT&TIS Operations Engineer as specified in the job documentation.

4.4.3 All equipment reused from another job site and equipment relocated within the same job site shall be upgraded by the Installation Supplier to meet current ATT-TP-76301 requirements (e.g. replace mechanical lugs and parallel taps with crimp type lugs and H-taps, remove old stenciling, replace aluminum lugs with UL approved copper lugs, etc.). Information on equipment drawings rated Manufacturer Discontinued (MD) or Addition and Maintenance (A&M) shall be superseded by the latest apparatus and wiring figures, drawings and requirements.

**[END OF SECTION]**

**SECTION C -- INSTALLER SKILL LEVEL ASSESSMENT**

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**TABLE C-1 – SUMMARY OF CHANGES IN SECTION C**

Change	Item in 09/08 Issue	Item in this Issue
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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&TIS 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 provides criteria for qualifying the Installation Supplier and their personnel to perform installation activities.
- 1.1.4 AT&T reserves the right to verify the Suppliers and their installer's skill level, and review the Installation Supplier's qualification process.
- 1.1.5 Changes to this issue of Section C are summarized in Table C-1.

2. SUPPLIER AND INSTALLER SKILL LEVEL REQUIREMENTS

2.1. Assessment of Supplier's Qualifications

2.1.1 The Supplier's qualifications are categorized as Tier 1 and Tier 2 as defined below. The Supplier's rating level determines the type of work the Supplier can perform.

2.1.2 An AT&T Approved Installation **Supplier** is qualified to work in an AT&TIS POP/Video office in the system technology category that they have been approved in by the appropriate vendor approval team. The system technology categories that a vendor Supplier can be qualified to work in are listed below.

- a) Common Systems: Cable Racking, Iron Work, Equipment Frames (frames (bay frame), MDF, FDF, and Lighting, Building System Grounding, Bay AC outlets, Etc.
- b) Information Services Equipment: Servers, Routers, Switches, Video, Alarm/Telemetry and Test equipment including secondary AC and DC power distribution.
- c) Information Services Equipment: Servers, Routers, Switches, Video, Alarm/Telemetry and Test equipment **excluding** secondary AC and DC power distribution.

Transport: Transport equipment (e.g. Telco SONET equipment) installation including secondary power distribution

- d) Power Equipment:

All AC and DC primary power work including power frame, equipment (includes Power Plants, UPS, Inverter Plants, Battery Plants, Engine Generator Plants, BDFBs), installation and connection to all primary equipment and frames.

- e) AC Installation Matrix

Who does work on load side of AC panel*	CRE	Tier 1 Supplier	Power Supplier
PSC to AC receptacles and NE aisle lights	2**	1	1
Lighting Panel to NE aisle lights	2	1	1
Lighting Panel to building lights	2	N/A	N/A
PDSC (w/o network power load) to AC receptacles and NE aisle lights	N/A	1	1
PDSC (w/ network power load)	N/A	N/A	1
PPDSC to load	N/A	N/A	1
General purpose power panel to building receptacles	2	N/A	N/A

\*An AC panel may be defined as:

**Power Service Cabinet (PSC)** is a general purpose AC panel that can be used for "Test" receptacles; convenience receptacles; lighting circuits and other general AC loads. These AC panels are generally, but not necessarily, connected to "essential" power which has standby engine backup.

**Power Distribution Service Cabinet (PDSC)** is a dedicated AC panel to distribute "essential" AC power to DC plant rectifiers; UPS; AC Maintenance Bypass; and other power equipment.

**Protected Power Distribution Service Cabinet (PPDSC)** is used to distribute UPS or Inverter "protected" power to AC loads that cannot tolerate an interruption. Never use an AC panel containing critical network loads for aisle lighting or receptacle service.

\*\*Indicator that defines who can perform the work function on the first column of the chart above:

1. Level 4 installer (experienced with the installation of AC wiring) performs the work or licensed electrician.
2. Licensed electrician or CRE (per local agreement).

Notes:

- Network Power includes "essential" AC power to DC plant rectifiers; UPS; AC Maintenance Bypass; and other power equipment.
- Installation Supplier Approval Process is responsible to get work done. May use Level 4 installer (experienced with the installation of AC wiring), CRE suggested licensed electrician, Tier 1 Power Supplier or CRE (per local agreement).
- See Figure C-1 for Central Office Demarcation Between AC Building Power And Communications Power

**2.1.3 Tier 2 Approved Suppliers:** "AT&T Collocation Approved Installation Suppliers - These suppliers have been approved to perform collocation installation work for CLECs in all AT&T Incumbent central offices in the Collocator's Physical footprint (Caged Collocation area and/or in the "footprint of the bay" in Cageless Collocation. This category of approval does not include the Tier 2 supplier's access to common areas, installation of cabling outside of the cage or the "footprint of the bay" in cageless collocation, virtual collocation, the MDF or the Power Board/BDFB central office areas. Tier 2 Suppliers can only coordinate a JSA/MOP for work within a Collocator's footprint. In addition, the JSA/MOP cannot include work scopes that require a Tier 1 Supplier. In order to attain Tier 2 approval a Supplier is required to complete a full day "Train-The-Trainer" training session from the AT&T Network Planning and Engineering Quality organization annually.

**2.1.4 Tier 1 Approved Suppliers:** A Supplier can request to be considered for approval as an AT&T Approved Installation Supplier (Tier 1 Supplier) by applying through AT&T Procurement Contract Management. Selection of new candidates for the Tier 1 approval process is made on an "as needed" basis by AT&T based upon the overall AT&T job volumes with the goal of maintaining enough total capacity among the Tier 1 Suppliers to handle the volume demand of the AT&T, an installation Supplier is selected for approval trialing by AT&T, the installation supplier is allowed to submit a firm price quote on jobs in the area/region of the AT&T representative that sponsored the Supplier. The installation Supplier must successfully complete 5 evaluation jobs in the technology category for which they have been sponsored by AT&T (Common Systems, Information Services Equipment, Transport, Power, Batteries, Engines, etc). Each job will be audited by AT&T. The job quality level shall meet AT&T's defect quality criteria. Once the installation Supplier has passed 5 consecutive certification audits, the supplier will be reviewed and, if accepted by the AT&T review team, their company name will be added to the AT&T Tier 1 list for the technology category. A Tier

1 supplier shall maintain an acceptable defect rate in order to retain this approval status. The list for Tier 1 Suppliers is maintained by AT&T Procurement Contract Management.

**2.2. Assessment of trade Vendor Qualifications**

- 2.2.1 All trade vendors sub-contracted by CRE Shall be approved by CRE to perform said work. This approval is based upon experience, proven competency and demonstrated performance in their particular trade.
- a) APPROVED INSTALLATION SUPPLIERS MAY BE LICENSED AND EXPERIENCED TRADE VENDORS. APPROVED INSTALLATION SUPPLIERS SHALL USE CRE APPROVED TRADE VENDORS WHEN THEY NEED TO SUBCONTRACT ELECTRICAL OR MECHANICAL WORK.
- 2.2.2 AT&TIS Equipment Engineering shall use CRE or Property Management approved Trade Vendors to address capacity and/or reliability issues (Electrical or Mechanical) at commercial leased sites
- 2.2.3 AT&TIS Operations shall use CRE or Property Management approved Trade Vendors to fix urgent maintenance problems (Electrical or Mechanical)

**2.3. Assessment of Installation Supplier Qualifications**

- 2.3.1 Installers' qualifications are categorized as Levels 1 through 4 as defined below. This skill level assessment is based on the installer's years of experience in specific systems/environments and his/her ability to perform work operations/job activities associated with equipment installation activities.
- 2.3.2 If the Installation Supplier can demonstrate to AT&T a documented program for qualifying an installer on specific work activities and specific systems, related to the level requirements indicated below, the Installation Supplier's rating of its personnel will be accepted. The Installation Supplier shall participate in the AT&T supplier verification process, such as a Quality Program.
- 2.3.3 While the years of experience listed for an individual level is the recommended minimum for that level; advancement from one level to the next shall not be based solely on the installer's years of experience. The Installation Supplier shall assure and concur that the installer has the appropriate skills and abilities to competently progress to the next skill level before the installer performs work operations/job activities associated with a higher level.
- 2.3.4 All levels require a complete understanding of the equipment installation requirements and procedures associated with the work operation/job activity being performed. In addition, installers at Levels 3 and 4 require a complete and in-depth understanding of the equipment installation standards and requirements of ATT-TP-76301.

- 2.3.5 The Installation Supplier shall assess and classify its personnel working on Information Services equipment by skill level in each of the following systems/environments:
- a) Common Systems
  - b) Information Services Equipment
  - c) Transport
  - d) Power
- 2.3.6 All Installation Supplier personnel shall carry in their possession and provide, upon request, a Skill Level Identification Card that provides identification of their skill level in each applicable system(s) for which they are qualified.
- 2.3.7 Once classified at a specific level on a system/environment, the installer shall perform only work operations/job activities associated with the assigned level unless properly supervised by an installer of the appropriate level.
- 2.3.8 A Level 3 or 4 installer shall directly supervise Level 1 and 2 installers. The in-charge or job supervisor shall be "on-site" to direct the Level 1 or 2 installers.

**2.4. Skill Level Definition and Activities**

2.4.1 Installers at Level 1 shall:

- a) Be directly supervised and instructed by an Installation Supplier's manager who is a Level 3 or 4 qualified installer or an installer qualified at Level 3 or 4
- b) Be capable of performing addition or removal of non-powered or passive equipment/hardware
- c) Not perform Level 2 and above work operations/job activities unless properly supervised
- d) Not progress to Level 2 without a minimum of 1-1/2 years experience or documented equivalent proficiency, as determined by the Installation Supplier

2.4.2 Installers at Level 2 shall:

- a) Have a minimum of 1-1/2 years experience, or documented equivalent proficiency, as determined by the Installation Supplier
- b) Be directly supervised and instructed by an Installation Supplier's manager who is a Level 3 or 4 qualified installer or an installer qualified at Level 3 or 4
- c) Be capable of performing the following work operations/job activities:
  - 1. Addition or removal of non-powered or passive equipment
  - 2. Addition or removal of wiring and connections (on non-working equipment only and switchboard cable only)
  - 3. Lead verification
- d) Not perform Level 3 or Level 4 work operations/job activities unless properly supervised

- e) Not progress to Level 3 without a minimum of 4 years experience or documented equivalent proficiency, as determined by the Installation Supplier.

**2.4.3 Installers at Level 3 shall:**

- a) Have a minimum of 4 years experience, or equivalent as determined by the Installation Supplier and demonstrated to AT&T in the equipment system/environment (e.g. common systems, information services, transport, power) being worked on
- b) Be capable of performing the following work operations/job activities without supervision or direction:
  - 1. Addition or removal of common systems equipment/hardware
  - 2. Addition or removal of wiring and connections (on non-working equipment only)
  - 3. Lead verification
  - 4. Analysis of job specifications and drawings
  - 5. Provide work assignments to crew
  - 6. Prepare the forms described in Section D and E of ATT-TP-76301
  - 7. Resolve job specification and/or drawing problems
  - 8. Correct office record drawings
  - 9. In-process and final quality inspections
  - 10. Able to communicate with AT&TIS on all aspects of the job throughout the duration of the job.
- c) Be capable of performing as the Installation Supplier's in-charge person on jobs not specifically restricted to having a Level 4 person in charge as defined later in this section. of ATT-TP-76301
- d) Not perform Level 4 work operations/job activities unless properly supervised
- e) Not progress to Level 4 without a minimum of 6 years experience or equivalent as determined by the Installation Supplier and demonstrated to AT&T in the system/environment (e.g. common systems, information services, transport, power) being worked on
- f) Not perform work operations/job activities on working equipment or circuits.
- g) Job site supervision of subcontractor work.

**2.4.4 Installers at Level 4 shall:**

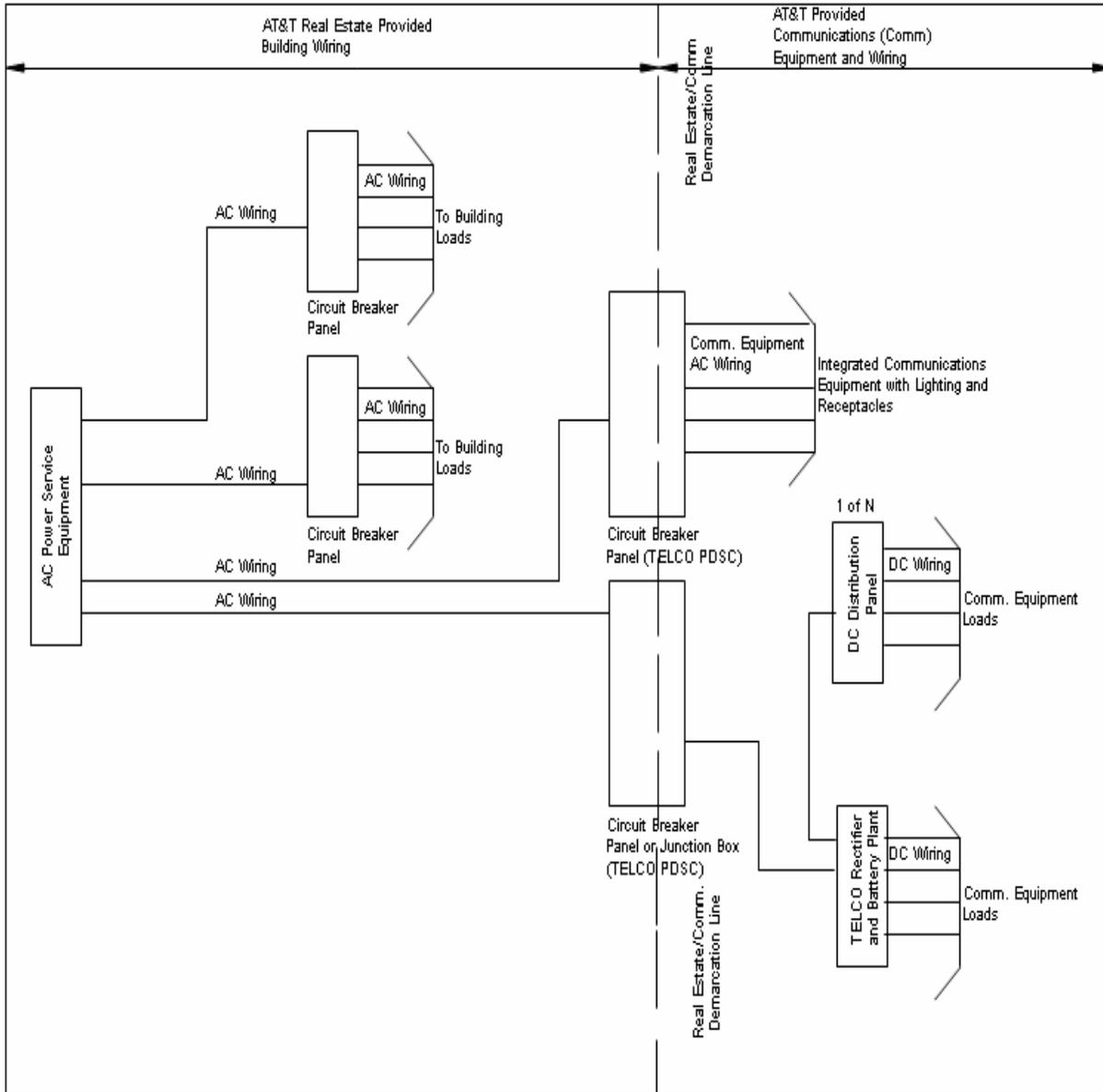
- a) Have a minimum of 6 years experience or equivalent as determined by the Installation Supplier and demonstrated to AT&T in the equipment system/environment (e.g. common systems, information services, transport, power) being worked on
- b) Be capable of performing the same work operations/job activities as a Level 3 installer without supervision or direction

- c) Be capable of performing as the Installation Supplier's in-charge person
- d) Be capable of performing additions, removals, wiring connections, and modifications on working equipment and circuits
- e) Level 4 work operations/job activities may include:
  - 1. Circuit modifications
  - 2. Software adds or upgrades
  - 3. Power transition work
  - 4. Addition or removal of batteries
  - 5. Addition or removal of circuits on working power distribution sources
  - 6. Equipment testing and turn-up
  - 7. Overseeing volatile work activities
  - 8. Job-site supervision of subcontractor work.
  - 9. Additions, modifications, or removals to Power Boards
  - 10. Additions, modifications, or removals to Engine Generator

2.4.5 Installer at Level 4A shall:

- a) A Skill Level 4A person shall be technically competent and have successfully completed training in the Test and Turn-up procedures for a specific piece of equipment or procedure. This person shall not be considered able to perform all the work operations of the Skill Level 1 through 4 installer.

Figure C-1  
Central Office Demarcation Between AC Building Power And Communications Power



[END OF SECTION]

**SECTION D -- NETWORK RELIABILITY AND PROTECTION OF SERVICE**

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**TABLE D-1 – SUMMARY OF CHANGES IN SECTION D**

<b>Change</b>	<b>Item in 09/08 Issue</b>	<b>Item in this Issue</b>
Revised	Revised to update document in comparison to TP76300	Complete Section
Deleted		
Added		

**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&TIS 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 Network reliability and the protection of service require full coordination and cooperation between the Installation Supplier and AT&TIS throughout the job. This section delineates the requirements for Job Start Agreement (JSA) Method of Procedure (MOP) important documents to facilitate job planning and coordination.
- 1.1.4 Changes in this issue of Section D are summarized in Table D-1.
- 1.1.5 If an electronic authorization is used to approve the Job Start Agreement (JSA) or Method of Procedure (MOP), a supporting email, that includes the date, job number (e.g. P/A oracle) and CLLI, shall also be sent by the signee to indicate that they are the person who approved the document. This email shall be attached to the JSA or MOP and then placed in the job folder at job completion. The name of the individual approving the document shall be included in the signature field of the JSA or MOP along with the date of approval.

## **1.2. Service Interruptions**

- 1.2.1 The Installation Supplier shall plan all work to minimize service interruptions.
- 1.2.2 A service interruption is defined as any one of the following conditions:
  - a) Interrupts, severely impairs or denies service availability to one or more subscribers.
  - b) Reduces the capacity of multiple access circuits where such reduction seriously impairs completion of offered traffic through an office.
  - c) Interrupts or seriously impairs the proper functioning of equipment for customer billing.
  - d) Interrupts or impairs in any way the functioning of national security circuits or emergency service such as 911.
  - e) Interrupts or reduces power.
  - f) Interrupts any type of operational support systems
- 1.2.3 If an unplanned service interruption occurs, the Installation Supplier shall:
  - a) Cease all work activity
  - b) Immediately notify the appropriate personnel listed in the MOP
  - c) Assist in the restoration of service, at the direction of AT&TIS
  - d) Provide a written report to AT&TIS personnel as directed.

## **2. JOB START AGREEMENT**

2.0.1 Only applicable where JSAs are required.

## **2.1 Preparation**

- 2.1.1 A Job Start Agreement (JSA) shall be completed and approved (signed) for all installation activity as identified in A 1.3.1 i..
- 2.1.2 The JSA is used to cover non-volatile (general) work activities.
- 2.1.3 The Job Start Agreement (JSA) shall document the start and complete dates for the job interval and serves as authorization to start a job.
- 2.1.4 No work activity shall begin before the actual start date and until both the AT&TIS Representative and the Installation Supplier have approved (signed) the JSA. A verbal JSA is not acceptable.
- 2.1.5 The JSA shall remain current throughout the duration of the job.
- 2.1.6 The Installation Supplier shall complete and immediately forward the approved (signed) JSA to the AT&TIS Equipment Engineer
- 2.1.7 A copy signed by both the AT&TIS Representative and the Installation Supplier shall be available at the job site throughout the duration of the job.
- 2.1.8 The Installation Supplier shall negotiate the date of the JSA meeting with the AT&TIS Representative(s).
- 2.1.9 The Installation Supplier shall convene the JSA meeting with the AT&TIS Representative(s). The AT&TIS Equipment Engineer will be responsible for determining the AT&TIS Representative(s) for the JSA meeting, at which the job plans will be discussed and the JSA (Figure D-1) approved.
- 2.1.10 The JSA shall include in the General Job Description the location of the major equipment components being added, modified or removed on the job, (i.e. bay location, shelf with bay location and shelf designation, etc.).
- 2.1.11 At the JSA meeting, the AT&TIS Representative(s) and Installation Supplier shall discuss all items listed on the JSA. The JSA shall be completed and approved (signed) by both the AT&TIS Representative(s) and the Installation Supplier at least five (5) business days, unless otherwise negotiated, before start of the job.
- 2.1.12 At job completion, a copy of all the approved JSAs shall be included in the job folder.

## **2.2 Job Scope Change**

- 2.2.1 It is recognized that, during the duration of a job, conditions may arise that change the original scope of the job and, in turn, adversely impact the scheduled completion date. These conditions may be the responsibility of either the Installation Supplier or the AT&TIS Equipment Engineer and include, but are not limited to, field conditions not matching design, changes in the original requirements, engineering omissions or errors.

- 2.2.2 As soon as the Installation Supplier determines that the scheduled installation completion date is in jeopardy, the Installation Supplier shall contact the AT&TIS Equipment Engineer.
- 2.2.3 When a job scope change has been communicated between the Installation Supplier and the AT&TIS Equipment Engineer, a revised JSA shall be issued. Changes in the job scope specifics shall be noted on the revised JSA along with the new completion date, the revised JSA shall be checked "Revised", signed, dated and distributed the same as the original JSA.

### **2.3 Post-job Job Start Agreement**

- 2.3.1 After the Job Completion Report (see Section E of ATT-TP-76301 has been issued, the Installation Supplier shall complete a post-job Job Start Agreement if additional or corrective work associated with the original job is required. This post-job JSA shall have the "POST JOB" box checked to indicate that this is a continuation of an existing job.
- 2.3.2 The Installation Supplier shall forward the signed post-job JSA to the AT&TIS Equipment Engineer and have it available at the job site.
- 2.3.3 At completion of the work, all approved copies of the JSA(s) shall be included in the job folder.

## **3 METHOD OF PROCEDURE**

### **3.1 Introduction**

- 3.1.1 The written Method of Procedure (MOP) is the document used to detail how, when and where work activities are performed including those that pose a significant risk to service, which are called volatile work activities.
- 3.1.2 A MOP shall be completed for all volatile work activities being performed.
- 3.1.3 AT&TIS reserves the right to require a MOP for any work deemed by AT&TIS as a volatile work activity.
- 3.1.4 The initial MOP shall be identified as MOP No. 1 in the MOP No. field. When multiple MOPs are written on a job, the MOPs shall be numbered consecutively.
- 3.1.5 The AT&TIS Equipment Engineer and /or Site Representative shall comply with company change control processes for all work activities deemed volatile.
- 3.1.6 The installation Supplier shall not perform volatile work activity without verification that the change control process has been completed. A copy of the approved change control notification shall be filed in the job folder.

### **3.2 Volatile Work Activities**

- 3.2.1 The following is a list of volatile work activities that shall be conducted during the "maintenance window", as directed by AT&TIS.
  - a) All activities on live power equipment that includes the addition, rearrangement or removal of power equipment, cable or terminations.

- b) All activities on timing equipment that include the addition, rearrangement or removal of either the input or output lead of a timing device.
- c) All software upgrades and transition activity, including integration of major equipment components. , except trunks and service circuits.
- d) Backplane work, shelf replacement, processor hardware activity.
- e) All relocation, re-cabling or other rearrangements of any currently in-service equipment.
- f) All relocation, re-cabling or other rearrangements of site specific equipment that is unique and identified as critical to service.
- g) Equipment removals and cable mining jobs that are considered to pose a significant risk to service.
- h) All other work operations on building and telecommunications equipment that are considered to pose a significant risk to service.
  - 1. Examples would include but are not limited to:
    - i. Electrical Switchgear maintenance and repairs, and infrared testing.
    - ii. Major Chiller teardowns, where there is no redundancy
    - iii. Work above Information Services Equipment
    - iv. Building structural work that could undermine the safety or support of existing equipment
  - i) All cutting of installed Fiber Protection System (FPS) that contains fibers.

### **3.3 MOP Preparation and Use**

- 3.3.1 The MOP requirements are determined by the job documentation (Job Specifications, Drawings etc.), complexity and technology type (e.g., switch, transport, and power).
- 3.3.2 Unless otherwise authorized by the AT&TIS Representative, the Installation Supplier shall perform a walk-through at the job site with the AT&TIS Representative to identify and address specific requirements, special conditions and potential risks to service.
- 3.3.3 The Installation Supplier shall list the detailed work steps associated with the volatile work activity in logical sequence.
  - a) The following work steps shall always be included:
    - 1. Notify the Alarms Surveillance Center about pending work
    - 2. Verify that no affected equipment alarm conditions exist.
    - 3. The responsibility (Installation Supplier and/or AT&TIS Representative) for each work activity.
    - 4. Protection required for the equipment
    - 5. Location and availability of spare fuses

- b) The following also shall be considered when developing a MOP (additional considerations may be necessary for unusual installations):
1. Possible service problems and restoration procedures.
  2. The time the various steps will be performed and the equipment to be removed from service, including the number and schedule of circuits to be impacted.
  3. The skill level of personnel performing the work outlined on the MOP.
  4. Availability of an alternative communication link such as a cell phone, etc.
- 3.3.4 If the Installation Supplier is authorized to perform volatile work activity that is normally performed by AT&TIS, the responsibility shall be defined in the MOP.
- 3.3.5 Unless agreed upon by the AT&TIS Representative, the MOP shall be presented for approval (signatures) at least seven (7) business days before the volatile work activity is to begin.
- 3.3.6 The MOP shall be presented for approval (signatures) at least three (3) business days before the non-volatile work activity is to begin.
- 3.3.7 At the discretion of the AT&TIS Representative, a dry run of the installation activity plan may be held with the Installation Supplier to ensure that procedures described in the MOP match the physical layout of the system to be worked on. The Dry Run form shall be completed and signed by both the Installation Supplier and the AT&TIS Representative.
- 3.3.8 Before any volatile work is performed, all persons involved in the work operation (s) covered by this MOP shall complete the Ask Yourself questions, check each box and sign off at the bottom, then the AT&TIS Representative shall approve (sign) the form.
- 3.3.9 No volatile work activity shall begin until both AT&TIS and the Installation Supplier have approved (signed) the MOP. A verbal MOP is not acceptable.
- 3.3.10 A copy of the signed, approved MOP shall be available at the work site and readily accessible to Installation Supplier personnel while work is being performed.
- 3.3.11 The Installation Supplier shall provide a Level 4 representative on-site to oversee any volatile MOP work performed by the Installation Supplier's personnel or non-approved subcontractors.
- 3.3.12 The Installation Supplier shall not deviate from the approved MOP unless authorized in writing by the AT&TIS Representative. In the case of a change in job scope the MOP shall be amended and approved by the AT&T Representative. The Installation Supplier shall perform a walk-through based on the amended MOP at the job site with the AT&T Representative to identify and address specific requirements, special conditions and potential risks to service
- 3.3.13 The Installation Supplier shall adhere to the Safe-Stop Points (SSP), back-out procedures, and restoration procedures as detailed in the MOP.
- 3.3.14 The Installation Supplier shall stop the MOP activities if conditions are encountered or observed that have affected or will adversely affect service.
- 3.3.15 The MOP shall include adequate testing time after a transition or modification.

- 3.3.16 The Installation Supplier shall ensure that affected alarms have been checked both before and after installation activity for proper functioning.
- 3.3.17 After completing each detailed step, the Installation Supplier shall date, time and initial the step, and if on-site coverage is required, have the AT&TIS Representative initial and date each step.
- 3.3.18 At job completion, a copy of all the approved MOP(s), including all the required pages, shall be placed in the job folder.

**4. CRITICAL POWER MOPS**

**4.1 A Critical Power MOP shall be provided for any of the following work activities:**

- a) Transitions associated with power plant replacements
  - b) Battery string replacements in single battery string power plants
  - c) Primary power rearrangements on BDFBs
  - d) All DC primary transition work
  - e) All AC work that affects the DC power plant including the standby engine, UPS, FDC and PDU
  - f) Power plant capacity expansions
  - g) Shunt replacement
  - h) Primary bus extension/expansion
  - i) Other documented requirements
- 4.1.2 Critical Power MOP shall adhere to the requirements as listed in Section 3 as well as those in the following paragraphs.
  - 4.1.3 Unless agreed upon by the AT&TIS Representative, the MOP shall be presented for signatures at least seven (7) days before the volatile work activity is to begin for all of the Critical Power Jobs defined above.
  - 4.1.4 In addition to the signatures required in 3.3.9, no Critical Power MOP volatile work activity shall begin until the AT&TIS Power Engineer, the appropriate AT&T Power Maintenance Engineer, the AT&TIS Operation Engineer or other AT&T Representatives, and the Installation Supplier have signed the MOP. A verbal MOP is not acceptable.
  - 4.1.5 A dry run of the installation activity plan shall be conducted with the AT&TIS Representative and the Installation Supplier to ensure that procedures described in the Critical Power MOP match the physical layout of the system to be worked on.
  - 4.1.6 The Dry Run form shall be completed and signed by both the Installation Supplier and the AT&TIS Representative.

- 4.1.7 The Installation Supplier shall adhere to the Safe-Stop Points (SSP), back-out procedures, and restoration procedures as detailed in the MOP. The Safe-Stop Points shall be clearly identified in the detailed steps of the MOP.
- 4.1.8 The Critical Power MOP shall include detailed steps to validate the integrity of the power plant bonding and grounding before any work activity begins. The Installation Supplier shall conduct a visual inspection per ATT-TP76403 Section 3, paragraph 3.3.2 Figure 3-1.
  - a) The Installation Supplier shall report all discrepancies (via a JIM where applicable) to the AT&TIS Equipment Engineer for resolution before proceeding with work activities.
- 4.1.9 Steps shall be identified on Critical Power MOPs that require an AT&TIS Representative to be on site and shall observe the Vendor while work is being done. The AT&TIS employee will monitor Critical Power MOP compliance and the completion of these steps as the work progresses.
- 4.1.10 After completing each detailed step, the Installation Supplier shall date, time and initial the step and have the AT&TIS Representative initial each step.

**FIGURE D-1 – JOB START AGREEMENT**

**A reproducible Job Start Agreement form is provided on the following page.**

**AT&TIS JOB START AGREEMENT**

Check One:  Original  
 Revised  
 Post Job

**CRITICAL POWER JOB**

This document establishes a firm work schedule for the start and completion of the job and authorizes the Installation Supplier to begin work. A MOP shall be issued before any Volatile Work Activity begins.

**JOB INFORMATION:**

CLLI \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_  
 AEO No. \_\_\_\_\_ P/A Oracle No. \_\_\_\_\_  
 Equipment Engineer \_\_\_\_\_  
 Installation Supplier \_\_\_\_\_ Supplier PO No. \_\_\_\_\_

**FIRM SCHEDULE FOR WORK TO BE DONE AT THIS JOB SITE:**

Actual Start Date \_\_\_\_\_ Scheduled Completion Date \_\_\_\_\_  
 Daily Work Schedule: Start Time \_\_\_\_\_ Stop Time \_\_\_\_\_

**JOB DESCRIPTION:** \_\_\_\_\_

**REASON FOR REVISION:** \_\_\_\_\_

Work shall not begin on this project until the designated AT&TIS Representative properly authorizes this Job Start Agreement and the following items have been discussed:

- |   |   |
|---|---|
| <input type="checkbox"/> Arrangements for building access                                       | <input type="checkbox"/> Network Awareness                    |
| <input type="checkbox"/> On-site coverage   | <input type="checkbox"/> Identify Non-approved subcontractors |
| <input type="checkbox"/> Equipment to be installed, removed, and/or modified                    | <input type="checkbox"/> Cable Routing (Blocked, Overload)    |
| <input type="checkbox"/> In-Service equipment affected, requiring a MOP before work begins      | <input type="checkbox"/> Safety considerations                |
| <input type="checkbox"/> Building and/or equipment protection during installation               | <input type="checkbox"/> Specific test requirements           |
| <input type="checkbox"/> Cable penetrations (complete Cable Penetration Reporting Log)          | <input type="checkbox"/> Space & Power Request Form           |
| <input type="checkbox"/> Storage of equipment, material, and tools                              |   |
| <input type="checkbox"/> Environmental permits, notifications, and floor drilling training      |   |
| <input type="checkbox"/> Alarm installation, cross-connection leads, and testing responsibility |   |
| <input type="checkbox"/> Target walk-through date (before or on completion date)                |   |
| <input type="checkbox"/> Problem resolution contacts (immediate supervisor):                    |   |

Manager (AT&T) _____	Tel. No. _____	AltPager No. _____
NNOC/VOCNOC/ST _____	Tel. No. _____	AltPager No. _____
C/TTC _____	Tel. No. _____	AltPager No. _____
Manager (Supplier) _____	Tel. No. _____	AltPager No. _____

**Installation Supplier's e-mail address:** \_\_\_\_\_

**If a service interruption occurs, the Installation Supplier shall:**

1. Stop all work operations immediately.
2. Notify local Operation and/or ASC personnel of details immediately.
3. Not replace fuses or restore breakers without the direction of AT&TIS.
4. Provide a written report to AT&TIS as directed.

Other pertinent factors unique to this project: \_\_\_\_\_

**Check box if the Job Start Agreement includes attachments.**

Agreement has been reached on all items checked above. No deviations from this agreement will be allowed without the approval of the designated AT&TIS Representative.

\*AT&TIS Rep. Signature/Title & Date

\*Installation Supplier Signature/Title & Date

Other Signature (As required)/Title & Date

Other Signature (As required)/Title & Date

Installation Supplier shall distribute this completed form to:

- AT&TIS Equipment Eng.  Job folder  
 AT&T Power Maintenance Engineer\*  
 \*ONLY on Critical Power Jobs

**FIGURE D-2 – METHOD OF PROCEDURE**  
**Reproducible MOP forms are provided on the following pages.**



AT&TIS

**METHOD OF PROCEDURE**

MOP No. \_\_\_\_\_

AEO No. \_\_\_\_\_

**If a service interruption occurs, the Installation Supplier shall:**

1. Cease all work operations immediately.
2. Local Operations personnel shall be notified of outage details immediately.
3. No fuses or breakers shall be replaced or restored without the direction of AT&TIS.
4. Provide a written report to AT&TIS as directed.

**List sequence for notification of service interruption or degradation**

	Name/Center (Alarm Surveillance Center (Required))	Phone	Alt No.
1			
2			
3			
4			
5			

**Installation Supplier Personnel working under this MOP**

Name	Skill Level	Emergency No.	Name	Skill Level	Emergency No.

The Installation Supplier shall not deviate from the approved MOP unless authorized by the AT&TIS Equipment Engineer and shall be communicated with the AT&TIS Representative. The approved MOP shall be filed in the Job folder. Copies can be made for further distribution if requested. Asterisk (\*) denotes mandatory signatures on all MOP's, (\*\*) denotes mandatory signatures on all Critical Power MOP's. The Installation Supplier shall determine from AT&TIS Representative whether additional signatures are required.

**MOP APPROVAL**

Title	Print Name	Phone/Contact No.	Signature	Date
*AT&TIS Operation EngineerT Rep.				
*Installation Supplier				
**AT&TIS Equipment Eng.				
Other as Required				

AT&TIS METHOD OF PROCEDURE

MOP No. \_\_\_\_\_  
AEO No. \_\_\_\_\_

When AT&TIS requires this page, it shall be completed and included with the previous required pages of the MOP.

**DRY RUN - Required**  Yes  No

A Step-by-Step "Dry Run" of the Volatile Work Activities listed in the "Detailed Steps" portion of this MOP has been performed by the following representative(s):

The Installation Supplier's personnel who will be performing the work activities:

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**AT&TIS Representative and Installation Supplier responsible for the equipment/system being worked on:**

\*AT&TIS Rep.  
Signature: \_\_\_\_\_ Date: \_\_\_\_\_

\*Installation  
Supplier Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Yes   
No   
N/A

(If there were changes as a result of the "Dry Run" they were incorporated into a revised, signed, and approved MOP?)

**AT&TIS METHOD OF PROCEDURE**

MOP No. \_\_\_\_\_

AEO No. \_\_\_\_\_

**ASK YOURSELF QUESTIONS**

**BEFORE ANY CRITICAL WORK IS PERFORMED, ALL PERSONS INVOLVED IN THE WORK OPERATION (S) COVERED BY THIS MOP SHALL COMPLETE THE FOLLOWING ASK YOURSELF QUESTIONS, CHECK EACH BOX AND SIGN OFF AT THE BOTTOM.**

---

**Check Box**

**Yes    No**

- |                          |                          |   |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | <p>1. DO I HAVE THE PROPER ID AND APPROPRIATE BUILDING ACCESS PERMISSIONS TO THE ENVIRONMENT I AM ABOUT TO ENTER?<br/>I am responsible for the security and safety of this work environment. Wearing two ID badges, one contractor and one AT&amp;T, will be strictly enforced at all times.</p>  |
| <input type="checkbox"/> | <input type="checkbox"/> | <p>2. DO I KNOW WHY I AM DOING THIS WORK?<br/>I am responsible for the work that is being performed. It is critical that I have a clear understanding of what work is being performed and why and it is essential to ask questions.</p>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <p>3. HAVE I IDENTIFIED AND NOTIFIED EVERYBODY-CUSTOMERS AND INTERNAL GROUPS-WHO WILL BE DIRECTLY AFFECTED BY THIS WORK?<br/>It is important to over communicate rather than under communicate in these situations. Do I have up to date phone and contact lists? In addition, have I used any applicable critical event notification processes, which may apply in these situations?</p> |
| <input type="checkbox"/> | <input type="checkbox"/> | <p>4. CAN I PREVENT OR CONTROL SERVICE INTERRUPTIONS?<br/>It is critical to know the potential impact of the work steps being performed and to understand how the equipment being worked on is used by our customers.</p>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <p>5. IS THIS THE RIGHT TIME TO DO THE WORK?<br/>Each of us must ask ourselves this question before we undertake any work activity that could adversely affect our network. Doing the right work at the right time would allow me to minimize the disruption to the network and our customers, should I have a problem.</p>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <p>6. AM I TRAINED AND QUALIFIED TO DO THIS WORK?<br/>Training could have been received in a formal classroom setting or it could have been received from my supervisor or peers. What is important is that I have the training and that I feel confident doing the work before entering into the work operation.</p>   |

AT&TIS METHOD OF PROCEDURE

MOP No. \_\_\_\_\_  
AEO No. \_\_\_\_\_

- 7. HAVE I CONSIDERED ALL THE INSTALLATION AND MAINTENANCE REQUIREMENTS THAT APPLY TO THIS PROCEDURE?  
I can find these requirements in a number of sources, such as the AT&TIS-TP-76301, the JSA and/or MOP and ATT technical documents, which are required to be on the job site. In addition, of course I can always refer to the manufacturers' technical documentation.
  
- 8. ARE THE WORK ORDERS, JSA and/or MOP AND SUPPORTING DOCUMENTATION DETAILED, CURRENT, ERROR FREE AND APPROPRIATELY APPROVED?  
It is necessary to have accurate information, and required approvals to ensure that the work activity can progress and to ensure customer service is not impacted.
  
- 9. DO I HAVE EVERYTHING I NEED TO QUICKLY BACK OUT OR RESTORE SERVICE IF SOMETHING GOES WRONG AND DO I KNOW WHOM TO CALL?  
I have back out procedures and I understand the procedures should something go wrong. I have the necessary equipment on-hand to assist me in the back out procedures. The contact telephone numbers for Technical Support or NNOC/VOC are available and I have a contingency plan should the back out procedure fail."
  
- 10. HAVE I WALKED THROUGH AND DO I UNDERSTAND THE PROCEDURE?  
I have a signed and approved MOP, but people who are executing the work may not understand the procedure. If any unusual situation occurred, they could react inappropriately and they may cause a service interruption. A walkthrough is critical to ensure Network health and personnel safety.

---

\*AT&TIS Rep. Signature: \_\_\_\_\_ Date: \_\_\_\_\_

\*Installation Supplier Signature: \_\_\_\_\_ Date: \_\_\_\_\_



**(END OF SECTION)**

**SECTION E-- JOB DOCUMENTATION**

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**TABLE E-1 – SUMMARY OF CHANGES IN SECTION E**

Change	Item in 09/08 Issue	Item in this issue
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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&TIS 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 Changes in this issue of Section E of ATT-TP-76301 are summarized in Table E-1.

**1.2. General Requirements**

- 1.2.1 The Installation Supplier shall use the current version of all forms, unless AT&TIS authorizes the use of surplus stock forms.
- 1.2.2 The Installation Supplier shall fill out any required forms accurately and in their entirety, including the job folder label.
- 1.2.3 The Installation Supplier shall ensure the AT&TIS Equipment Engineer or the AT&TIS Operations Engineer signs any required forms where a signature is listed on a form or note the refusal of signature of AT&TIS.

**2. JOB FOLDER AND LABEL**

- 2.0.1 Only applicable where required.

**2.1. General**

- 2.1.1 The Installation Supplier shall provide the job folder for the job. The job folder is a standard accordion folder with cover, minimum size 9" X 12", in which job documentation to remain at the site shall be filed.
- 2.1.2 The Installation Supplier shall complete a job folder label, Figure E-1, and attach it on the outside cover of the job folder.
- 2.1.3 The job folder and all required documents therein shall remain at the job site at all times.
- 2.1.4 The Installation Supplier shall turn over to the AT&TIS Operations Engineer all technical manuals, practices, and drawings received with the equipment as specified in the contract.
- 2.1.5 The Installation Supplier shall leave a complete copy of the detail specifications, all office drawings (i.e. floor plan and front equipment views,, etc.) as well as a copy of all job forms, in the job folder.
- 2.1.6 The Installation Supplier should ensure that an AT&TIS Operations Engineer signs the job folder label.

- 2.1.7 The Job folder is the property of AT&TIS and shall be turned over to the AT&TIS Operations Engineer upon completion of the job. This Requirement is valid for all equipment installations in an AT&TIS office.
- 2.1.8 The job folder shall be left at the designated AT&TIS location at job completion.
- 2.1.9 A job folder is not required to be maintained by Trade Vendors hired by Site Operations to perform maintenance work or hired by the Equipment Engineer to perform installation activity (Electrical, Mechanical) outside the immediate equipment area.

**3. CABLE PENETRATION REPORTING LOG**

**3.1. General**

- 3.1.1 The Installation Supplier shall complete the Cable Penetration Reporting Log (Figure E-2) to document the cable penetration activity.
- 3.1.2 At the Job Start Agreement meeting or MOP, the Installation Supplier shall provide a list of the cable penetrations to be opened during the job and attached to the JSA. If there are no cable penetrations accessed the form shall be noted NA.
- 3.1.3 The Installation Supplier shall record all cable penetrations that have been accessed during each day.
- 3.1.4 The Cable Penetration Reporting Log shall be placed in the job folder at the completion of the job.

**4. SITE POWER ASSIGNMENT LOG**

**4.1. General**

- 4.1.1 The Installation Supplier/General Contractor shall complete the UPS tab of the Site Power Assignment Log for all new UPS installations as well as for additional PDUs that are fed from an existing UPS. The completed log shall be sent to the Equipment Engineer and Capacity Manager and a copy filed in the Job folder.
- 4.1.2 The Installation Supplier/ General Contractor shall complete the PDU, Electrical Panel (e.g. FDC, RPP, wall panel, etc), or Inverter tabs of the Log for all new PDU, Electrical Panel or Inverter installations. The completed log shall be sent to the Equipment Engineer and Capacity Manager and a copy filed in the Job folder.
- 4.1.3 The Installation Supplier shall complete the BDFB, PDU, or Electrical Panel tabs of the Log whenever network equipment is added that is fed directly from one of these power distribution elements. The completed log shall be sent to the Equipment Engineer and Capacity Manager and a copy filed in the Job folder.

**5. JOB INFORMATION MEMORANDUM**

6.0.1 Only applicable where required.

**5.1. General**

5.1.1 The Installation Supplier shall use the Job Information Memorandum (JIM) as a notification for additional information or for record purposes.

5.1.2 The JIM (Figure E-3) shall be used for those occasions when formal communications between the AT&TIS Equipment Engineer and Installation Supplier are necessary, including, but not limited to the following:

- a) Additional material
- b) Additional engineering
- c) A change in the AEO or detail specification
- d) Additional information
- e) Request for additional Installation Supplier effort
- f) Request for disposition of AT&TIS material
- g) Approved deviation from AT&TIS standards on a per job basis
- h) Document verbal agreements between the Installation Supplier and AT&TIS.

5.1.3 The Installation Supplier shall not request from the AT&TIS Equipment Engineer any variances from the requirements outlined in this document related to fire stopping and safety issues.

5.1.4 The Installation Supplier shall forward a copy of the JIM to the recipient and place a copy in the job folder.

**6. TEST RECORD**

**6.1. Equipment Tests**

6.1.1 As an integral part of the installation, the Installation Supplier shall perform tests, in accordance with the AT&TIS testing requirements, as stated in ATT-TP-76900, to:

- a) Test and verify all features and functions of the equipment provided, rearranged and/or modified to ensure that it is properly powered and it will operate properly when placed in service.
- b) Ensure correct termination of all cable conductors and wiring by performing continuity tests.
- c) Installation Supplier shall perform a continuity test on the wiring between the network element and the alarm collection device (e.g. Falcon Unit). In addition, Installation Supplier shall record the port assignment of the alarm collection device and alert AT&TIS Equipment Engineer that it is ready for alarm testing.

- d) Site Operations Manager shall perform all alarm testing and record the results on the Alarm Record Report, (Figure E-7).
- e) The Alarm Record Report shall be placed in the job folder at the completion of the job.
- f) Ensure that all required alarms work properly and are received at the local (If applicable) and remote alarm monitoring station. Responsibility for the testing of all required telemetry alarms (from Network Element to Alarm Surveillance Center) shall reside with the Installation Supplier of any element being added to the network or connecting to a power source (BDFB, Power Distribution Unit (PDU), Hendry fuse panel, etc.). Alarm requirements are specified by ATT-TP-76900. The Installation Supplier shall coordinate with the AT&T Representative for required alarm assignments.
- g) In situations of pre-provisioned or empty chassis/shelf installations where common plug-in modules are not provided as part of the installation, discrete or serial alarms (both local and remote) shall be wired and tested as per this section. Other remote alarm protocols, such as TL1 or SNMP cannot be fully tested to the Alarm Surveillance Center without the common plug-in modules, therefore, any and all cabling required in the AEO for these alarm types shall be verified for correct and complete continuity from the network element to the appropriate termination point.
- h) The results of all remote alarm tests shall be recorded on the Remote Alarm Test Record, (Figure E-7).
- i) The Remote Alarm Test Record shall be placed in the job folder at the completion of the job.

## **6.2. Preparation and Distribution**

- 6.2.1 The Installation Supplier shall maintain and complete a Test Record of the tests and inspections performed during the installation. Test results shall be recorded on the Test Record as the tests are completed. If a Vendor Acceptance Record is not available, Figure E-4 in this document shall be used.
- 6.2.2 When using Figure E-4:
  - a) If trouble is found it shall be recorded, listing the location of the failure that was indicated, the trouble found and the location of the trouble.
  - b) When the trouble is cleared, the Installation Supplier shall initial the "Tested By" column to indicate the trouble has been cleared.
  - c) If the equipment is determined to be free of trouble, the Installation Supplier shall record the letters "NTF" indicating No Trouble Found, in the "Trouble Found" column and enter initials and date in the "Tested By" column to validate that the test was performed and completed satisfactorily.
- 6.2.3 The Test Record shall be placed in the job folder.

## **7. MATERIAL DISPOSITION RECORD**

**7.1. General**

- 7.1.1 The Material Disposition Record (MDR) shall be used to record the transfer of tangible items from the Installation Supplier to AT&TIS. Turned-over items are listed on the MDR (Figure E-5) by the Installation Supplier and accepted by the AT&TIS Operations Engineer.
- 7.1.2 Removed equipment classified as reuse, salvage, junk and any hazardous or regulated material generated during installation shall be reported on a separate MDR.
- 7.1.3 The Installation Supplier shall be liable for those items that have not been turned over to AT&TIS.
- 7.1.4 Copies of all MDRS shall be left in the job site job folder.

**7.2. Purpose**

- 7.2.1 Examples of tangible items turned over that shall be documented using an MDR are:
  - a) Office and equipment drawings
  - b) Handbooks and pamphlets
  - c) Spare circuit packs/plug-ins
  - d) Test Sets/accessories
  - e) Hand tools
  - f) Maintenance kits
  - g) Equipment not installed
  - h) Scrap cable and wire
  - i) Generic documentation
  - j) Jumper wire
  - k) Marked drawings
  - l) Corrected specifications
  - m) Corrected equipment order.
  - n) Floor tile drilling waste
  - o) Excess or spare material purchased by AT&TIS
- 7.2.2 Only one type of item shall be listed per line on the MDR.

**8. JOB COMPLETION REPORT**

**8.1. Purpose**

- 8.1.1 The properly authorized Job Completion Report (Figure E-6) serves as notification from the Installation Supplier that the job has been completed.

**8.2. Job Completion Requirements**

8.2.1 The Installation Supplier shall consider the job complete when all items described below have been complied with:

- a) All infrastructure (electrical, mechanical, and building construction) specified in the drawings has been completed and is ready for equipment placement without exception.
- b) All equipment (i.e., bays, frames, circuits, etc.) specified in the detail specification(s) has been completely wired, adjusted, tightened, labeled or stenciled, tested or removed and is ready for service without exception.
- c) An Installation Supplier quality performance audit of the installation has been completed; results of the audit documented in the job folder, and written documentation that all defects and/or discrepancies have been corrected. This includes when the defect was corrected and who corrected the defect.
- d) Spare parts (e.g., circuit packs, fuses, etc.) have been turned over to AT&TIS and are in good working condition.

NOTE: Circuit packs shall be stored in the original protective shipping cartons to reduce the possibility of ESD damage.

- e) Damage to buildings and grounds (e.g., walls, floors, driveways, fences, etc.) have been corrected.
- f) Correction of Installation Supplier caused defects or damage to existing equipment.
- g) Removal of temporary floor, wall and column protection placed by Installation Supplier.
- h) Removal of Installation Supplier's installation tools, surplus/excess equipment, excess material, trash and all other property.
- i) All associated installation documentation, along with the detail specification(s), Space & Power Request Form and the AEO, has been turned over to the AT&TIS Operations Engineer in the job folder.
- j) All removed or equipment not installed and/or material has been disposed of per the detail specification(s) or AT&TIS equipment engineer's written instructions.
- k) Copies of all JSAs, MOPs, JIMs, Marked Prints, MDRs and Job Completion Reports, etc., have been distributed as required.
- l) The Installation Supplier shall notify AT&TIS a minimum of 3 days prior to test and acceptance.
- m) Unless already provided via a mechanized system, the Installation Supplier shall electronically submit to the AT&T Installation Quality organization no later than the fifth calendar day of the month a list of all the jobs that were completed the previous month and meet all the requirements as stated in Section E, 8.2.1, subparagraphs a-k. The submittal shall be in the form of an Excel spreadsheet.

**8.3. Job Completion Report Procedure**

8.3.1 The Installation Supplier shall follow these job completion steps in order, unless already provided via a mechanized system:

- a) Prepare and sign the Job Completion Report (JCR)
- b) Notify AT&TIS Equipment Engineer or AT&TIS Operations Engineer, as determined at the JSA meeting, of the completion of installation and request a job completion walk-through meeting at the job site, prior to the scheduled complete date of the job. The Installation Supplier shall provide a JCR at the start of the job completion walk-through meeting.
- c) The AT&TIS Equipment Engineer or AT&TIS Operations Engineer and the Installation Supplier shall conduct a formal job completion walk-through during which a complete review of all details of the project will be performed. The intent of this review is to verify all work items outlined in the job specification were completed and installed according to ATT-TP-76301 and all equipment added and/or modified is both operational and functional.
- d) At the completion of the walk-through, the AT&TIS Equipment Engineer or AT&TIS Operations Engineer will either note the job as "Complete" or "Not Complete" and require the Installation Supplier to correct all defects or deviations from the specification as noted in the job completion walk-through. The job will not be noted as "Complete" until it is properly installed.
- e) When the AT&TIS Equipment Engineer or AT&TIS Operations Engineer determines that the job has been completed, he/she shall sign the JCR.
- f) The Installation Supplier shall distribute the JCR as indicated on the form.

**FIGURE E-1 – LABEL FOR JOB FOLDER**

A reproducible copy of the Label for Job Folder form is provided on the following page.

FIGURE E-1 – LABEL FOR JOB FOLDER



\_\_\_\_\_ of \_\_\_\_\_

ATTENTION AT&T INTERNET SERVICES PERSONNEL– Retain this wallet with all its contents (Documents, Drawings, Etc.) at the job site for 180 days after completion.

OFFICE:

CITY/STATE:

AEO NO:

PROJECT NO:

SUPPLIER:

SUPPLIER ORDER NO:

AT&TIS EQUIPMENT ENGR:

JOB COMPLETION DATE:

COMPLETION WALK-THROUGH DATE:

JOB DESCRIPTION:

The following items shall be included in job folder upon completion when applicable (please  appropriate box):

- Job Start Agreement (JSA)
- Method of Procedure (MOP)
- Copy of SPEC
- Copy of Drawings
- Test Record
- Job Completion Report
- Storage Battery Charge Report
- Cable Penetration Reporting Log
- Internal Audit Documentation
- Other – JIM, EIU, ETC:
- NEA Floor Drilling Form
- AEO
- Material Disposition Record (MDR)  
MDR # \_\_\_\_\_ listing office drawings and tangible items left in C.O.
- MDR # \_\_\_\_\_ listing corrected drawings distributed per SPEC/Equipment Engineer
- MDR # \_\_\_\_\_ disposition of asbestos or presumed to contain asbestos residue
- BDFB Load Demand Worksheet
- DC Distribution Worksheet
- Remote Alarm Test Record
- New BDFB WORKSHEET

SUPPLIER:

AT&TIS REP:

Signature  
DATE:

Signature (Ensure all required documentation is enclosed)  
DATE:

**FIGURE E-2 – CABLE PENETRATION REPORTING LOG**

A reproducible copy of the Cable Penetration Reporting Log form is provided on the following page.



**FIGURE E-3 – JOB INFORMATION MEMORANDUM**

A reproducible copy of the Job Information Memorandum (JIM) form is provided on the next page.

**JOB INFORMATION:**

AEO No \_\_\_\_\_ P/A Oracle No \_\_\_\_\_

AT&TIS Equipment Engineer \_\_\_\_\_

**JIM NO.** \_\_\_\_\_

TO

Installation Supplier \_\_\_\_\_ Supplier PO No \_\_\_\_\_

TO

ADDR.

CITY

PHONE

FROM

ADDR.

CITY

PHONE

**JOB DESCRIPTION**

SUBJECT

DETAILS

ORIGINATOR \_\_\_\_\_ TITLE \_\_\_\_\_

SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_

RESPONSE

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_

**Distribution: Job folder Folder, AT&TIS Equipment Engineer**

**FIGURE E-4 - TEST RECORD**

A reproducible copy of the Test Record form is provided on the following page.



**FIGURE E-5 – MATERIAL DISPOSITION RECORD**

A reproducible copy of the Material Disposition Record form is provided on the following page.

**MATERIAL DISPOSITION RECORD**  
**AT&T Internet Services**

Reference: ATT-TP-76301  
 September, 2008

**MATERIAL DISPOSITION RECORD**

**JOB INFORMATION:**

AEO No \_\_\_\_\_ P/A Oracle No \_\_\_\_\_

AT&TIS Equipment Engineer \_\_\_\_\_

Installation Supplier \_\_\_\_\_ Supplier PO No \_\_\_\_\_

MDR Number \_\_\_\_\_ Page \_\_\_\_\_ of \_\_\_\_\_

**TO:**  
 Location: \_\_\_\_\_ Attention: \_\_\_\_\_  
 Address: \_\_\_\_\_ City, State, ZIP: \_\_\_\_\_

**FROM:**  
 Address: \_\_\_\_\_ City, State, ZIP: \_\_\_\_\_

Quantity	Material Name and Description	Corrected Drawing	Spec/PO	Item

Office Drawings \_\_\_\_\_ Remarks: \_\_\_\_\_  
 Equipment Manuals \_\_\_\_\_  
 Ckt Packs/Plug-ins \_\_\_\_\_  
 Corrected Dwgs Yes  No  Job Completion Date: \_\_\_\_\_  
 Test Set/Accessories \_\_\_\_\_  
 Supplier Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
 Other (Explain in Remarks) \_\_\_\_\_

**Distribute to:**  
 AT&T Representative: \_\_\_\_\_ Date: \_\_\_\_\_  
 Job folder \_\_\_\_\_  
 Folder \_\_\_\_\_

**Received:**  
 Shipment from Job Site \_\_\_\_\_  
**AT&TIS**  
 Equipment Engineer: \_\_\_\_\_ Date: \_\_\_\_\_

**FIGURE E-6 – JOB COMPLETION REPORT**

A reproducible copy of the Job Completion Report form is provided on the following page.

**JOB COMPLETION REPORT**

Advance

FINAL

**JOB INFORMATION:**

AEO No \_\_\_\_\_ P/A Oracle No \_\_\_\_\_

AT&TIS Equipment Engineer \_\_\_\_\_

Installation Supplier \_\_\_\_\_ Supplier PO No \_\_\_\_\_

Jim No \_\_\_\_\_

After proper authorization, this document serves as notification from the Installation Supplier of job completion.

**Actual Job Completion Date:**

Project Description:

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**Material Hardwired Inventory**

**Action	Equip Description	PN	Quantity	*** Frame ID

\* Material Inventory section required on Legacy SBC and Bellsouth 'Telco' jobs only.

\*\* Action: Enter 'Add', 'Remove', or 'Retire'

\*\*\*\* Frame ID: Use 8 character format (floor 2, Aisle4, Bay 2) i.e. 01 0123 45

The following individuals were present and participated in the final job review:

Name	Title

**INSTALLATION REQUIREMENTS  
AT&T Internet Services**

**Section E, ATT-TP-76301  
September, 2008**

**YES / NO** All equipment ordered in the above specification has been provided and/or installed, without exception, in accordance with the current ATT-TP-76301 and is ready for service.  
(NOTE: Even if there are exceptions, this job is subject to AT&TIS quality audits.)

If **NO** is circled, list the exceptions below, and reschedule the job completion by issuing a revised Job Start Agreement.

---

Installation Supplier Representative (Sig)	Title	Date
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<b>AT&amp;TIS Operations Engineer (Sig)</b>	Title	Date
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Installation Supplier Representative (Sig)	Title	Date
--	-------	------

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AT&T Representative (Sig)	Title	Date
---------------------------	-------	------

This completed form (whether **YES** or **NO** is circled) shall be distributed to:  
AT&TIS Equipment Engineer, Job folderFolder

**FIGURE E-7 –ALARM RECORD REPORT**

A reproducible copy of the Alarm Record Report form is provided on the following page.



**FIGURE E-7 – REMOTE ALARM TEST RECORD REPORT**

A reproducible copy of the Remote Alarm Test Record Report form is provided on the following page.





**Power Assignment Log**



Master Site Power  
Assignment L...

**[END OF SECTION]**

**SECTION F -- FIRE STOPPING**

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**TABLE F-1 – SUMMARY OF CHANGES IN SECTION F**

<b>Change</b>	<b>Item in 09/08 Issue</b>	<b>Item in this issue</b>
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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&TIS 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 general requirements for opening and closing through-penetrations in floors and fire rated walls and protection of cable runs.
- 1.1.4 3M fire and smoke stopping procedures in this document describe previously used methods. Paragraphs are presented solely for purposes of assuring those remaining openings are in compliance to those methods. No new applications of 3M fire stopping systems shall be applied.
- 1.1.5 All fire stopping installed in AT&TIS equipment buildings shall be with UL Listed Systems installed in strict accordance to the manufacturer’s installation instructions.
- 1.1.6 Changes in this issue of Section F are summarized in Table F-1.

**2. REQUIREMENTS**

**2.1. General**

- 2.1.1 Smoke and fire stopping is required at all through-penetrations in floors and fire rated walls.
  - A: Through-penetrations in non-fire rated walls shall not be fire stopped.
  - B: The Installation Supplier shall contact the AT&TIS Equipment Engineer for questions regarding the fire rating of a specific wall. This information shall be documented on a JIM and a copy left in the job folder or job folder on site.
- 2.1.2 Fire-stopping products made by different manufacturers shall not be used in the same cable hole or through-penetration. The exception to this requirement applies to smoke stopping at

the interior of cable bundles. Existing fire stopping putty between cable layers that are not accessible and where new putty pads cannot be applied may remain in place even though the product is of another manufacturer.

- 2.1.3 When the Installation Supplier opens a cable hole, the Installation Supplier shall close and fire stop the cable hole in accordance with this section and in accordance to UL certified fire stop system drawings.
- 2.1.4 The Installation Supplier shall comply with the following fire stop management considerations:
  - a) The Installation Supplier shall permanently close through penetrations at the end of each workday or at the completion of an installation or removal operation, whichever occurs first.
  - b) The Installation Supplier shall update the Cable Penetration Reporting Log (see Section E).
  - c) The installation Supplier shall not leave the premises while a through-penetration is open.
  - d) Unframed cable holes in hollow walls shall be referred to the AT&TIS Equipment Engineer for upgrading so holes are framed on all four sides. Any supporting documentation regarding this issue shall be left in the job folder.
- 2.1.5 All penetrations shall be closed with Hilti fire stop materials and smoke stop putty in accordance to Hilti and UL Listed Fire Stop systems. Exceptions to this policy will be limited to the following:
  - a) Existing penetrations with other manufacturers' UL certified fire stopping systems may continue to be fire and smoke stopped with existing systems until those penetrations are opened in the future.
  - b) Cable penetration opened for inspection and immediately closed with no cable add or removal.
  - c) Closure of penetration during course of project when work in a penetration has not been completed. Final closure of penetration will be fire and smoke stopped with Hilti fire stop system.
  - d) Cable penetrations previously closed using other fire stopping system shall have all existing materials removed and replaced with Hilti materials. Smoke stop putty of another manufacturer that is not accessible internal to the opening or between cable bundles may be left in place.
- 2.1.6 If technical assistance is required for non-standard cable hole penetrations, the Installation Supplier shall complete the Request for Technical Assistance form at the end of this Section and forward as indicated on the form. When this form is used, a copy of the response from AT&TIS shall be left in the job folder at job completion.
- 2.1.7 Conduits and pipes shall not be added to through-penetrations containing network interconnection cables. Conduit and pipes shall be run through a separate opening, which shall be fire stopped with approved intumescent products. Refer to paragraphs 4.7 to 4.10 of this section for more information.

- 2.1.8 Through-penetration covers shall be removed before installing new cable and removing dead cable. Cable(s) and conduit shall not be pushed or pulled through an opening without the removal of the cable hole covers.
- 2.1.9 The Installation Supplier shall provide adequate protection for open cable holes to protect personnel and equipment where there is danger of material or personnel falling through the cable opening. This may include barricades, warning signs and mechanical protection.
- 2.1.10 The Installation Supplier shall ensure that all surfaces are clean and free of dust, grease, oil, loose materials, rust, or other substances, prior to applying intumescent putty or caulk.
- 2.1.11 The Installation Supplier shall ensure that fire stopping products are prepared and used in accordance with the manufacturer's documentation before installation.
- 2.1.12 The edges of cut intumescent composite sheets and cable hole cover plates shall be deburred and free of sharp corners.
  - a) The corners of composite sheets and cable hole covers shall be rounded to an 1/8-inch minimum radius.
- 2.1.13 The cover plate and intumescent composite sheets shall not extend beyond the edge of the corners of the cable hole sheathings at floor openings.
- 2.1.14 Multipiece cable hole covers shall be spliced together in the following manner:
  - a) A 2 inch wide 28 gauge galvanized steel splice strip shall be used to join the two pieces together. A splice strip shall not be multi-piece. It shall be of one continuous length.
  - b) The splice strips shall be secured with ¼ inch by ½ inch sheet metal screws spaced at a maximum of 3 inches apart starting from each end.
  - c) 1-¼ inch fender washers shall be used under the screw heads located on the outer edge of the cable hole perimeter.
  - d) Intumescent putty shall be placed under the splice strip filling the seam between adjacent pieces of composite sheets and adjacent pieces of covers at floor openings
  - e) Multiple small pieces shall not be spliced together to form one large piece.
- 2.1.15 Refer to figure F-50 for general guidelines for fire stopping adjacent wall building constructions.
- 2.1.16 Cable rack pans shall not be installed on internal cable rack sections running through fire rated surfaces such as walls. The cable rack pans shall end just at the opening of the penetration and continue on the other side where cable leaves the penetration. Cables shall be secured with cord to the cable rack at nearest external cross straps to penetration opening where cable enters and exits.

### **3. SMOKE STOPPING**

#### **3.1. Smoke Stoppage Associated with Cable Installation**

- 3.1.1 During cable installation, smoke stopping shall be achieved by filling the interior voids between the cables being installed with approved non-hardening intumescent putty as described below and shown in the appropriate figures in this section to the point of not permitting air flow to be detected through penetration.
- a) Smoke stopping is required on both sides of hollow wall penetrations that are not equipped with metallic sleeves or are not framed on all four sides.
  - b) Smoke stopping for solid wall and four sided framed hollow wall applications shall be applied on the side of the wall providing the greatest ease of installation, preferably the network equipment side.
  - c) The ends of all conduits, pipes, tubing, etc. used for routing cable and wire through fire rated walls and floors that do not terminate in an enclosure, shall be sealed with a minimum of 1/4" depth of intumescent putty or 1" minimum depth of Hilti fire block material.
  - d) Smoke stopping shall be applied to all cables restored to cable racks after cable removal/mining activity.
  - e) To limit the air flow from between cable bundles and around cable racks, putty shall be applied as well as possible around these areas.
- 3.1.2 Mini-coax cables shall be bundled together and treated as a single cable. They shall be fire stopped as follows:
- a) Each individual coax cable shall not be individually wrapped with an intumescent putty pad.
  - b) Intumescent putty or caulk shall be placed into the middle of the cable bundle to fill all of the void space between the coax cables.
  - c) The banded mini-coax bundle shall be treated as a single cable and fire stopped per requirements found in the rest of Section F.
- 3.1.3 After installing cables and applying smoke stopping material between the cables, the Installation Supplier shall tightly band cables together to compress the cable bundle and effectively join smoke stopping material to form an airtight seal. (See Figure F-2).
- a) Cable bands shall be a 1/4-inch or larger nylon cable tie (preferred) or a minimum of 4 strands of 9-ply wax fiber cord.
  - b) Cable bands shall be placed 1 ½ to 2 inches above the top cable hole cover and shall be visible for inspection when the last securing strap is more than six inches from the cable hole cover.
  - c) Cable bands shall be placed 1 ½ to 2 inches below the bottom side cable hole opening and shall be visible for inspection when the first securing strap is more than six inches from the cable hole opening
  - d) The locking head of the cable tie shall be positioned at the side or rear of the cable rack..

- e) Cable protection practices may require wrapping some cable types with protective sheeting such as fiber paper before they are banded together. Refer to Section J of this document.

**3.2. Smoke Stopping For Cable Holes Closed With 3M Products**

3.2.1 The Installation Supplier shall apply a minimum of 2 linear inches of intumescent putty between the last existing layer and any new cables during installation so that all voids and valleys between adjacent cables are effectively filled to achieve an air tight seal.

- a) The putty shall be applied in rope form filling the interior cable voids. To avoid unnecessary buildup of cable bundles, the vendor shall not wrap each individual cable with a putty strip.
- b) A minimum of two inches of putty shall be placed so that it extends at least 1-inch above the cable hole cover and 1-inch below the cover into the opening.

3.2.2 3M fire barrier pillow systems may have been installed in some locations. No further installations of the pillow systems shall be deployed. Existing wall penetration applications are required to be inspected for conformance to 3M UL Listed System drawings to pillow compression requirements and cable pileup limits. Pillow compression is required to be 20% and cable pileup on cable trays cannot exceed 3 inch height. Pillow systems installed in floor penetrations do not require inspection.

**3.3 Smoke Stopping For Cable Holes Closed With Hilti Products**

3.3.1 Cable openings and cable bundles shall be smoke stopped as follows;

- a) A single layer of minimum 1-inch wide putty pad material shall be firmly applied across the face of opening where cables will rest against the building surface. This layer of material shall be minimally as wide as the opening's cable rack(s) and extend 1 inch above/from the building surface. The portion of material extending above/from the building surface shall be pressed into the cable curvatures as cable is placed across the face of the opening in their final installed position.
- b) A single layer of minimum 1-inch wide putty pad material shall be firmly applied across each layer of cable in a manner that fills the voids between the cables to form an air tight seal.
- c) All layered smoke stopping material shall extend a minimum of 1 inch into floor and wall openings. Adjacent segments of layered material shall overlap a minimum of ¼ inch

**4. FIRE STOPPING**

**4.1. General**

4.1.1 Non-metallic pipe and tubing installed with cables shall be wrapped with a layer of intumescent wrap strip that is a minimum of 2 inches wide. Wrap strips to be located where pipe/tubing exits holes through floors and on both sides of walls.

- 4.1.2 Wrap strips shall be held in place by the use of nylon tie wraps, two strands of 9 ply cord, or aluminum tape unless otherwise specified herein.

**4.2. Continuous Slots Under Office Distributing Frames**

- 4.2.1 The closing of continuous slots under office distributing frames, regardless of depth, may be accomplished in the following manner. See Figure F-9.
- a) Work from below with covers in place. Use mineral wool batting of 3 or 4 inches thickness and cut 2 inches oversized to ensure a tight fit. Force mineral wool batting into the slot and press up against the covers to tightly pack all voids between vertical bundles of stub cables.
  - b) Insert mineral wool batting so that there are no vertical joints except at the stub cable. No bottom plates are required with this method.
  - c) Mineral wool batting installed over an equipment area shall be wrapped in aluminum foil to minimize dusting problems. Cutting and wrapping should be done in an area other than the telephone equipment area.
  - d) Smoke stop all spaces between the cable and cover plate with intumescent putty.
  - e) Eye protection and dust masks shall be worn by the installer for this operation.

**4.3. Partially Occupied Cable Slots and Large Floor Openings**

- 4.3.1 The occupied portion of cable slots shall be isolated from unoccupied portions and from portions fire stopped with another media by installing a steel partition between the ceiling and floor surfaces similar to the one as shown in Figure F-6A. Partitions are not required if the occupied and unoccupied portion(s) of a slot are fire stopped in the same manner with the same fire stopping products.
- a) Partitions shall be made from a minimum of 16-gauge painted or galvanized sheet metal.
  - b) There shall be zero to 1/4 inch of clearance between the partition and the sides of the cable hole for ease of installation. The partition shall be fastened to ceiling cover plates or to the building surface at a minimum of two locations at the lower end and shall be fastened at a minimum of one location at the upper end. The use of multi-piece partitions is acceptable. Multi-piece partitions shall be fastened together with a minimum of two fasteners in a manner that assures the pieces will react as a single rigid piece when subjected to pressure.
  - c) A 1/2 inch bead of intumescent putty shall be installed around the perimeter of partitions at their interface with building surfaces, slot covers and cable hole sheathings to form an airtight seal.
  - d) Partitions shall also be used to segment cable holes when opening is fire stopped with different technologies (mineral wool, blocks, composite sheets, etc) or are fire stopped with products from different manufactures (Hilti, 3M, etc).
- 4.3.2 Figure F-6B shall be used as a reference when it is necessary to segment large openings into smaller openings to enable more affective cable management and/or fire stopping. In such

cases partitions shall be fabricated from a minimum of 16 gauge (0.06) painted or galvanized steel and a minimum of 11 gauge steel shall be used for hole covers. The actual partitioning configuration used is dependant on floor/wall location and hole usage.

- a) At this time, the 15-inch front-to-back maximum size of a cable opening shown in Figure F-6B is applicable to holes fire stopped with Hilti fire blocks. It is relative to cable pileup allowances on miscellaneous cable racks.
- b) Wall cable holes greater than 2,496 square inches (17.3 sq. ft.) in size require partitioning into smaller openings when fire stopped with Hilti Fire Blocks. The longest allowable dimension comprising the 2,496 square inches is 52 inches. Reference UL Design WL-8014.

#### **4.4. Fire Stopping Small Rectangular Floor Openings Under Office Distributing Frames**

4.4.1 The closing of occupied small rectangular openings up to 4 x 10-inches in size shall be accomplished in the following manner. Refer to Figure F-10.

- a) Provide a temporary method of containment on one side (top or bottom, preferably the bottom) so that material can be packed against it.
- b) Pack all voids around the cables at the perimeter of the cable bundle to the full depth of the opening with mineral wool batting
- c) Install a layer of intumescent putty over the mineral wool batting at the top of the hole to a minimum depth of 1 inch.

#### **4.5. Fire Stopping Large Rectangular Openings Using 3M Products**

4.5.1 The fire stopping of large rectangular cable holes using intumescent material, regardless of depth, shall be accomplished in the following manner. Refer to Table F-2.

- a) Unless otherwise indicated for a particular fire stopping application, the space between the cable and intumescent cover plates shall be 1/2 inch ( $\pm 1/4$  inch) in width.
- b) Intumescent sheets shall be installed with the galvanized steel side exposed.
- c) The bottom intumescent sheet shall be supported in one of three methods listed below, in order of preference:
  - 1. Support stirrups – Six stirrups shall be installed for support of a drop in intumescent sheet. When the cable hole is wider than 24 inches, additional stirrups shall be placed not to exceed 12 inches between stirrups. When cable growth is within  $\frac{1}{2}$  inch of the rear center stirrup, that stirrup shall be removed. When cable is mined beyond the mid-point of the rear of the cable hole, install a rear center stirrup. Refer to Figure F-3.
  - 2. Modified steel ceiling cover plate – Cut the bottom steel cover plate to create a modified cover plate on the bottom of the cable hole using all existing and accessible fastener holes. A minimum of four bolts, one near each corner, is required to support modified ceiling plates at 1'-0" x 2'-0" openings. For new holes cut into existing floors, a bolt shall be placed within 2 inches of all corners. Additional bolts shall be

placed around the perimeter and spaced not more than 8 inches apart. This arrangement will be used to support a drop in intumescent sheet. Refer to Figure F-4.

3. Intumescent sheet attached to the ceiling—Place a 1/4 inch bead of intumescent putty between the ceiling surface and the intumescent sheet. Bolt the intumescent sheet directly to the bottom cable hole cover support or ceiling surface. A bolt with a 1 1/4-inch fender washer shall be placed within 2 inches of all corners. Additional bolts and fender washers shall be placed around the perimeter and spaced not more than 6 inches apart. Refer to Figure F-11.
- d) Where possible, install a one-piece drop in intumescent sheet. Multiple pieces shall be joined with a 2" seam strip secured with screws placed at 3" intervals. A bead of putty shall be placed under the seam strip where the two pieces join together. Refer to Figures F-3 and F-4. For the stirrup arrangement, secure the intumescent sheet with self-tapping 1/4 x 3/4 inch sheet metal screws and 1 1/4 inch fender washers. For the modified ceiling cover arrangement, secure the intumescent sheet with self-tapping 1/4 x 3/4 inch sheet metal screws and 1 1/4 inch fender washers spaced at a maximum of 12-inch intervals.
- e) A continuous dome of intumescent putty shall be placed around the cable bundle on the inside of the hole to fill the space between the cable bundle and the bottom intumescent sheet. This dome of putty shall extend a minimum of 1 inch out from the cable and 1 inch up from the bottom intumescent sheet. It shall be a minimum of 1/2 inch thick from the point where the cable bundle emerges from the intumescent sheet.
- f) To seal the interior of the opening, a continuous 1/2 inch dome of approved intumescent putty shall be placed around the perimeter of the bottom intumescent sheet and the side of the cable hole, as shown in Figure F-11. This shall include the space between the stirrups and the interior wall of the cable hole and wall and partition, if equipped.
- g) To seal the top of the opening, a 1/4 inch bead of intumescent putty shall be placed along the edge of the cable hole sheathing prior to installing the intumescent sheet. Refer to Figure F-11.
- h) The top intumescent sheet may be comprised of multiple pieces and shall be closed as follows: A 1/4 inch minimum bead of intumescent putty shall be applied along the butted edges. The seam of the butted edges (which may extend entire width of opening) shall be covered with a 2 inches wide, 28 gauge galvanized steel strip centered over the seam. The splice strip shall be secured with 1/4 inch self-tapping sheet metal screws spaced at 3 inches maximum on each side of the seam. Refer to Figure F-12.
- i) For floor openings, a 1/8-inch thick steel protective cover plate shall be installed. The space between the protective cover plate and the cable shall be no closer than 1/2 inches and no farther than 4 inches. Refer to Figure F-5.
- j) Steel cover plates shall be secured with a bolt placed within 2 inches of all corners. Additional bolts shall be placed around the perimeter and spaced no more than 8 inches apart.

- k) When the steel cover plate does not cover the total perimeter of the top intumescent composite sheet, additional bolts with fender washers shall be provided through the exposed intumescent sheet on 6 inch centers to secure the top intumescent sheet to the cable hole sheathing. Refer to Figure F-5.
- l) A continuous dome of intumescent putty shall be placed around the cable bundle above the top plates. This dome of putty shall be packed tightly into the space between the cables and the composite sheet. The dome shall extend a minimum of 1 inch from the cable and up from the top of the composite sheet. It shall be a minimum of 1/2 inch thick from the point where the cable bundle emerges from the composite sheet
- m) Empty cable openings shall be fire stopped using a single piece of intumescent board and steel cover plate.

#### **4.6. Large Rectangular Wall Openings Using 3M Products**

4.6.1 Wall openings for all types of fire-rated walls and partitions shall be fire stopped in the following manner. Refer to Figures F-12, F-13 and F-14.

- a) Intumescent composite sheets shall be installed with the galvanized metal side exposed and shall be sized to provide a minimum 2-inch overlap around the perimeter of the opening.
- b) Unless otherwise indicated for a particular fire stopping application, the space between cable and composite sheet shall be 1/2 inch ( $\pm 1/4$  inch) in width so that a minimum of caulk or putty material is required to seal an opening.
- c) A continuous bead of approved intumescent putty shall be installed around the perimeter of the opening under the composite sheet and the wall mating surface.
- d) Where necessary, the composite sheets may be pieced together in order to fit around the cables to form a continuous sheet. A 1/4-inch (minimum) bead of intumescent putty shall be applied along the seam of butted cover pieces. The seam shall be covered with a 2-inch wide, 28 gauge galvanized steel strip centered over the seam. The seam cover shall be secured with self-tapping screws spaced at 3-inch maximum O.C. on each side of the seam. Screws located at the outside perimeter of the composite sheet shall be equipped with 1 1/4 inch fender washers under the screw head.
- e) Securing screws and anchors shall be within 2 inches of all corners and not exceed 6 inches on center. Screws shall have a minimum 1-1/4 inch fender washers installed under the screw head at securing points..
- f) A continuous dome of putty shall be installed\_around the cable bundle as it exits the composite sheet. This dome of putty shall be 1-inch minimum out from the cable along the composite sheet and 1 inch out from the composite sheet along the cable. It shall be a minimum of 1/2 inch thick at the gap where the cable bundle emerges from the composite sheet.

4.6.2 Empty cable openings shall be fire stopped using a single piece composite sheet on both sides of the opening.

**4.7. Circular Openings Using 3M Products**

- 4.7.1 Circular openings containing cable shall be fire stopped in accordance with Figures F-16 to F-18, and F-23.
- 4.7.2 Mineral wool batting shall be installed at the required 1" minimum depth.
- 4.7.3 Intumescent caulk and/or putty shall be installed at the required 1" minimum depth.
- 4.7.4 Circular openings with non-metallic sleeves shall be equipped with the correct number of wrap strip layers or correct size of plastic pipe device per Table 18 of this section.
- 4.7.5 Apparatus surrounding penetrants shall be sealed with intumescent putty at the apparatus and building surface interface.
- 4.7.6 For circular opening with a Non-metallic sleeve, it shall be equipped with restricting collar per Figure F-18.
- 4.7.7 Openings in hollow walls shall be equipped with a properly constructed and sealed steel sleeve.

**4.8 Non-metallic Pipe Using 3M Products**

- 4.8.1 Circular openings containing non-metallic pipe shall be fire stopped in accordance with figures F-19, F-20 and F-24 at both sides of the wall.
  - a) Putty shall be installed at the required 1/4 or 1" minimum depth per the referenced figure.
  - b) Pipe shall be equipped with the correct number of wrap strip layers or size of plastic pipe device per table F 18 of this section.
  - c) Apparatus surrounding non-metallic penetrants shall be sealed with intumescent putty at the apparatus and building surface interface.
  - d) Openings in hollow walls shall be equipped with a properly constructed and sealed steel sleeve and packed with mineral wool batting.
  - e) The wrap strip layers shall be secured with a restrictive collar.

**4.9 Metallic Pipe Using 3M Products**

- 4.9.1 Circular openings containing metallic pipes shall be fire stopped in accordance with Figures F-21 and F-25.
  - a) Mineral wool batting shall be installed at a minimum of 1 inch required depth.
  - b) Intumescent putty or caulk shall be installed at a minimum of 1 inch required depth or the thickness of the wall; whichever is the lesser of the two. Refer to figures F-21 and F-25.

**4.10 Flexible non-metallic Tubing Using 3M Products**

- 4.10.1 Circular openings containing flexible non-metallic tubing shall be fire stopped in accordance with Figure F-22 at both sides of a wall.
  - a) Tubing shall be equipped with the correct number of wrap strip layers or size of plastic pipe device.

- b) The area surrounding the tubing and the building surface shall be sealed with a minimum depth of 1 inch of intumescent putty.
- c) Voids between adjacent runs of tubing shall be filled with a minimum depth of 1 inch of intumescent putty.

#### **4.11 Empty Openings Using 3M Products**

4.11.1 Empty circular openings shall be fire stopped in accordance with Figure F-26.

- a) Mineral wool batting shall be installed at a minimum of 1 inch depth in solid floors or walls and shall fill the complete area in framed wall openings.
- b) Intumescent caulk or putty shall be installed at a minimum of 1 inch of depth.
- c) Openings in hollow walls shall be equipped with a properly constructed and seal steel sleeve in accordance with Figures F-23 and F-24.

#### **4.12 Fiber Optic Cable Troughs Using 3M Products**

4.12.1 Fiber optic cable troughs shall not be run through floor penetrations. Where they presently exist, the opening shall be fire stopped in the manner shown in Figures F-15.

#### **4.13 Covered Metallic Raceways Using 3M Products**

4.13.1 Covered metallic raceways that penetrate fire rated walls or floors are not recommended. However, where they are currently installed they shall be fire stopped with Hilti M&P.

#### **4.14 Fire Stopping Using Hilti Products**

4.14.1 The fire stopping of large through penetrations using Hilti FS-657 fire blocks shall be in accordance with Figures F-30 to F-33 and F-45 to F-47 as covered below and in 4.14.2. Putty pads may/should be applied to building surfaces to assist with fire block installation when necessary or desirable.

- a) A single layer of minimum 1-inch wide putty pad material shall be firmly applied around the perimeter of the cable bundle and pressed into the curvatures formed by adjacent cables. Adjacent segments of layered material shall overlap a minimum of ¼ inch.
- b) Layered putty material shall extend a minimum of 1 inch into cable openings. This layer of fire protection material becomes the smoke stopping element of subsequent cable layers.
- c) Fire blocks shall be cut to the cable bundle's shape and to minimize the potential for air gaps. The blocks shall be installed in an overlapping (staggered) fashion to completely fill the remaining interior void of the through penetration. Blocks shall overlap a minimum of 1/4".
- d) Fire blocks shall be installed flush with the floor/wall building surface and extend 5-inches into the opening for miscellaneous holes and 8-inches into the opening for power and fiber cable only holes. On a single cable rack with mixed cabling (secondary power and switchboard cabling), the blocks shall extend 5-inches into the opening. Fire block installation shall equal wall thickness for power and fiber only holes in walls less than 8-

inches thick. Blocks may extend below the ceiling in the floor applications and beyond wall surfaces when covers are not required.

- e) Air leaks in the fire block installation shall be sealed at the top by wedging CP-617 putty pad or CP-618 putty stick material into detected air passages. There shall be no spaces between fire blocks.
  - f) A ½-inch (min.) dome or minimum 1-inch wide layer of putty shall be applied around the cable bundle and other penetrating items at their interface with the fire blocks. This perimeter of putty material is required at both sides of wall openings.
  - g) A 1-inch wide strip of putty pad or a 1/4-inch bead of putty material shall be applied around the top perimeter of the cable hole sheathings at floor openings as indicated in Figure F-30.
  - h) Large floor openings shall be covered with a minimum 11 gauge steel cover that is cut to approximate the shape of the installed cable bundle. The gap between the installed cable and the steel cable hole cover shall be 1/2-inch ± 1/4-inch.
  - i) In some AT&TIS offices, optional quick-release fasteners for floor top cover will require a thinner steel sheet to be used. The cover for these floor penetrations shall be 20 gauge steel. Only penetrations equipped with quick-release fasteners shall use the thinner covers.
  - j) A 1-inch minimum dome of putty shall be applied around the entire perimeter of the cable bundle at its interface with the steel cover plate, cable rack and cable hole sheathing. This dome of putty shall overlap onto the steel cable hole surfaces a minimum of 1/2-inch.
  - k) Fasteners shall be located within 2-inches of cable hole corners and spaced no more than 8-inches apart.
- 4.14.2 Wall openings having more than 4-inches of space between the penetrants, such as cable, cable racking, raceways and conduits, and the wall opening shall be equipped with wire mesh or sheet metal retention covers on both sides of the opening. Wire mesh shall be used when the distance between the wall surface and installed fire blocks does not exceed 1/2" on either side of the opening. Sheet metal covers shall be used when the distance between the wall surface and installed fire blocks exceeds 1/2-inch on either side of the opening. For walls 8-inches or less thick, wire mesh covers may be used if the fire blocks are installed in the 8-inch direction.
- a) Installed wall hole covers shall be no closer than 1 inch or more than 2-1/2 inches away from the hole penetrants.
  - b) Mesh covers shall be fabricated from #16 gauge galvanized 2-inch square (max.) wire mesh.
  - c) Sheet metal covers for wall openings shall be fabricated from #20 gauge (min.) galvanized steel.
  - d) Covers shall be fastened to the building surface with 1/4-inch fasteners with 1-1/2" fender washers installed under the fasteners head. Cover fasteners shall be appropriate for the building surface they are installed in.

- e) Fasteners shall be located within 2-inches of cable hole corners and spaced no more than 8-inches apart.
- f) Cable hole covers shall extend a minimum of 3" beyond the opening of cable holes in walls.
- g) Wall holes shall be closed with one type of cable hole cover. Wall holes shall not have wire mesh on one side and a steel cover plate on the other side.

Note: Hilti's strut system for supporting solid covers at wall openings may be used where space permits. Refer to figure F-49 for general strut system application guidelines.

4.14.3 Wire mesh or cover plate over Hilti fire stopping blocks will not be required in wall penetrations when T-Separator bar and Z-frame system is used as shown in Figure 33. The T-bar will provide the necessary resistance for fire hose stream requirement when fire block height does not exceed 6 inches above or below T-bar and wall opening height does not exceed 12 inches. Hilti Z-frame shall be secured around perimeter of wall penetration and T-bar secured with two rotating latches over face of the T-bar. T-bar may be screw fastened to Z-frame but makes future movement of T-bar more difficult when adding or removing cables.

#### **4.15 Fire Stopping Circular Openings Using Hilti Products**

- 4.15.1 Circular openings shall be fire stopped in accordance with Figures F-34 to F-44, and F-51.
- a) Mineral wool batting shall be tightly packed into the opening at the required minimum depth.
  - b) Fire blocks, caulk and putty shall be installed at the required locations and minimum depth.
  - c) Plastic pipe and sleeves shall be equipped with the required number of wrap strip layers or proper size of collar assembly.
  - d) Steel sleeves installed in hollow walls shall comply with the construction elements indicated in the relevant Figure reference.
  - e) Fire stop plugs (figure F-51) shall not be used in void openings unless the opening is equipped with a metallic sleeve.
  - f) Fire stop plugs (figure F-51) shall be sealed with a 1/2" minimum dome of CP-618 putty stick.

#### **4.16 Retrofitting 3M Fire Stops**

- 4.16.1 Retrofitting 3M fire stops with Hilti products shall be accomplished by:
- a) The vendor shall completely remove all accessible 3M materials except that used for smoke stopping the interior of cable bundles.
  - b) The periphery of cable bundles and building surfaces shall be thoroughly wiped to remove as much 3M material as practicable or where contact with Hilti's products is likely.
  - c) Modified ceiling plates used to support 3M drop-in composite sheets shall not be removed unless there is a need to do so such as a safety hazard or to avoid cable congestion.

**4.17 Replacement of Hilti Fire Stop Blocks**

- 4.17.1 Hilti FS-657 fire stop blocks shall be examined for suitability of reuse whenever cable penetrations in walls and floors are opened. The blocks shall be in one piece, compressible and pliable without tears, breaks, cracks, flaking, powdering, or signs of wear. Fire blocks showing any unacceptable conditions stated shall be removed and replaced with new block. Blocks cut to fit openings are not considered unacceptable blocks.
- 4.17.2 Hilti FS-657 fire stop blocks have a usable life expectancy of 25 years. After 25 years in service the old blocks shall be removed and replaced with new blocks. The examination and replacement of blocks should only occur when cable penetration is opened as a part of a cable project in the office. Blocks with fewer than 5 years of life remaining shall be replaced. Any block that is not dated shall be assumed to have been placed into service January 2005.
- 4.17.3 The Installation Supplier shall hand mark any new installed block with the month and year of installation with a black permanent marker pen.
- a) Blocks shall be installed so the markings are clearly visible.
- 4.17.4 Cable penetrations may have fire blocks of different installation dates.
- 4.17.5 Fire blocks in penetrations of buildings that have been through a fire event shall be examined for damage, discoloration, charring, burns, intumescent expansion and replaced if any of these signs are discovered.

**4.18 Fire Stopping Large Wall Openings with Hilti Board**

- 4.18.1 Alternative method to fire stopping large through penetrations in walls using a combination of Hilti FS-657 fire blocks and Hilti CP 675T fire stop boards shall be in accordance with Figure F- 31(b). The alternative method reduces the number of fire stop blocks required for fire stopping large penetrations by replacing fire stop blocks with fire stop boards.
- a) Hilti FS-657 fire blocks will be applied to areas of penetration where cables and cable rack pass through wall. Procedures for fire stopping using Hilti FS-675 fire blocks shall be in accordance to paragraph 4.14. Limit fire blocks above cables to no more than three rows to avoid wire mesh requirement.
- b) Hilti CP 675T fire stop boards shall be applied to areas of penetration away from cable and cable rack area.
- c) The area between fire stop blocks and fire stop board shall be separated horizontally by a Hilti CP 675 T-Separator Bar fastened to the back lip of Hilti CP 675 Z-Frame. The Hilti Z-frame lengths are installed to two vertical sides and top edge of the penetration secured to studs or directly to wall if concrete or masonry. Hilti CP 619T putty, 1" wide by 1/8" thick, shall be applied to inside of Z-frame between the wall and Z-frame.
- d) One Hilti CP 675T fire stop board shall be cut to fit opening (within 1/4") and inserted into opening until flush with back lip of Z-Frame. Hilti CP 619T putty is applied to inside perimeter of Z-frame edge prior to inserting interior board. An additional Hilti CP 675T board cut to fit opening (within 1/4") is inserted flush with wall assembly over the previous interior board. Distance holders attached to interior board keeps outside board flush with wall.

- e) Rotate latches across board placed on Z-frame to secure board and slide T-bar latches up to secure board. Finish by applying Hilti CP 619T putty to perimeter of board for smoke stop.

4.18.2 Large wall openings may also be fire stopped in accordance to Figure F-33 with Hilti FS-675 Fire Block and Hilti CP-675 T-Separator Bar. This system will be a fire block only application. Fire stopping to this system does not require outer wire mesh if installed in accordance to Figure F-33. The installation requires Z-frame secured around perimeter of wall opening and Hilti T-Separator Bar secured to Z-Frame.

#### **4.19 Optional Quick-Release Top Cover Floor Openings**

4.19.1 Quick-release hardware used to secure top covers to floor penetration sheathing may be substituted for cap-screws where required by the AT&TIS Equipment Engineer and the penetration has been identified for high activity. Because of the greater cost for installing the hardware, only authorized penetrations shall be equipped with quick-release feature. Quick-release feature allows cover to be removed and replaced without tools. Kits are available from Hilti.

- a) Quick-release feature is not recommended for general applications because of higher initial cost for materials and labor and the risks for metal shavings being introduced into the equipment space. The shavings are generated from the drilling of sheathing to install inserts.
- b) Where quick-release feature is required, every precaution shall be taken to avoid metal shavings from falling down cable hole or to embed into cable bundle. The area directly under sheathing shall be sealed with flame resistant plastic sheet taped to side of opening and around cables. The plastic sheet shall be formed to capture all shavings. A ball of clay or tacky putty shall be placed directly under top of sheathing in the area to be drilled to capture metal chips and shavings.

### **5. FIRE STOP LABEL REQUIREMENTS**

#### **5.1. Fire Stop Labels**

5.1.1 The AT&TIS approved cable hole labels (Figure F-7) shall be completed and affixed to an opening's cover plate and cable hole sheathing, building surface or cables upon completion of the fire stopping activity in a manner that will cause the label(s) to tear when the cable hole cover is removed. The label is not required when drop in ceiling plates are utilized.

- a) On wall openings closed with 3M or Hilti products, the label shall be affixed to the intumescent sheet, wire mesh or solid cover plate and the building surface it is attached to. For applications not requiring cover, mesh or sheet such as Hilti Z-Frame and blocks, the label shall be applied across the Z-Frame and one fire stop block immediately next to a block up against cables.
- b) For multi-piece 3M covers, a label shall be affixed across all pieces at the splice strips so that it must be removed to add or remove cables. This is in addition to the requirements in paragraph "a" above.

- c) At floor openings closed with 3M or Hilti products, a label shall be applied on each side of the steel cover plate (sides paralleling cable growth).
- d) For 3M composite sheets attached to ceilings, a label shall be applied on each side of the composite sheet and the building surface.
- e) All existing closed and/or open cable hole labels (as shown in Figure F-7 or similar) shall be removed in their entirety before affixing new labels.
- f) While a cable hole is open, the AT&TIS approved open cable hole label, (Figure F-32), shall be completed and affixed to the cable hole opening. This label shall remain in plain view until such time the hole is permanently fire stopped.
- g) For any situations where the cable hole label requirements cannot be met as noted in the above paragraphs, then the fire stop labels shall be placed across and affixed to the cables as shown in Figure F-8.

## **6 Building Services Fire Stopping**

### **6.1 Scope**

- 6.1.1 The following section provides fire stopping and smoke stopping requirements for CRE initiated building construction projects in AT&TIS network equipment buildings when no other fire stopping practices exist. CRE practices take precedence over these practices when they exist. However, fire stopping requirements within this document shall always apply when building services contractors perform work in AT&TIS network equipment space around where network services exist.
- 6.1.2 As a minimum all work performed by contractors shall be in conformance to Federal, State and local building, electrical and fire codes.
- 6.1.3 Fire stop and smoke stop requirements shall be applied to any penetrations of fire rated walls or floors using approved methods to maintain the fire resistance rating. At minimum the fire stop systems used shall be 2-hour rated.

### **6.2 Wall Penetrations**

- 6.2.1 Upon completion of cutting rectangular wall penetration and preparing penetration for use by Network, the opening shall be fire and smoke stopped in accordance to requirements stated in this document.
- 6.2.2 Wall penetrations shall be finished properly with no rough edges exposed, no sharp edges, hollow spaces, surfaces protected from release of loose concrete, sand, cement or gypsum powder. Edges of walls shall be trimmed and prepared for possible attachment of steel plate, wire mesh or other penetration closing material with threaded fastener to outside surface of opening.
- 6.2.3 Rectangular wall penetrations cut in concrete with series of circular borings that may leave scalloped edges shall be finished with steel finishing trim. The trim shall completely cover cut areas around and through the opening plus scalloped surfaces shall be filled with smoke stopping putty so smoke does not move through that space.

6.2.4 Wall penetrations not used immediately for cable racks, pipes and/or conduits shall be closed with Hilti Fire Stop methods using Hilti CP675T Fire Stop Board and Hilti CP675T Z-Frame system as shown in Figure F-52 or Hilti fire blocks as shown in Figure F-31.

6.2.5 Penetrations that have cable racks and cables running through them shall be fire stopped in accordance to methods referenced in paragraphs 2, 3 and 4 for Network equipment applications of this document.

### **6.3 Floor Penetrations**

6.3.1 Upon completion of cutting rectangular floor penetration and preparing penetration for use by Network, the opening shall be fire and smoke stopped in accordance to requirements stated in this document.

6.3.2 Floor penetrations shall be finished properly with no rough edges exposed, no sharp edges, surfaces protected from release of loose concrete, sand, or cement. Edges of floor shall be trimmed and prepared for installing sheathing if floor penetration is intended for network cable.

6.3.3 Cable hole sheathing assembly shall be steel C-channel surround of top perimeter. Floor penetrations for other applications shall have inside edges finished with steel angles.

6.3.4 Waterproofing shall be installed at the floor under new cable hole sheathings and equipment frameworks with cable access from the bottom such as BDFBs in accordance with Figure F-1 using a bead of intumescent caulk or non-hardening gasket compound such as Permatex No.2.

6.3.5 The Installation Supplier shall use four fasteners when installing cable hole sheathings up to 35 inches in any direction (one at each corner). Six fasteners shall be used when installing cable hole sheathings 36 inches or larger in any direction. The holes on the ends of the channel (1'-0" direction) are there in case the holes in the long direction cannot be used.

6.3.6 Rectangular floor penetrations cut in concrete with series of circular borings that may leave scalloped edges shall be finished with steel finishing trim. The trim shall completely cover cut areas around and through the opening plus scalloped surface shall be filled with smoke stopping putty so smoke does not move through that space.

6.3.7 Penetrations not used immediately for cable racks, pipes, conduits shall be closed with Hilti Fire Stop methods using Hilti FS-657 Fire Stop Blocks and a steel plate cover over opening as shown in Figure F-53.

6.3.8 Penetrations that have cable racks and cables running through them shall be fire stopped in accordance to methods referenced in paragraphs 2, 3 and 4 for Network equipment applications of this document.

### **6.4 Water, Compressed Air, Fuel, Natural Gas, Drain Pipes**

6.4.1 Steel, plastic or plastic encased pipes running through walls or floors in equipment buildings shall be fire stopped and smoke stopped to requirements of this document.

6.4.2 Penetrations for pipes may be circular bores or rectangular cut penetrations in concrete, block or wallboard. Each type of penetration requires the appropriate method designated to properly fire and smoke stop that opening.

- 6.4.3 Wall or floor cuts made with circular bore for installation of steel pipes shall be fire stopped following pipe installation with methods shown for Hilti Sleeve or Collars in Figures F-54 and F-55.
- 6.4.4 Wall or floor cuts of rectangular openings for multiple runs of pipes shall be fire and smoke stopped with Hilti FS-657 Fire Stop Blocks and Hilti CP-619T Smoke Stop Putty as shown in Figure F-56. Wall openings having more than 4-inches of space between the penetrants, such as cable, cable racking, raceways and conduits, and the wall opening shall be equipped with wire mesh or sheet metal retention covers on both sides of the opening. Wire mesh shall be used when the distance between the wall surface and installed fire blocks does not exceed 1/2" on either side of the opening. Sheet metal covers shall be used when the distance between the wall surface and installed fire blocks exceeds 1/2-inch on either side of the opening.

**6.5 HVAC Duct**

- 6.5.1 HVAC rectangular ducts running through walls shall be fire stopped and smoke stopped to the requirements of this document.
- 6.5.2 Penetrations cut into wall for HVAC rectangular ducts shall be sized as close to duct dimensions as possible. Minimal gap between duct and wall opening shall be maintained so excessive filling material will not be necessary. However, clearance between 1/2 to 1 inch should be provided between wall and HVAC duct to permit expansion and contraction of sheet metal and lateral movement of HVAC duct in wall penetration.
- 6.5.3 HVAC duct shall be supported by hanger rods from ceiling. HVAC duct shall be supported by ceiling hangers on both sides of the wall opening and duct should not contact wall as it enters or leaves opening.
- 6.5.4 Flashing made of minimum 14 gauge sheet metal around the perimeter of the HVAC duct with 1" bead of Hilti CP-619T Smoke Stopping Putty around flashing and HVAC duct wall shall be required for fire stopping and smoke stopping these penetrations as shown in Figure F-57.
- 6.5.5 Larger cutouts in wall resulting in an oversize opening for the HVAC duct requires filling all gaps on top, side and bottom with tightly packed mineral wool and 14 gauge sheet metal cover on both sides of wall. Sheet metal cover shall be smoke stopped with 1/4" bead of Hilti CP-619T Smoke Stopping Putty under cover and a 1" dome around cover and duct wall joint as shown in Figure F-57B.

**6.6 Electrical Conduit**

- 6.6.1 Electrical conduit used for AC power wiring running through walls and floors shall be fire stopped and smoke stopped to requirements of this document.
- 6.6.2 Circular electrical conduit running through walls or floors in circular bored hole shall be fire and smoke stopped as shown in Figures F-54 or F-55.

**6.7 Junction Boxes and Other Wall Mounted Equipment**

- 6.7.1 Electrical junction boxes requiring cutouts in walls shall require smoke stopping at the box cover plate to prevent intrusion of smoke. A strip of Hilti CP-619T Smoke Stop Putty shall be applied to perimeter on the back of the cover plate prior to attaching plate to the junction box. Putty shall be formed flat to permit cover to seat flush with outlet or switch.

6.7.2 Wall mounted equipment requiring a cutout in a wall shall be smoke stopped to prevent intrusion of smoke. A strip of smoke stop putty shall be applied to the inside surface of the mounting plate around the perimeter to seal the equipment to the wall. If the mounting plate does not overlap the wall opening, the smoke stop putty shall be applied around the perimeter of the equipment on the surface sealing any openings between the wall and equipment.

6.7.3 Any installation of junction boxes or wall mounted equipment requiring cutouts to both sides of wall resulting in a through hole to the fire rated wall, shall be fire stopped to return the wall to original fire rating.

## **6.8 Doors and Fire Dampers**

6.8.1 Doors installed in fire rated walls shall be a fire resistive door of F-rating not less than the rating of the wall. Doors shall have that rating stated on a label affixed to the door.

6.8.2 Doors shall have seals to limit smoke intrusion around all surfaces of door jambs and an under door sweep.

6.8.3 Automatic door closing feature shall be provided with door to keep door closed at all times.

6.8.4 Fire dampers shall be fitted with seals to prevent intrusion of smoke with vanes in their closed position. Damper shall close with automatic actuator provided with assembly.

6.8.5 Fire dampers shall be sealed around the damper frame's perimeter with Hilti CP-619T Smoke Stop Putty.

## **6.9 Top of Wall Joints**

6.9.1 Fire resistive walls shall be constructed from floor to building ceiling unless lay-in ceiling panels are provided to a fire resistive ceiling of F rating not less than the required rating of the wall.

6.9.2 Top of wall joints between wall and ceiling shall be fire stopped and smoke stopped in compliance to building and fire code requirements.

6.9.3 Walls shall be designed and installed to seismic design conditions applicable to site conditions and building usage.

**REQUEST FOR TECHNICAL ASSISTANCE RESPONSE**

**FIRE STOPPING NON-STANDARD THROUGH-PENETRATION ASSEMBLY**  
**TELECOMMUNICATIONS FACILITIES**

Author's RFTA Ref. No. _____			
Date _____	Telco Job Ref. No. _____	Office CLLI _____	Floor _____
Office Address _____		Cable Hole Desig. _____	
AT&TIS LEC Eqpt. Engr. _____		Phone _____	
<b>Submitted By:</b> _____		Company: _____	
Phone: _____	FAX: _____	Response Needed By: _____	

**Building Surface Construction:** Floor \_\_\_ Wall \_\_\_ Thickness \_\_\_\_\_ F Rating (if known) \_\_\_ hr.

Framed/Hollow Wall \_\_\_\_\_ Concrete/Block Wall \_\_\_\_\_

Size Of Opening \_\_\_\_\_ Describe Hole Lining/Sheathing If Any: \_\_\_\_\_

**Use Of Space On Both Sides Of Opening:** Side A: \_\_\_\_\_ Side B: \_\_\_\_\_

**Penetrating Apparatus** (include cable bundle size if applicable): \_\_\_\_\_

**Function Of Fire Stop:** Permanent Closing \_\_\_\_\_ Re-enterable Closing \_\_\_\_\_

**The problem/situation (By Installation Contractor):**

**Proposed resolution (By Hilti/AT&TIS Approval Team):**

**Send Request To:**

Hilti Fire Protection Engineering Team  
Ph: 1-800-886-8915 FAX 918-254-1679 E-mail Chad.Stroike@hilti.com

Approved \_\_\_ Denied \_\_\_

Questions to AT&TIS: Larry Wong, Ph. 925 823-4544 E-mail LW6932@att.com

**Comments:**

TABLE F-2 INDEX OF FIGURES

Line	Figure	Subject			
1	F-1	Waterproofing large holes in floors			
	F-2	Banding Cables			
	F-3	Stirrups for intumescent composite sheet support ( For info purposes only, no new installations)			
	F-4	Modified ceiling plates fro intumescent composite sheet support ( For info purposes only, no new installations)			
5	F-5	Protective covers for intumescent composite sheets at floors ( For info purposes only, no new installations)			
	F-6A, B	Cable slot partitioning arrangements			
	F-7	Cable hole label descriptions			
	F-8	Cable hole label installation at wall openings without solid covers			
	F-9	Continuous slots under distributing frame			
10	F-10	Small rectangular slots under distributing frame			
	F-47	Hilti fire block orientation guide			
	F-48	Cover junctioning – Large holes using Hilti fire stop blocks			
	F-49	Hilti solid cover strut kit guide			
	F-50	Fire stop application adjacent wall constructions			
<b>Hilti Fire Stop Systems</b>					
15	<b>Hole Type</b>	<b>Size</b>	<b>Construction</b>	<b>Penetrant</b>	<b>Figure</b>
	Large Rectangular	12" x 24"	Floor	Cable/Void	F-30,45,46
			Wall	Cable/Void	F-31,47A,B
	Very Large Rectangular	Greater than 12" X 24"	Floor	Cable/Void	F-48
			Wall	Cable/Void	F-31B
	Small Rectangular	Smaller than 12" x 24"	Floor/Wall	Non-met. Pipe	F-32
	Large Rectangular	12" X 24"	Floor/Wall	Non-met. Pipe/ENT	F-32
			Wall T-Bar substituting mesh	Cable/Void	F-33
20	Circular	≤ 6"	Solid Floor/Wall	Cable	F-34
		≤ 4"		Cable/Non-met. Sleeve	F-35
		≤ 4"		Cable/Non-met. Sleeve	F-19, 36
25		≤ 7"		Non-met. Pipe	F-37
		≤ 4"		Cable/Non-met. Sleeve	F-51
		≤ 6"		Non-met. Pipe	F-38
		≤ 6"		Metallic Pipe	F-39
		≤ 4"		Single ENT	F-40
		≤ 5"		Multiple ENT	-
		≤ 4"		Void	F-44
30	Circular	≤ 5"	Hollow Wall	Non-met. Pipe	-
		≤ 4"		Cable	F-41
		≤ 4"		Non-met. Pipe	F-42
		≤ 7"		Non-met. Pipe	-
		≤ 3"		Metallic Pipe	F-43
35		≤ 6"		Cable/Void	F-44
	Rectangular	12" x 24"	Floor	Building Svcs	F-53

			Wall	Pipes, conduit	F-52,56
	Circular	32" dia. max.	Floor/Wall	Building Svcs Pipes, conduit	F-54, 55
	Rectangular	12" X 24"	Wall	Building Svcs HVAC Duct	F-57

**FIGURE F-1 – TYPICAL WATERPROOFING OF LARGE HOLES IN FLOORS**

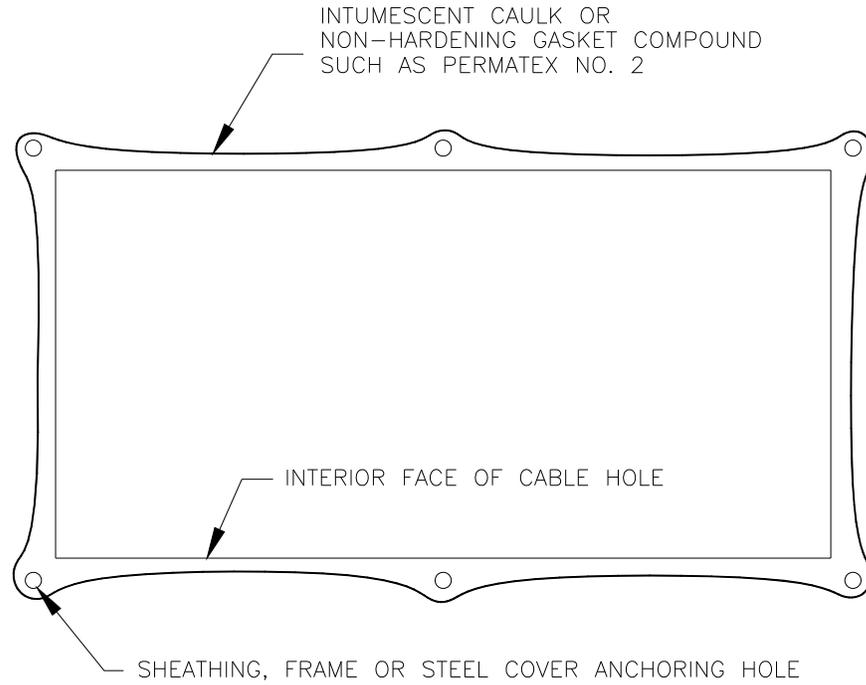
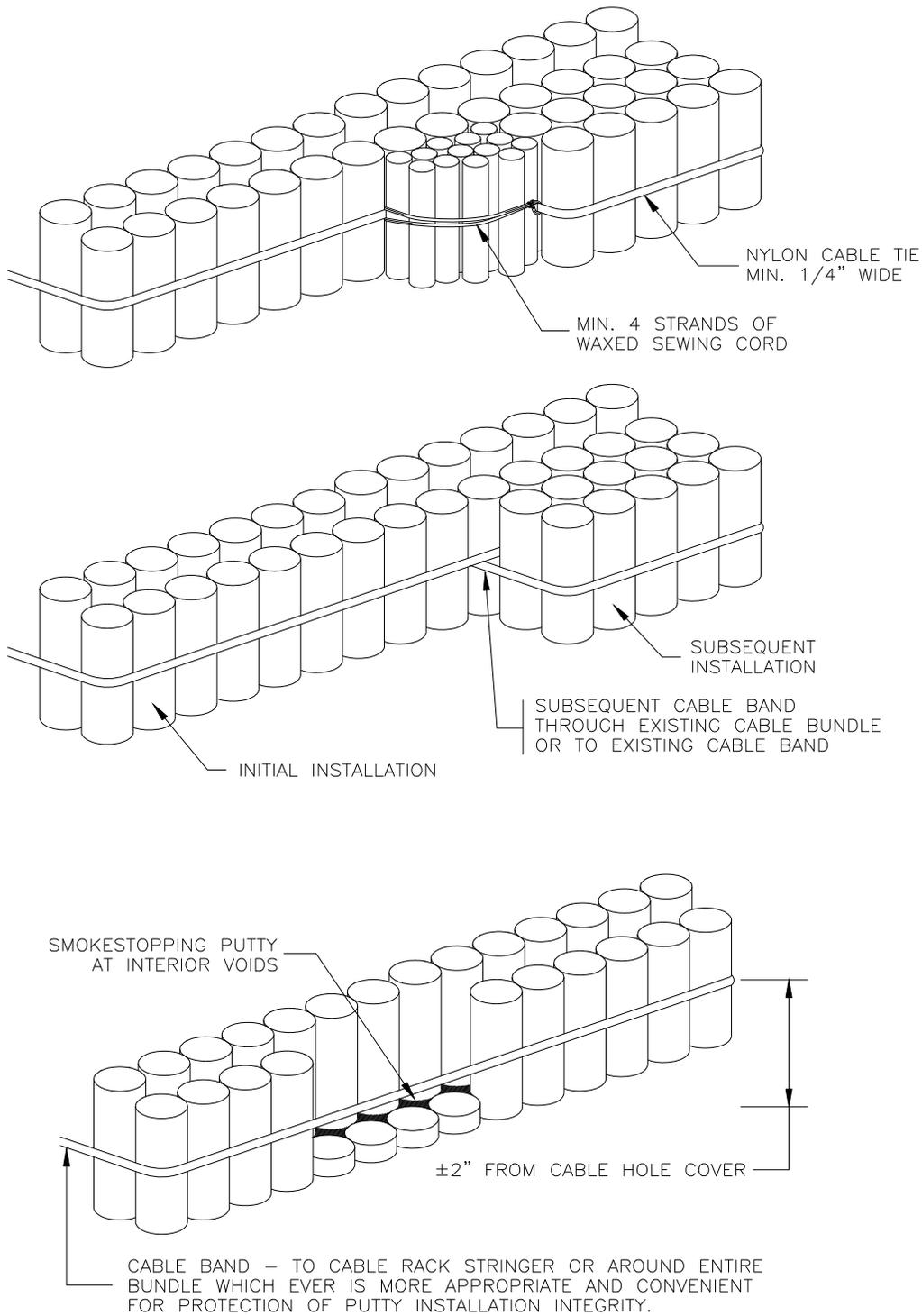


FIGURE F-2 – APPLICATION OF CABLE BANDING FOR SMOKE STOPPING



**FIGURE F-3 – CABLE HOLE SET-UP FOR COMPOSITE SHEET PRODUCTS USING SUPPORT STIRRUPS (UL FB-3004 METHOD)**

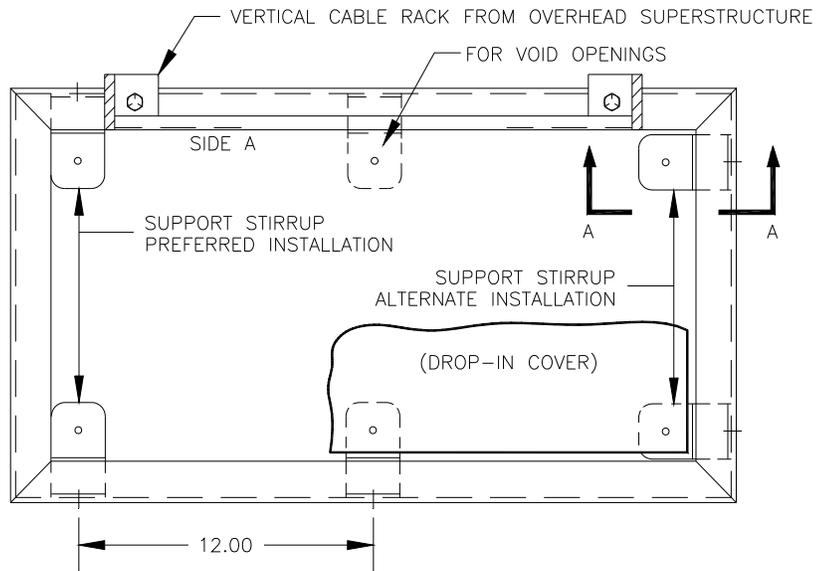
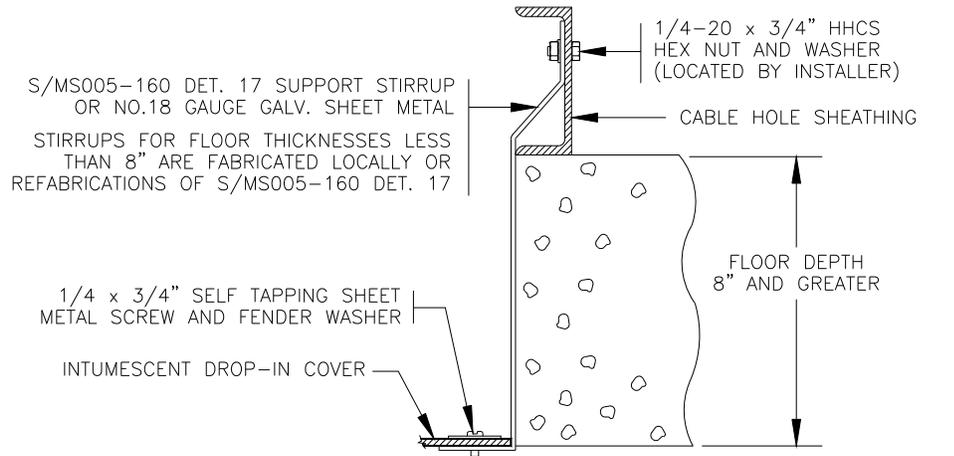


FIGURE F-4 – CABLE HOLE SET-UP FOR COMPOSITE SHEET PRODUCTS USING MODIFIED CEILING PLATE SUPPORT (UL FB-3004 EJ)

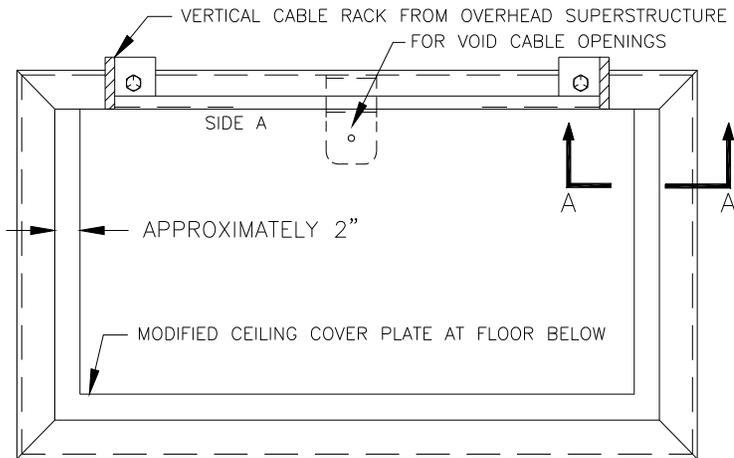
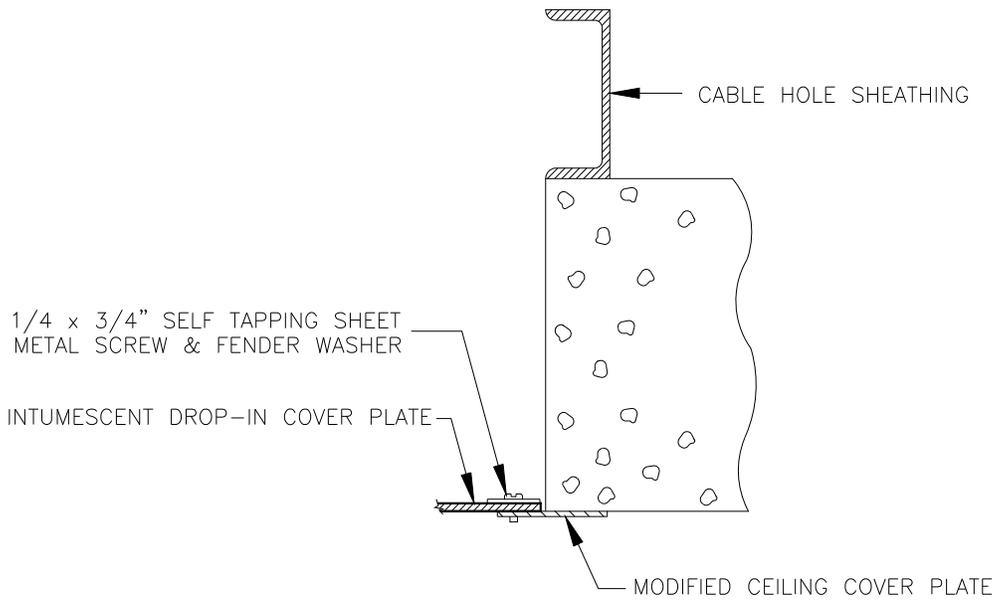


FIGURE F-5 – METHOD OF PROTECTING EXPOSED INTUMESCENT COVERS AT FLOOR OPENINGS

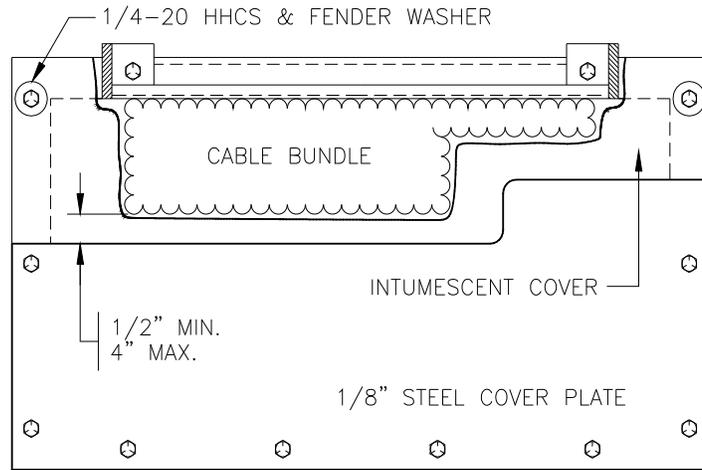


FIGURE F-6A – PARTITIONING CABLE SLOT IN FLOOR

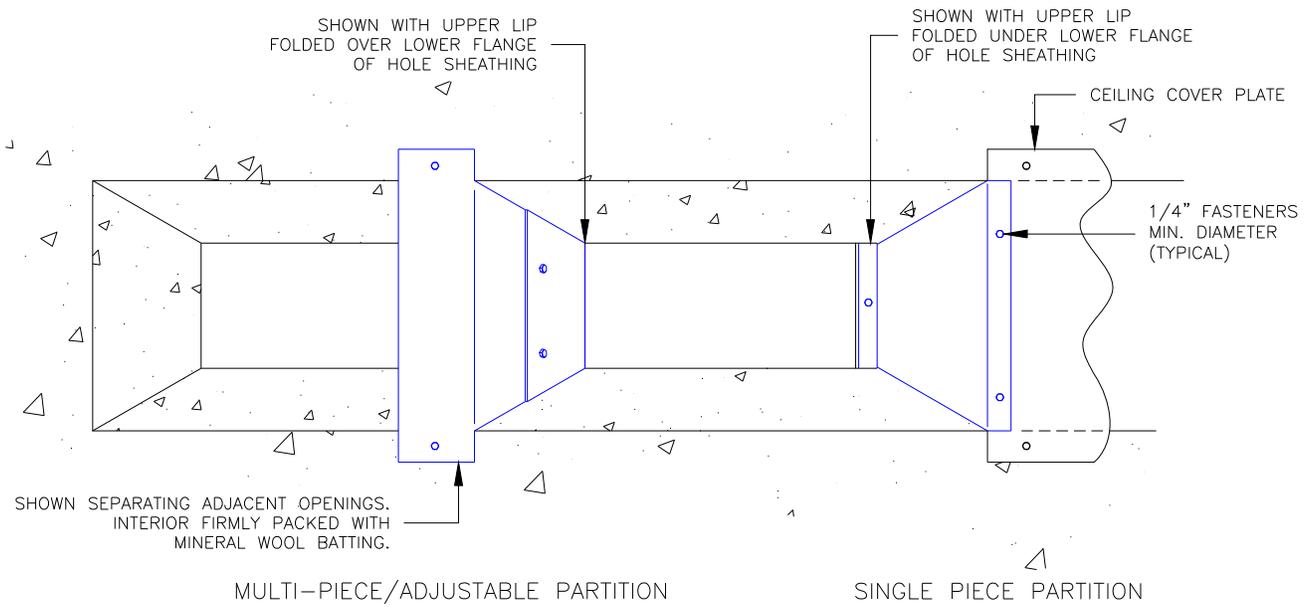
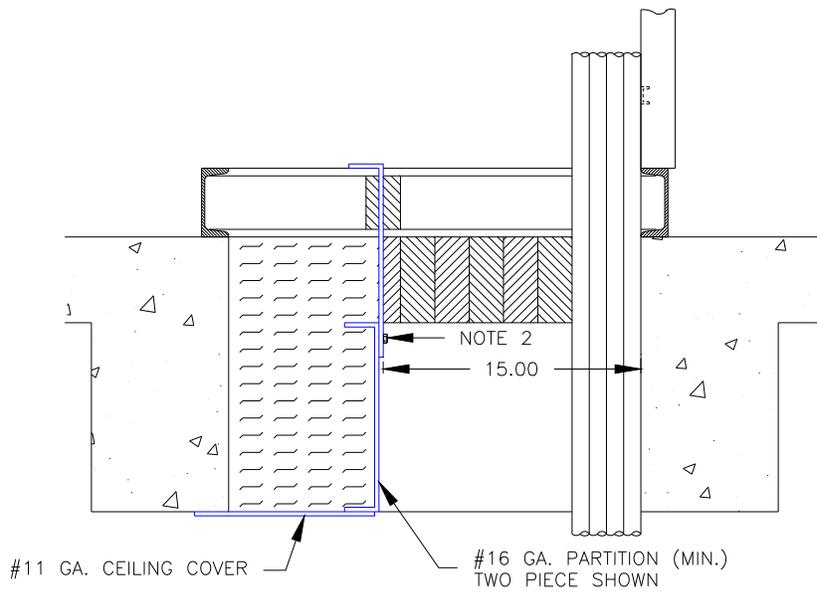
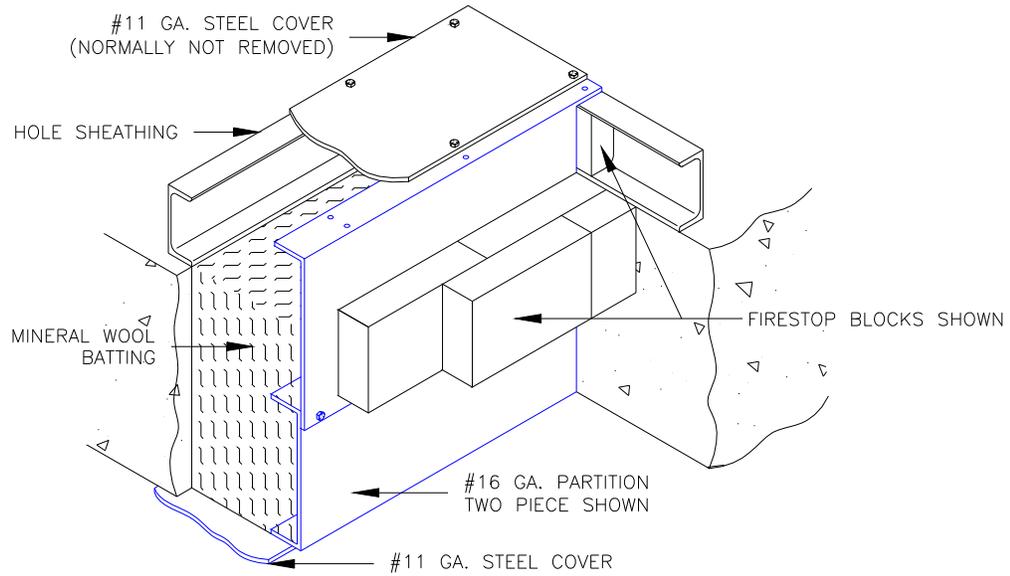


FIGURE F-6B – SEGMENTING LARGE FLOOR OPENINGS INTO SMALLER ONES



NOTE 1. SINGLE PIECE PARTITIONS MAY BE USED WITH FLOORS UP TO 12-INCHES DEEP. MIN. 1/4-INCH FASTENERS USED THROUGHOUT ASSEMBLY.

NOTE 2. FASTENERS OF TWO PIECE PARTITIONS TO BE LOCATED BELOW FIRESTOP MEDIUM, AT EACH END OF PARTITION AND ON APPROX. 8 CENTERS.

**FIGURE F-7 – TYPICAL FIRE STOP LABELS**

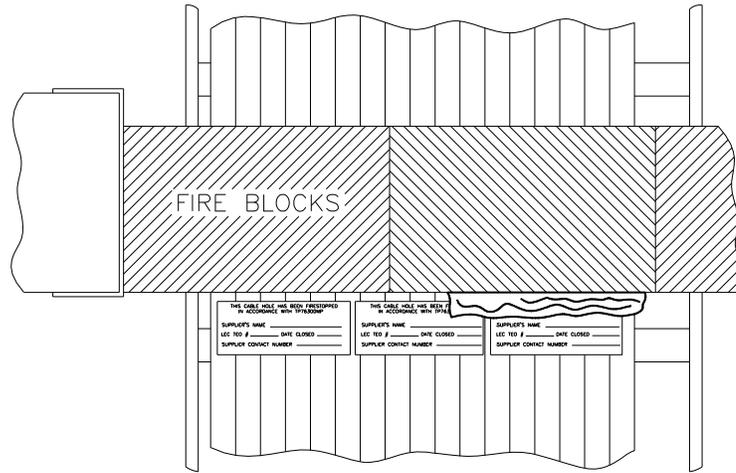
AT&TIS EQUIPMENT ENGINEER	
<b>THIS CABLE HOLE OPENED BY:</b>	
SUPPLIER NAME:	_____
<b>AEO #:</b>	_____ <b>DATE/TIME OPENED:</b> _____
SUPPLIER CONTACT NUMBER:	_____

Open Cable Hole Label  
(Black Characters On Green Background)  
(A)

AT&TIS EQUIPMENT ENGINEER	
<b>THIS CABLE HOLE HAS BEEN PROPERLY FIRE STOPPED IN ACCORDANCE WITH ATT-TP-76300</b>	
SUPPLIER'S NAME:	_____
<b>AEO #:</b>	_____ <b>DATE CLOSED:</b> _____
SUPPLIER CONTACT NUMBER:	_____

Closed Cable Hole Label  
(Black Characters On Orange Background)  
(B)

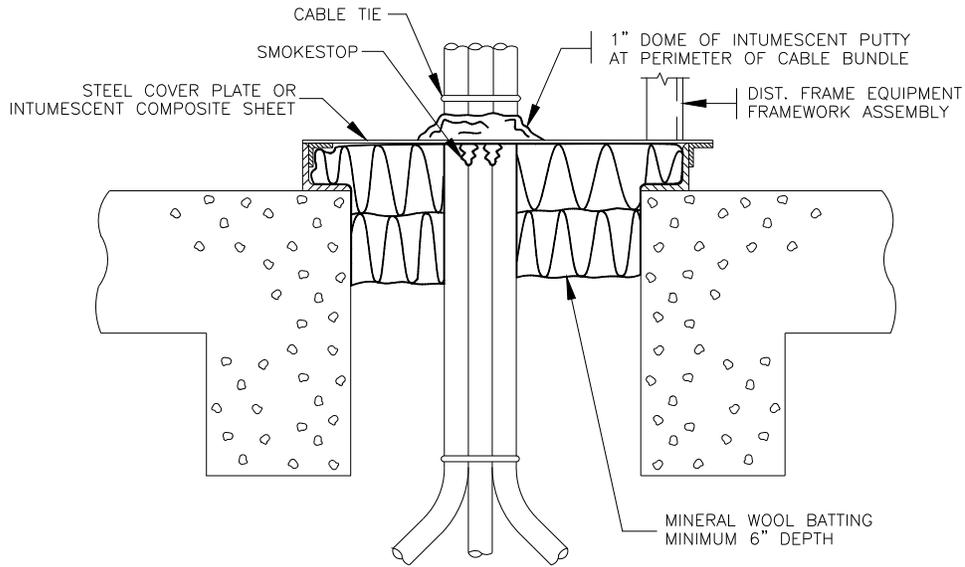
FIGURE F-8— APPLICATION OF FIRE STOP LABELS



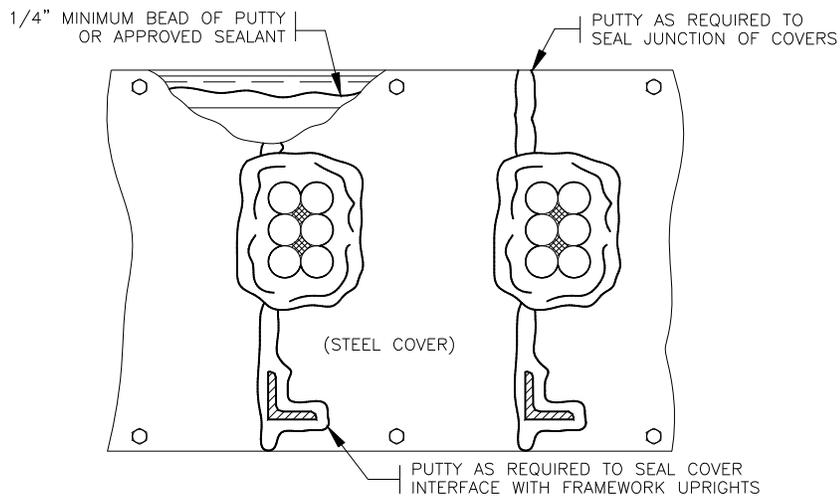
LABELS APPLIED ACROSS CABLE BUNDLE  
PRIOR TO SEALING BLOCK INSTALLATION.  
CONTRACTOR AND JOB INFORMATION NOT  
COVERED BY PUTTY.

(

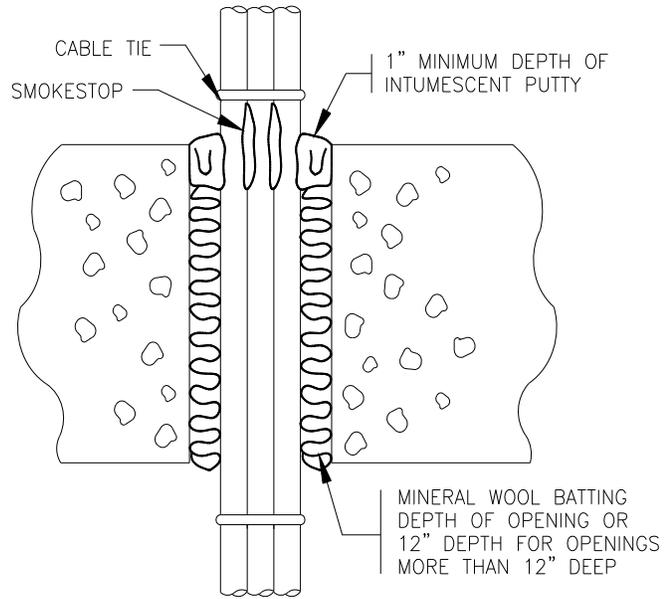
FIGURE F-9 – FIRE STOPPING CONTINUOUS SLOTS UNDER OFFICE DISTRIBUTING FRAMES



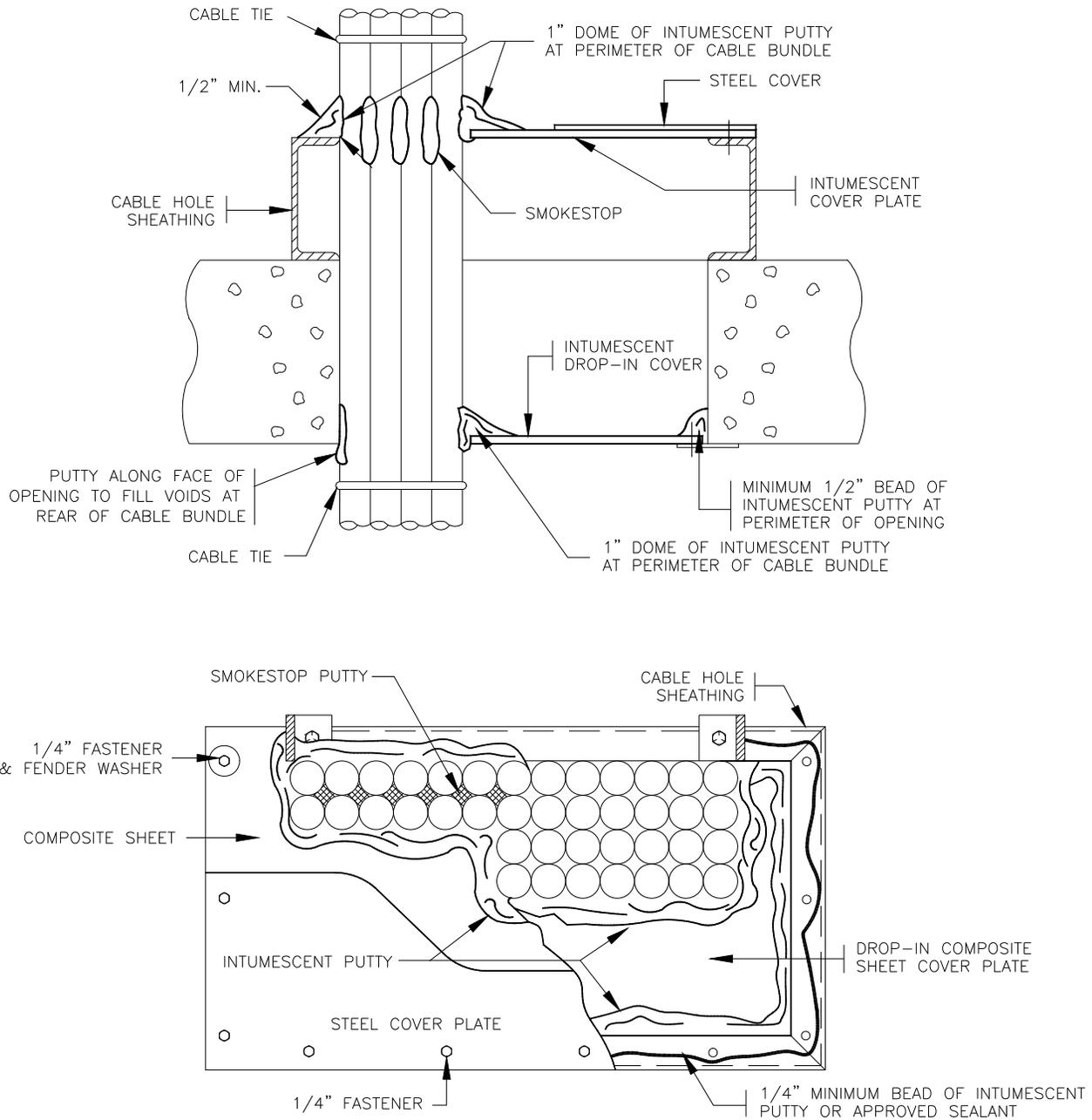
CROSS SECTION OF OPENING



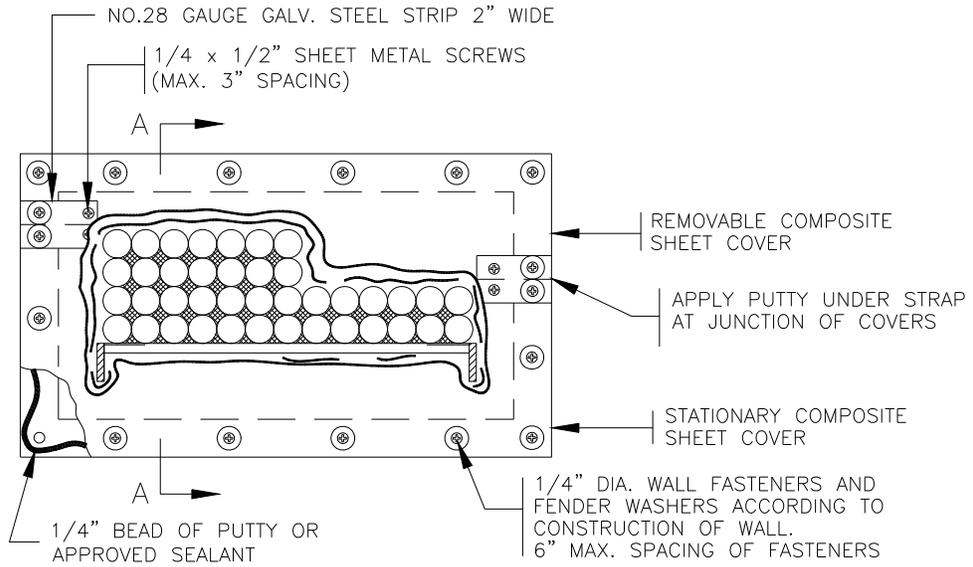
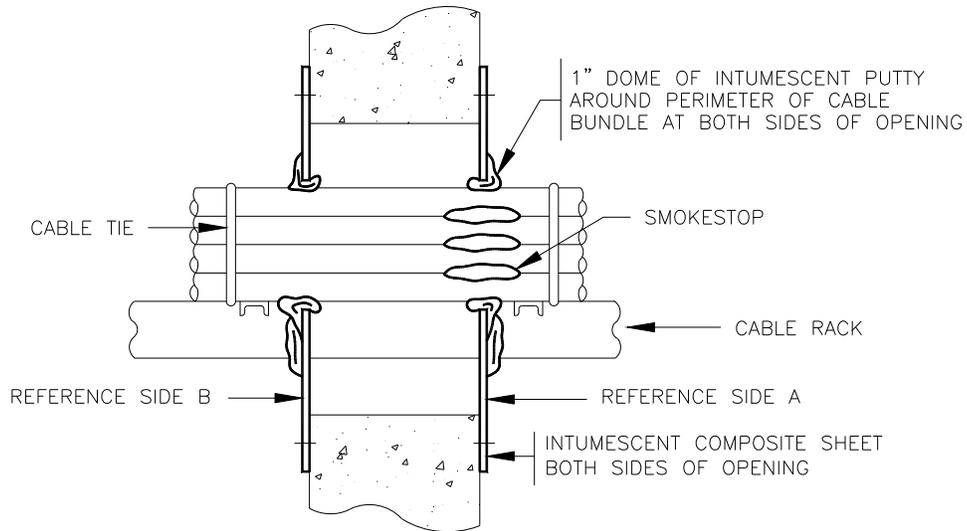
**FIGURE F-10 – FIRE STOPPING SMALL RECTANGULAR OPENINGS  
UNDER OFFICE DISTRIBUTING FRAMES**



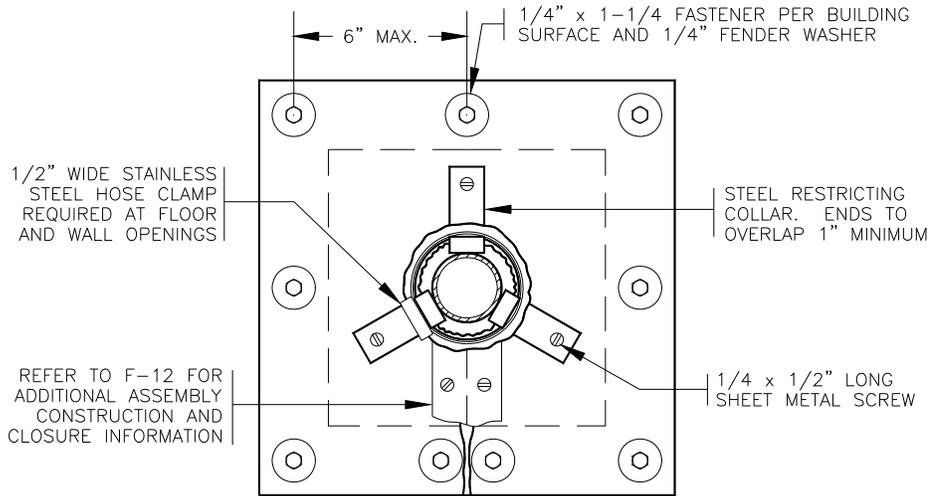
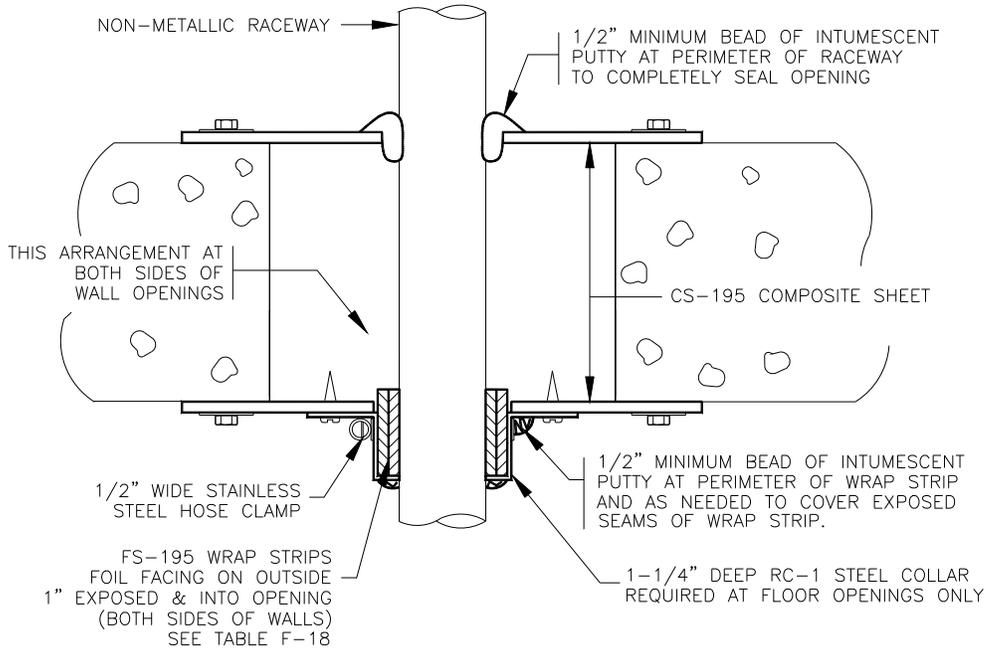
**FIGURE F-11 – FIRE STOPPING LARGE FLOOR OPENINGS USING INTUMESCENT COMPOSITE SHEET PRODUCTS (UL FB-3004)**



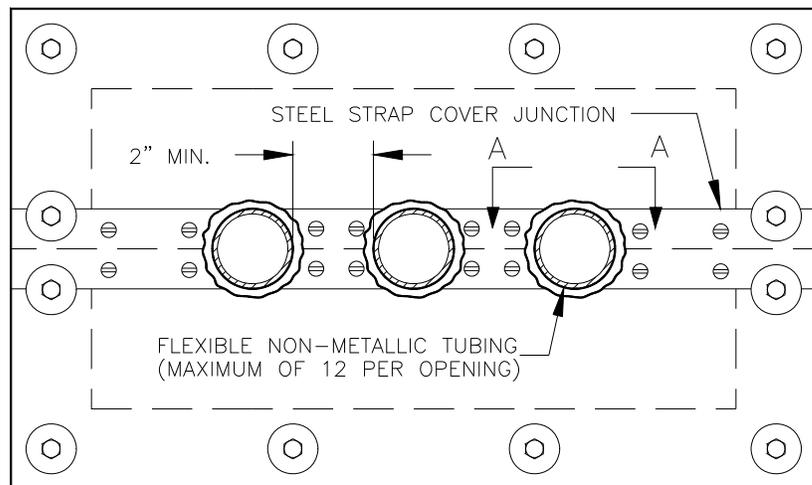
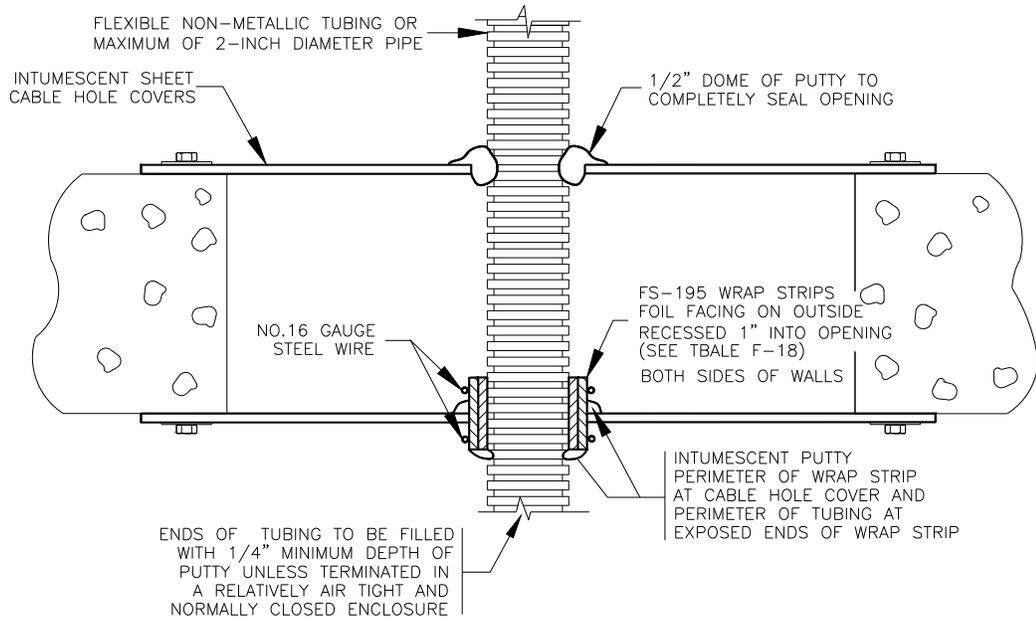
**FIGURE F-12 – FIRE STOPPING LARGE WALL OPENINGS USING INTUMESCENT COMPOSITE SHEET PRODUCTS (UL CAJ-4003)**



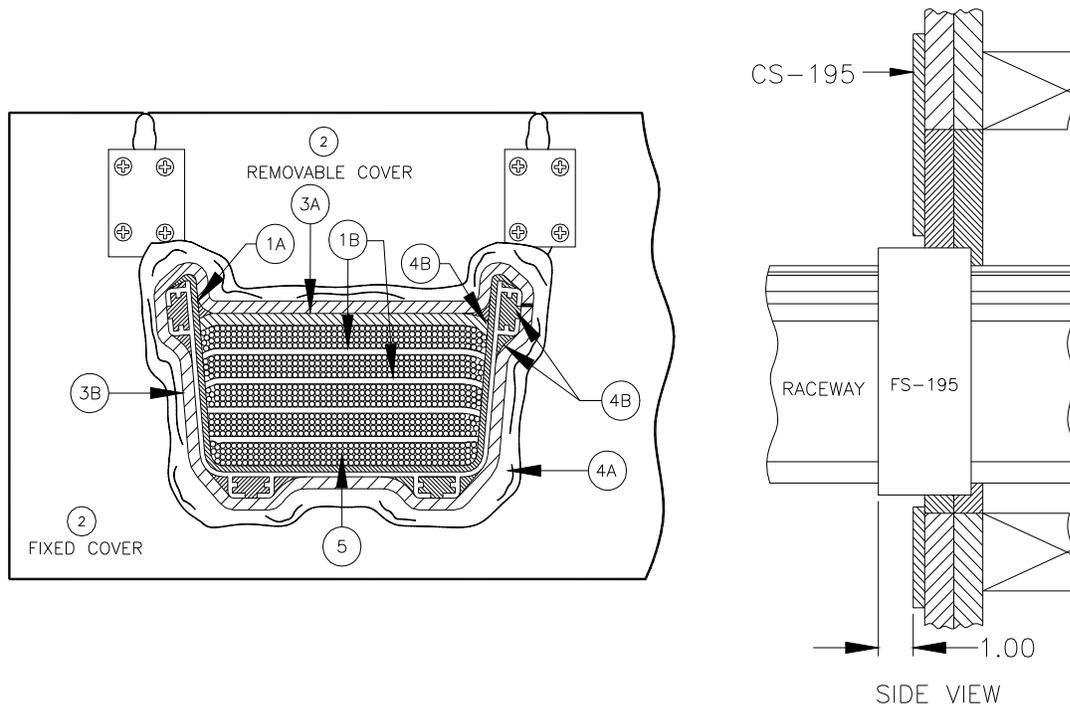
**FIGURE F-13 – FIRE STOPPING NON-METALLIC PIPE IN LARGE RECTANGULAR OR CIRCULAR OPENINGS USING INTUMESCENT COMPOSITE SHEETS (OPENINGS UP TO 84 IN.<sup>2</sup>) (ULCAJ-2003)**



**FIGURE F-14 – FIRE STOPPING FLEXIBLE NON-METALLIC TUBING IN LARGE RECTANGULAR OPENINGS USING INTUMESCENT COMPOSITES SHEETS (UL CAJ-2030)**



**FIGURE F-15 – FIRE STOPPING ADC RACEWAY IN LARGE WALL OPENINGS USING INTUMESCENT COMPOSITE SHEETS (UL WL-6002)**



**1. MPP+ Moldable Putty Pad**

- 1A. Interior of raceway lined with single 4" wide strip of MMP+ putty pad. A 4" wide strip to overlap top of raceway sides 1/2" and extend a minimum 1" from the wall surface.
- 1B. A single strip of 2" wide MPP+ putty pad formed across top of 1/2" maximum cable pileup. Putty strip to extend a minimum 1" from wall surface.

**2. CS-195+ Composite Sheet**

Installed per standard fastening and opening overlap requirements. Fixed and removable portion of cable hole cover cut to fit contour of raceway and installed cable. Space between covers and raceway to be  $\pm 1/2"$  to allow insertion of FS-195+ Warp/Strip around perimeter of raceway.

**3. FS-195+ Wrap/Strip**

- 3A. Apply a single layer of FS-195+ Wrap Strip across the top of cable bundle. This layer of wrap strip to be relocated to top of cable bundle as additional cable is installed.
- 3B. Raceway and installed cable enclosed by a single layer of FS-195+ Wrap Strip. Wrap strip to overlap top of either side of raceway and extend a minimum of 1" from wall surface.

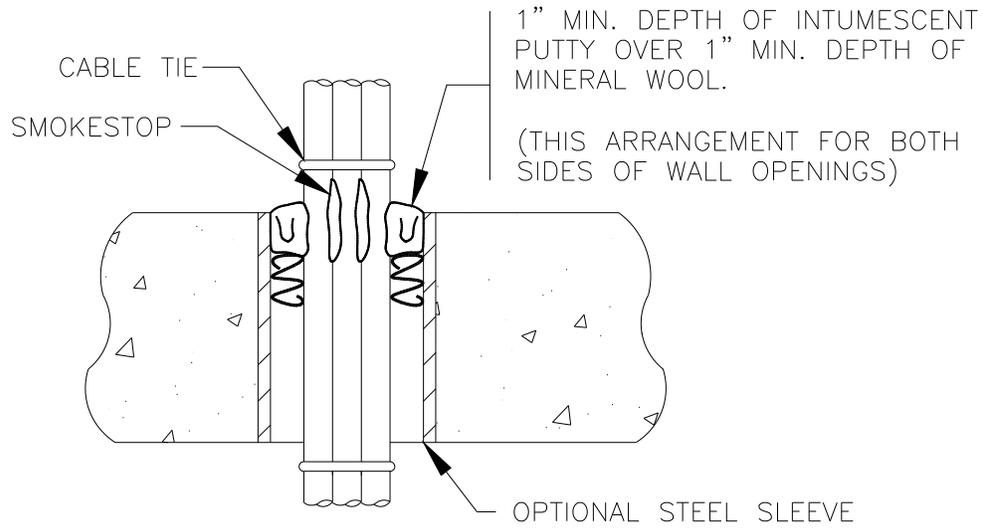
**4. MPS-2+ Putty Stix**

- 4A. A min. 1/4" bead of bulk putty to be installed around perimeter of FS-195+ Wrap/Strip to seal opening. Putty to be wedged into space between composite sheet and wrap strip so that wrap strip is held against raceway and installed cable. Putty to overlap composite sheet a minimum 1/4".
- 4B. Additional putty to be applied around the exposed side of wrap strip to seal all gaps and spaces between wrap strip and raceway and to plug interior of raceway support channels.

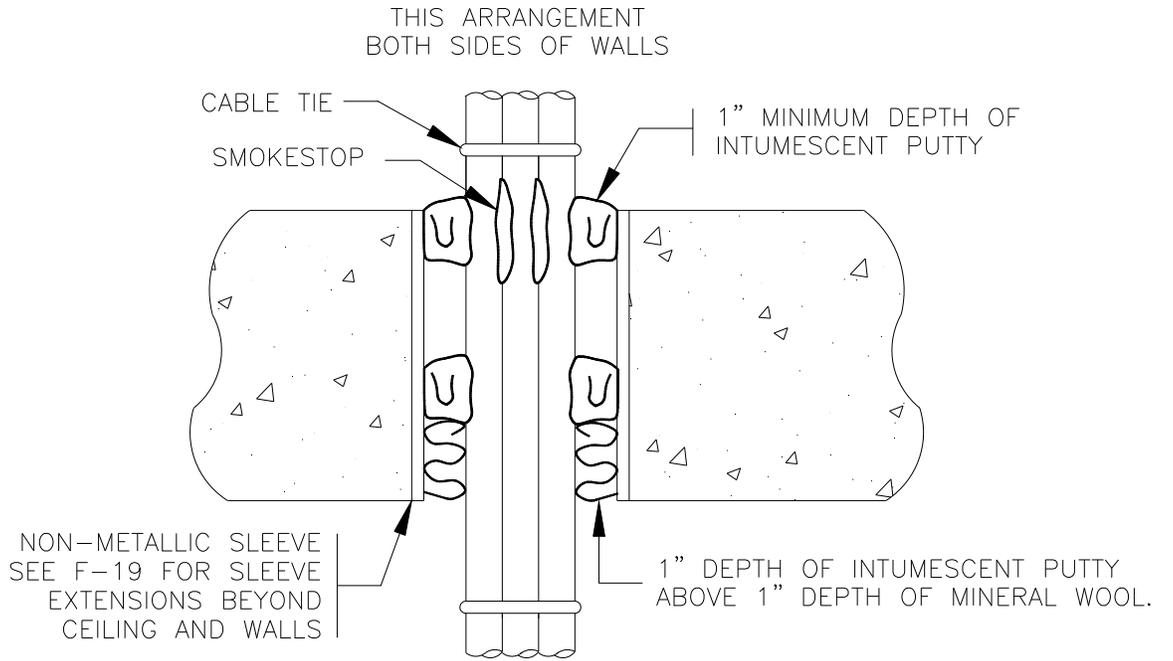
5. 3MM Diameter Fiber Optic Cables

Maximum of 960 jumper cables per raceway (approximately 3/4 visual fill). Cables to be installed and layered with single layer of 2" wide MPP+ pad for every 1/2" of cable pileup until pileup nears 3/4 visual fill. Install 1 layer of FS-195+ Wrap/Strip at the top of cable pileup.

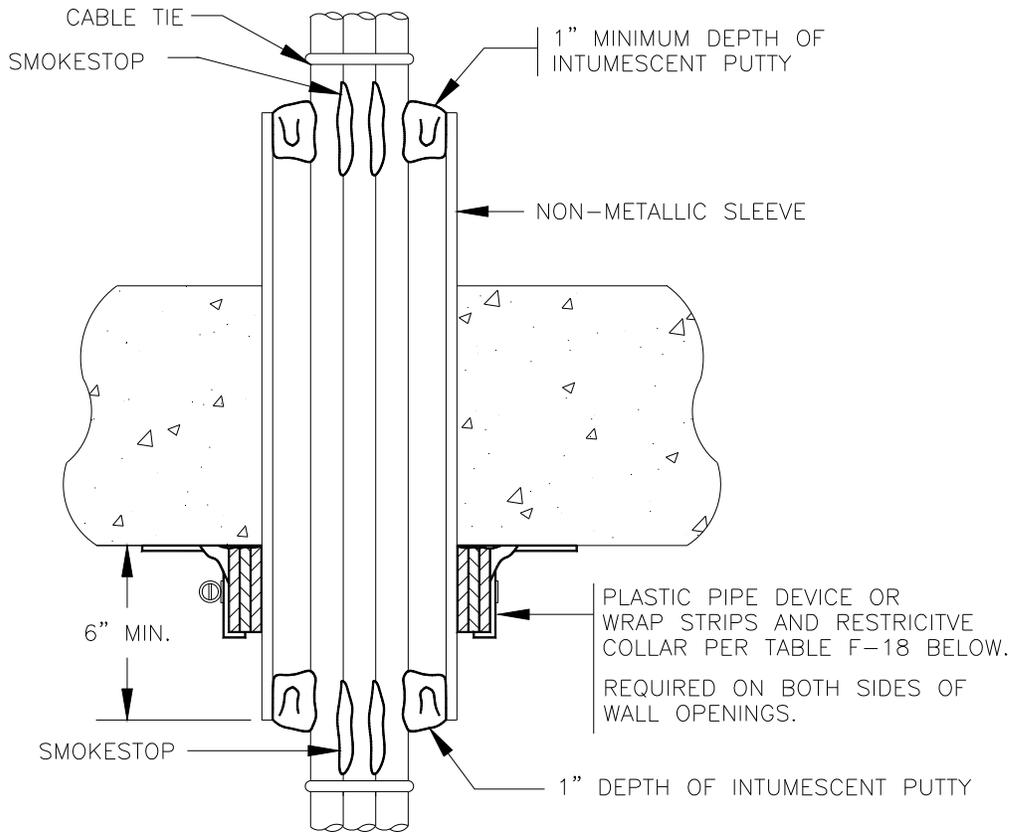
FIGURE F-16 – FIRE STOPPING CABLE IN CIRCULAR OPENING UP TO 6" DIAMETER IN  
CONCRETE/MASONRY FLOORS AND WALLS (UL CAJ-3021)



**FIGURE F-17 – FIRE STOPPING CABLE IN CIRCULAR OPENING UP TO 4" DIAMETER IN CONCRETE/MASONRY FLOORS AND WALLS HAVING A NON-METALLIC SLEEVE – SLEEVE EXTENDS 2" OR LESS BEYOND BUILDING SURFACE (UL CAJ-3058 EJ)**



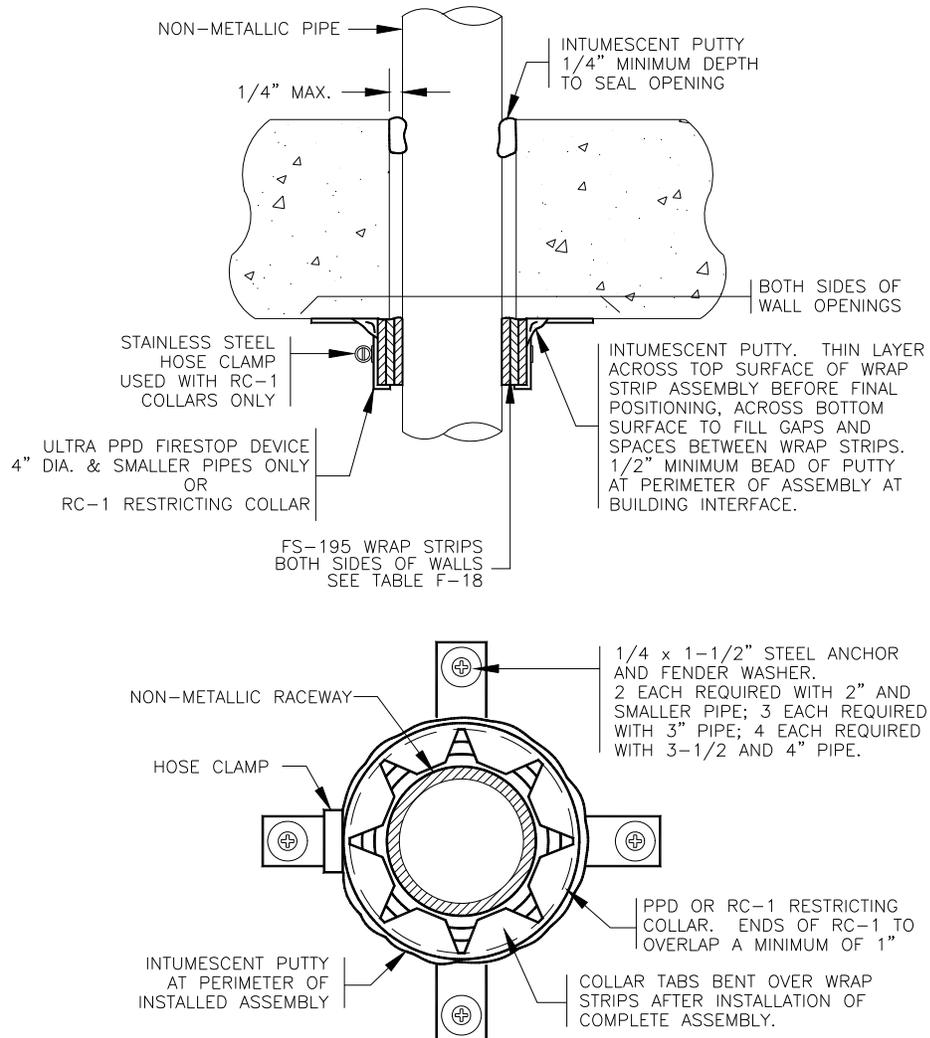
**FIGURE F-18 - FIRE STOPPING CABLE IN CIRCULAR OPENING UP TO 4" DIAMETER IN CONCRETE/MASONRY FLOORS AND WALLS HAVING A NON-METALLIC SLEEVE – SLEEVE EXTENDS MORE THAN 2" BEYOND BUILDING SURFACE (UL CAJ-3058 EJ)**



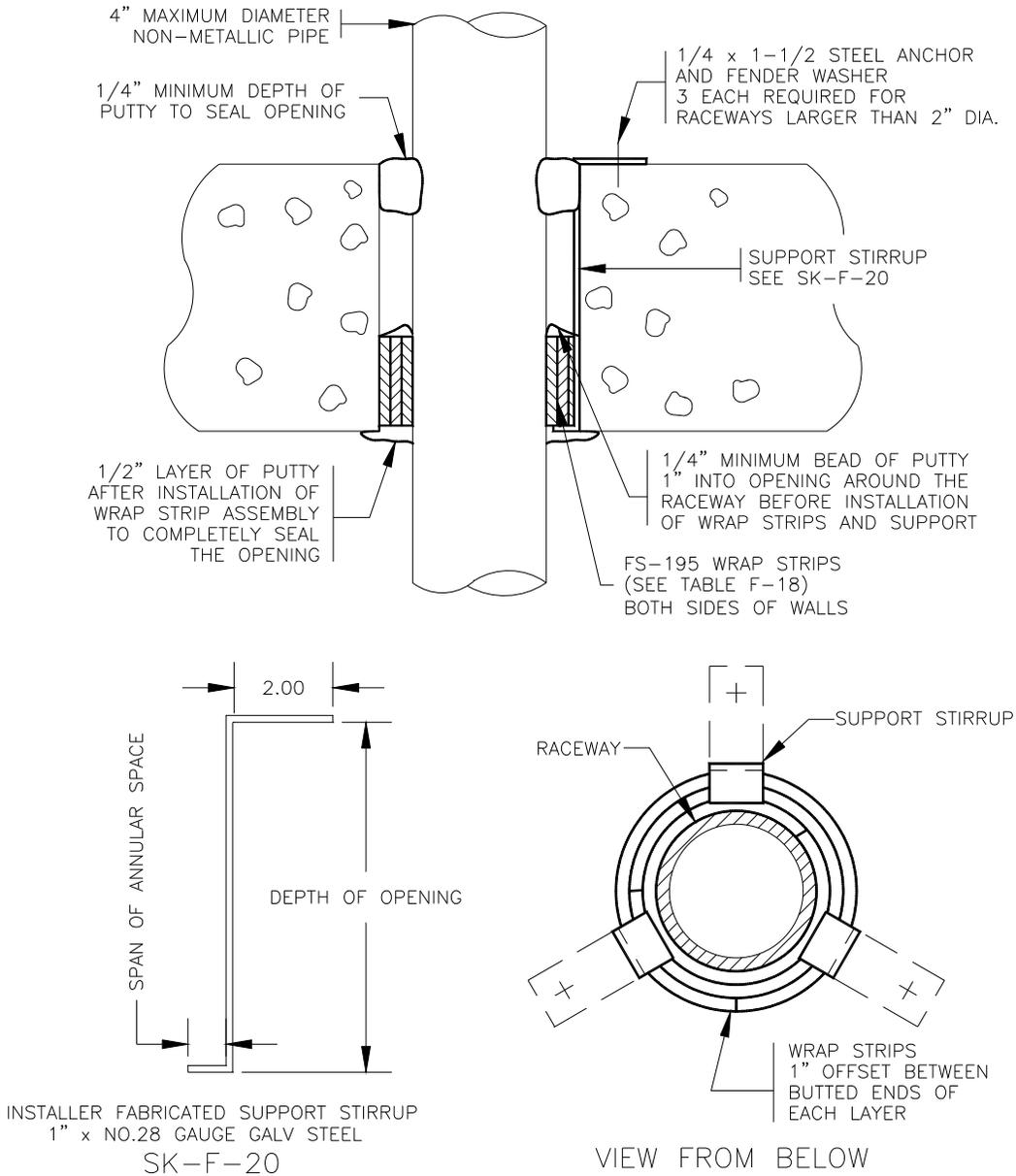
**TABLE F-18**

APPLICATION OF 3M FS-195 WRAP STRIP TO NON-METALLIC PIPES			
Pipe Size			No. of Wrap Strip Layers
PVC	ENT	SQ. or Rectangle	
1/2 to 2"	<1-1/2"	<3 Sq. In.	1
2-1/2 to 3"	1-1/2 to 2"	3 to 7 Sq. In.	2
3-1/4 to 4"	Bundles of <2" (7 max.)	>7 Sq. to 12-1/2 Sq. In.	3
6"		13 to 28 Sq. In.	2 Stacks of 3
8"		>28 Sq. In.	2 Stacks of 4

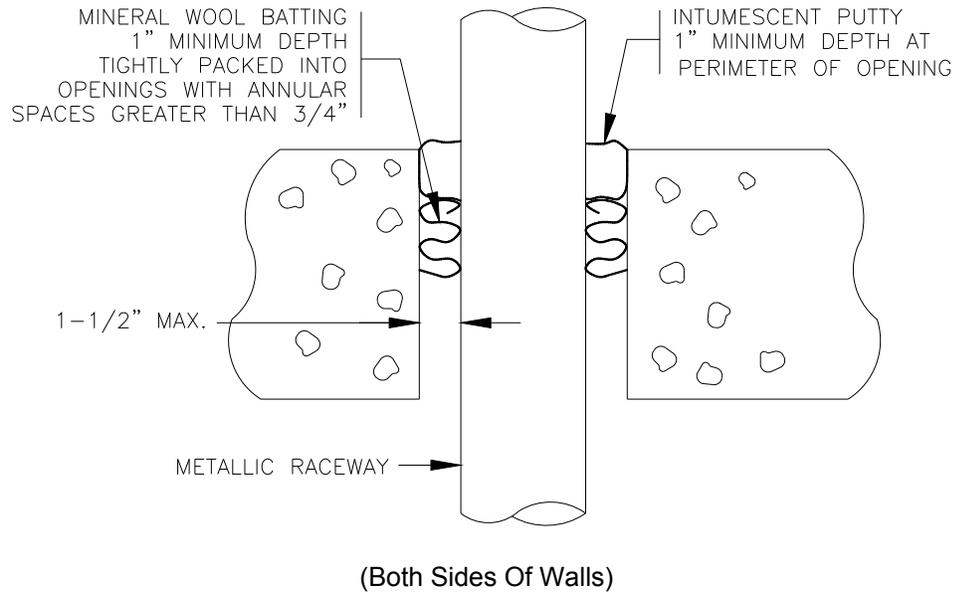
**FIGURE F-19 – FIRE STOPPING NON-METALLIC PIPE UP TO 4" DIAMETER IN A 7" MAX. DIAMETER CIRCULAR OPENING IN SOLID/HOLLOW FLOORS AND WALLS (UL CAJ-2001, CAJ-2226, WL-2092)**



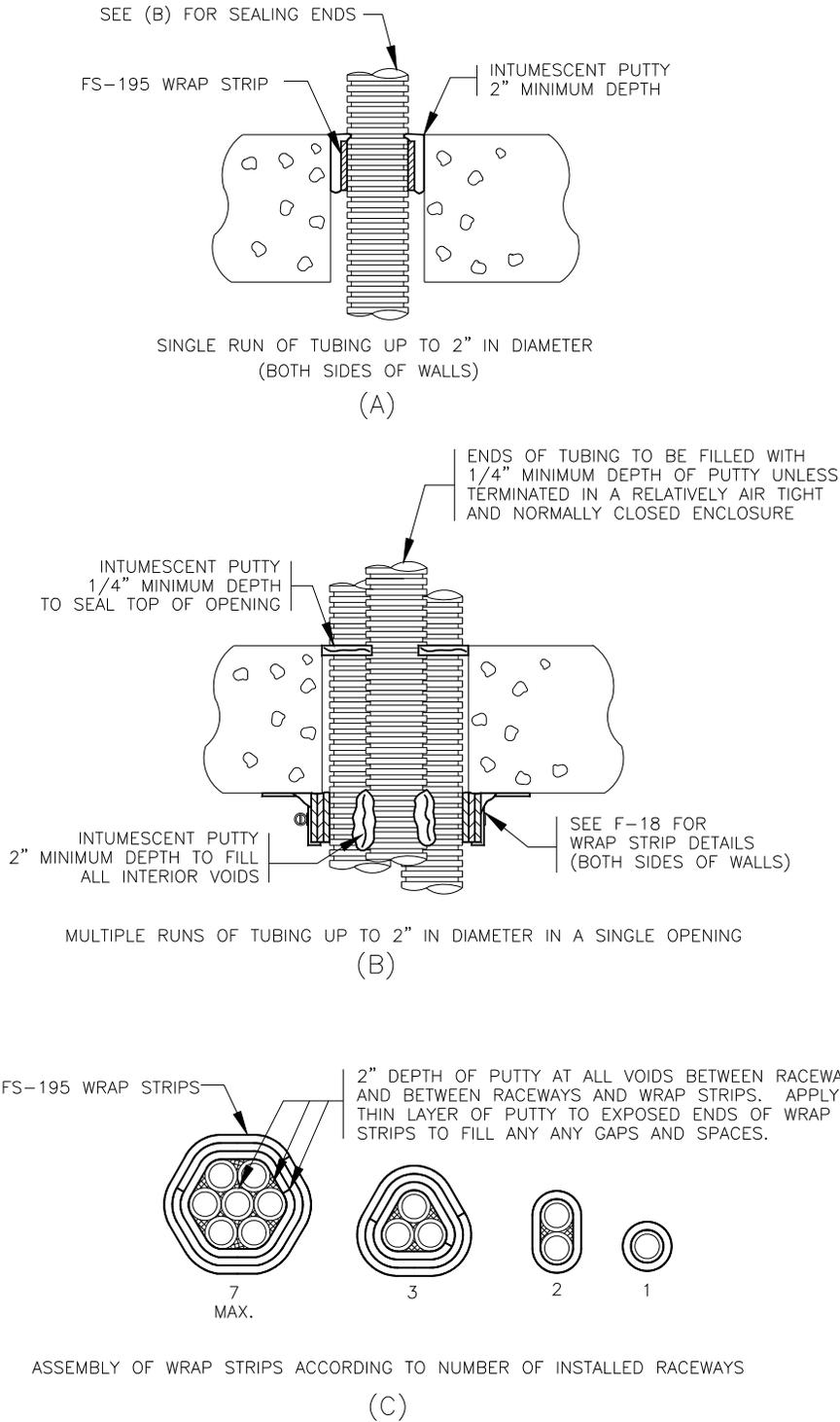
**FIGURE F-20 - FIRE STOPPING NON-METALLIC PIPE UP TO 4" DIAMETER IN A 6" MAX. DIAMETER CIRCULAR OPENING IN CONCRETE/MASONRY FLOORS AND WALLS (UL CAJ-2002)**



**FIGURE F-21 – FIRE STOPPING METALLIC PIPE IN CIRCULAR OPENING OF CONCRETE/MASONRY FLOORS AND WALLS (UL CAJ-1027)**

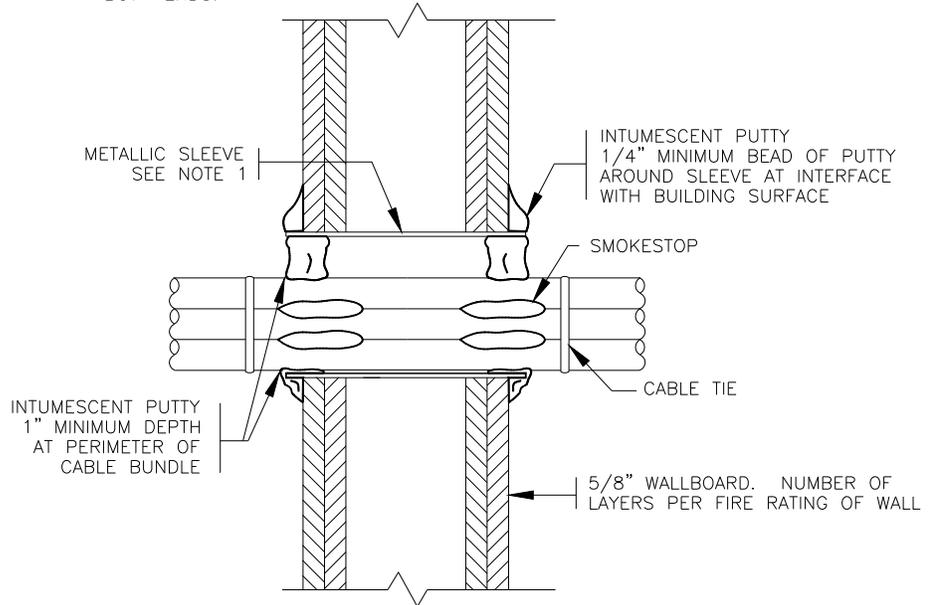


**FIGURE F-22 – FIRE STOPPING FLEXIBLE NON-METALLIC TUBING IN CIRCULAR OPENINGS OF CONCRETE/MASONRY FLOORS AND WALLS (UL CAJ-2028 & CAJ-2029)**



**FIGURE F-23 – FIRE STOPPING CABLE IN CIRCULAR OPENINGS OF HOLLOW WALLS (UL  
WL-3031)**

NOTE 1. SLEEVE TO BE 4" MAXIMUM DIAMETER EMT OR NO.28 GAUGE GALVANIZED SHEET STEEL. SLEEVE TO EXTEND 1/2" MINIMUM BEYOND WALL SURFACES. SHEET STEEL SLEEVE TO HAVE 2" MINIMUM OVERLAP ALONG ITS LONGITUDINAL LENGTH AND BE EQUIPPED WITH CABLE PROTECTION SUCH AS SLIT FLEXIBLE TUBING AT BOTH ENDS.



**FIGURE F-24 – FIRE STOPPING 2" MAX. DIAMETER NON-METALLIC PIPE  
IN HOLLOW WALLS (UL WL-2097)**

NOTE 1. SLEEVE TO BE 7" MAXIMUM DIAMETER EMT OR NO.28 GAUGE GALVANIZED SHEET STEEL. SLEEVE TO EXTEND 1/2" MINIMUM BEYOND WALL SURFACES. SHEET STEEL SLEEVE TO HAVE 2" MINIMUM OVERLAP ALONG ITS LONGITUDINAL LENGTH AND BE EQUIPPED WITH CABLE PROTECTION SUCH AS SLIT FLEXIBLE TUBING AT BOTH ENDS.

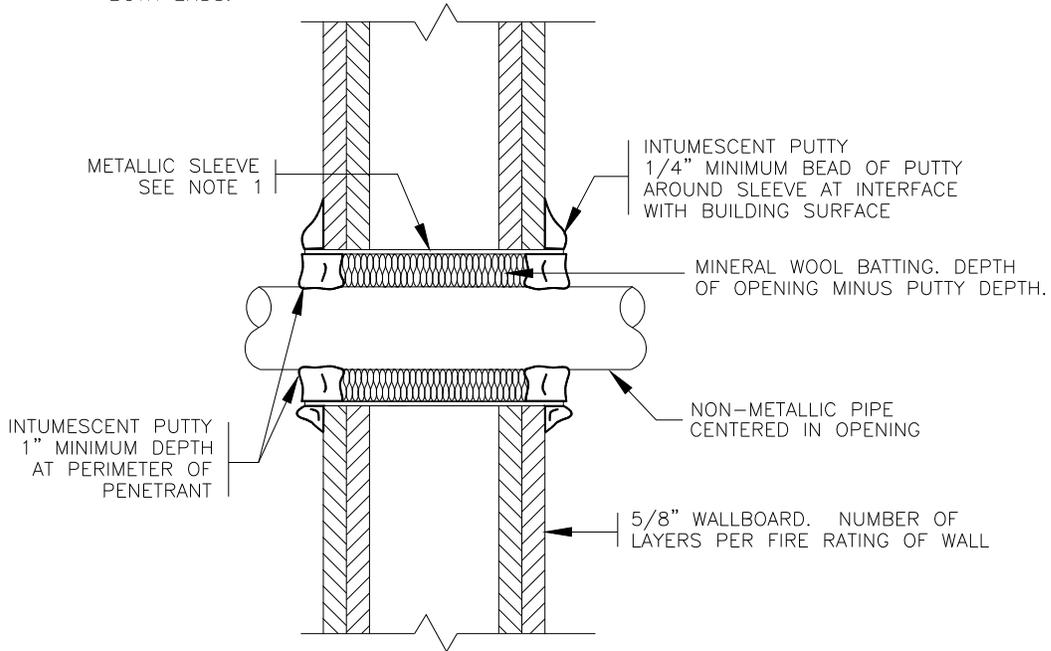


FIGURE F-25 – FIRE STOPPING METALLIC PIPE IN HOLLOW WALLS  
(UL WL-1001, WL-1032)

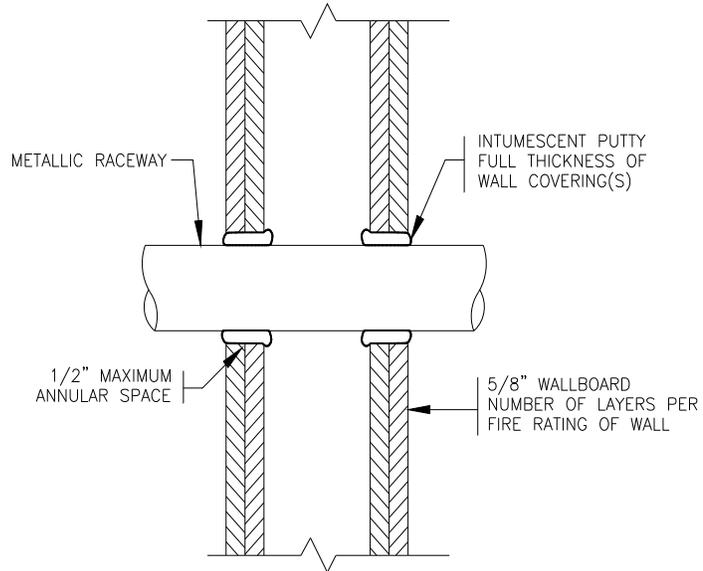
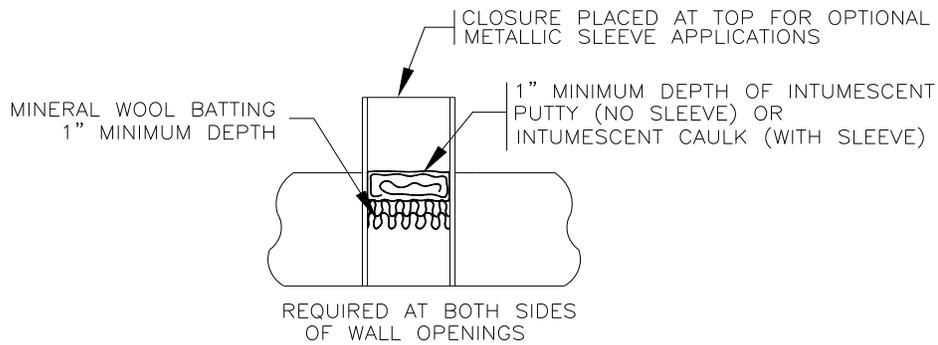
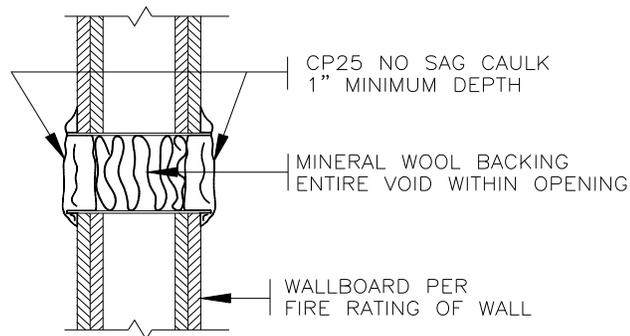


FIGURE F-26 – FIRE STOPPING VOID CIRCULAR OPENINGS IN FLOORS AND WALLS (UL WL-3031 EJ)



VOID CIRCULAR OPENING IN CONCRETE/MASONRY FLOOR AND WALLS

(A)

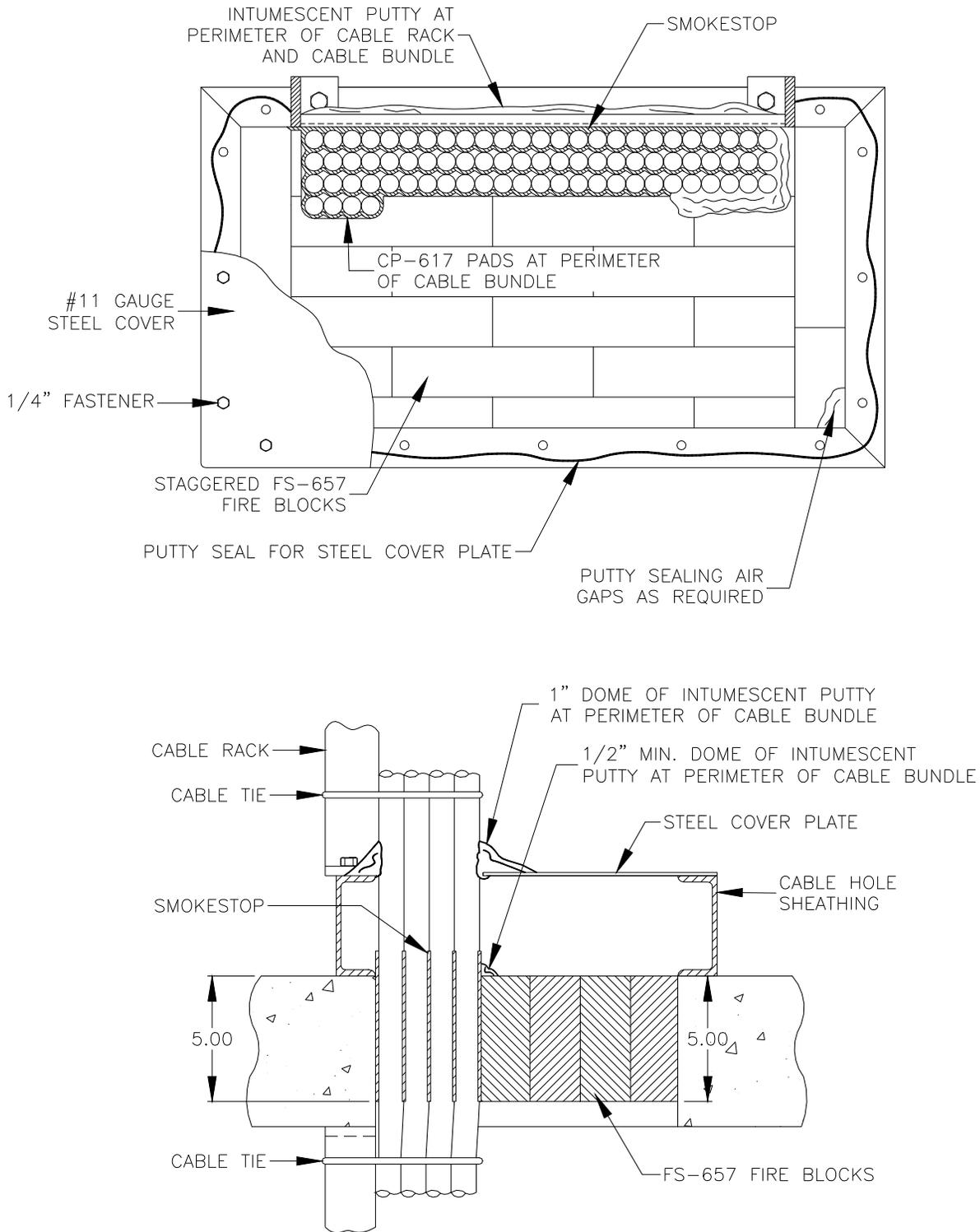


VOID CIRCULAR OPENING IN FRAMED WALLS

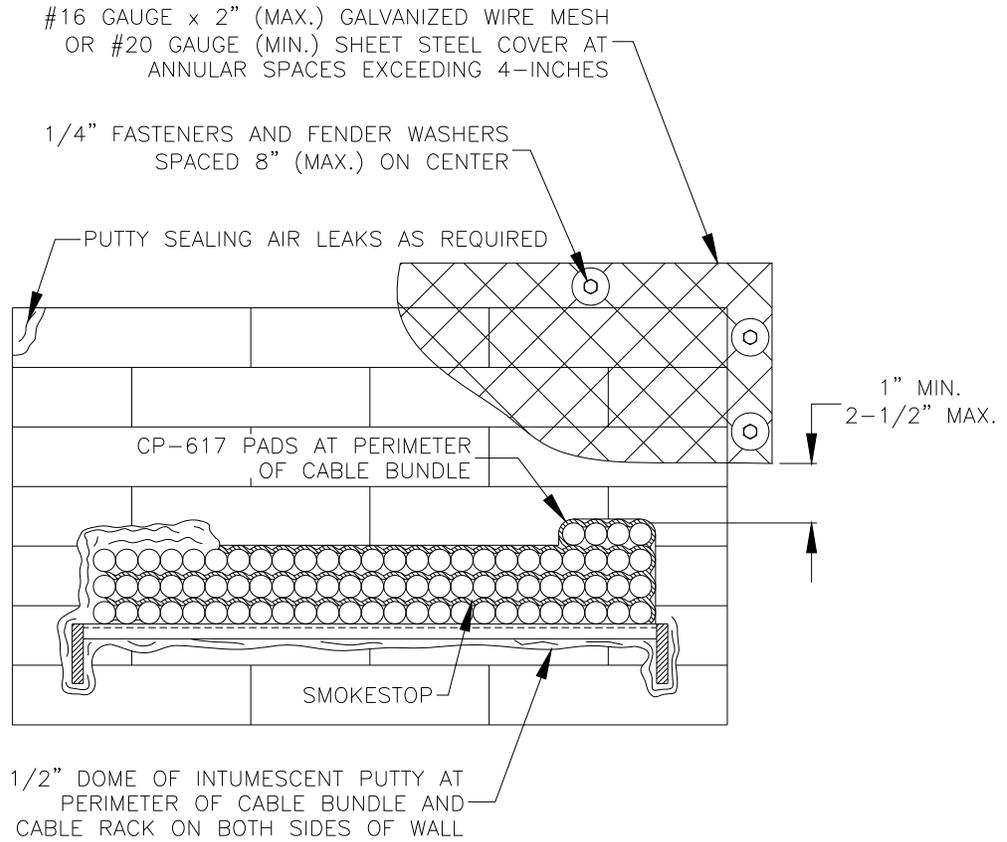
(B)

**THIS SPACE IS RESERVED FOR FUTURE FIGURES F27 – F29**

F-30 – FIRE STOPPING LARGE FLOOR OPENINGS USING  
INTUMESCENT FIRE BLOCKS (CBJ-8013)



**F-31 – FIRE STOPPING LARGE WALL OPENINGS USING  
INTUMESCENT FIRE BLOCKS (CBJ-8013)**



**FIGURE F-31B – FIRE STOPPING LARGE WALL OPENINGS  
USING HILTI FIRE STOP BOARD AND BLOCKS  
(UL WJ-4049)**

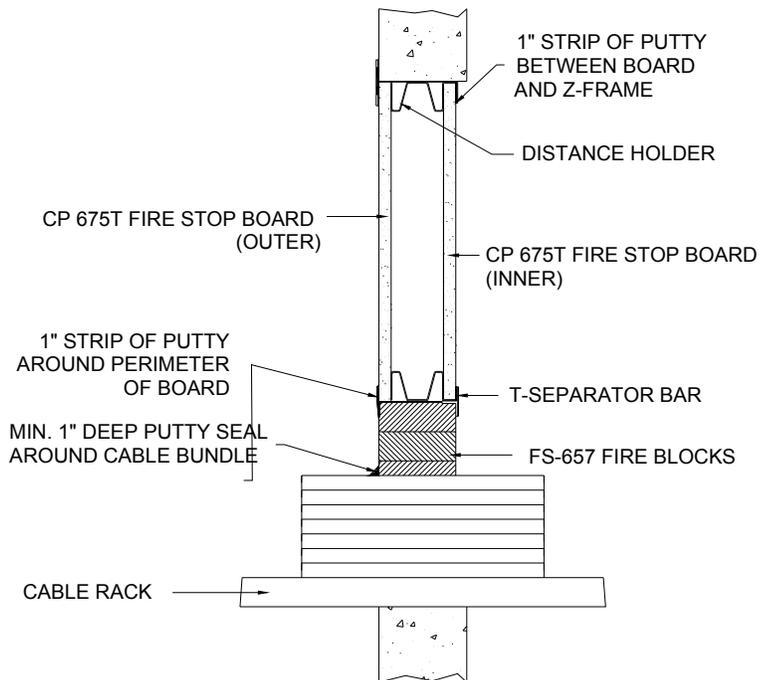
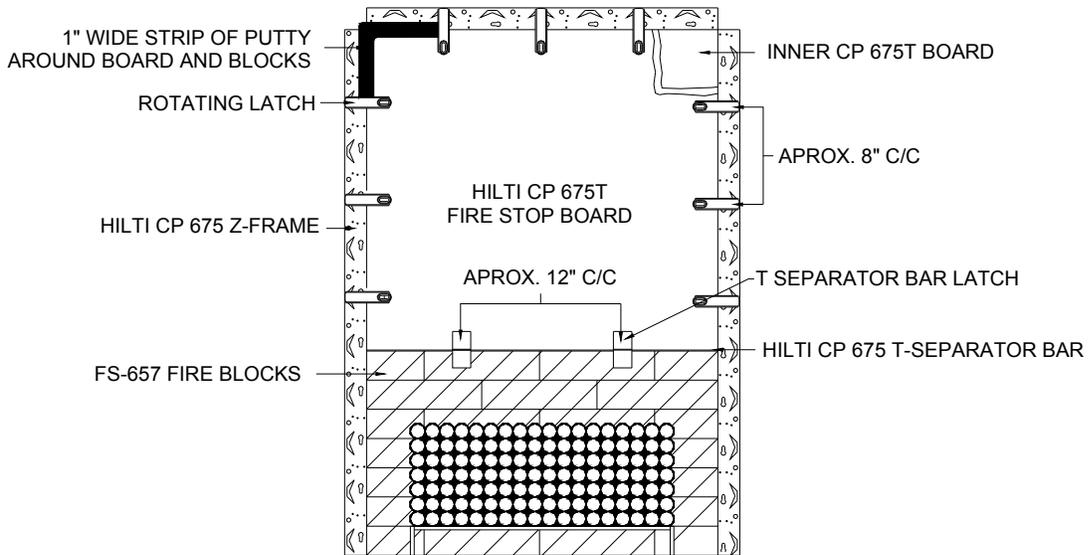
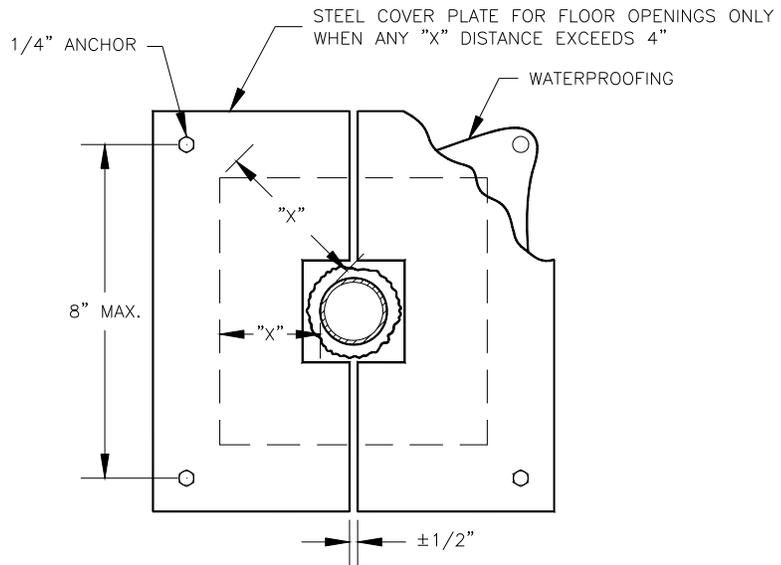
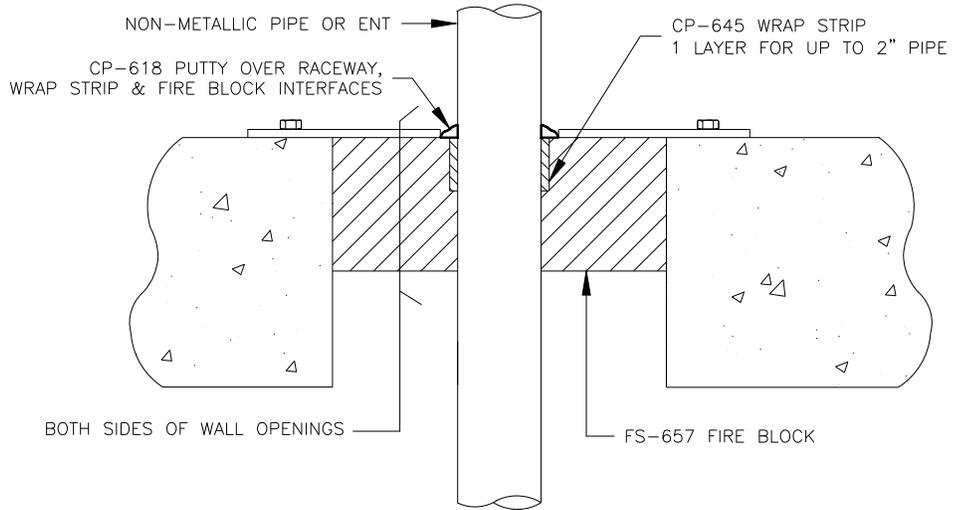
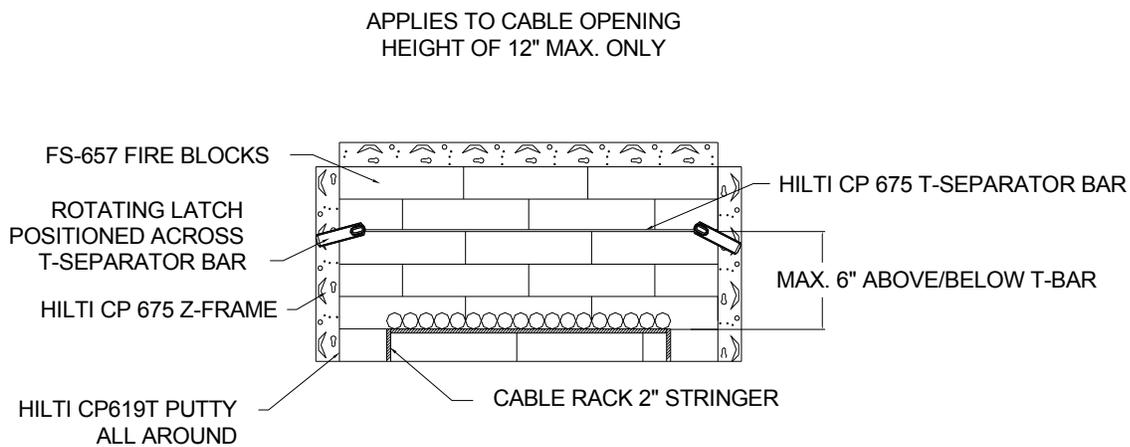


FIGURE F-32 – FIRE STOPPING NON-METALLIC PIPE AND TUBING IN RECTANGULAR OPENINGS USING INTUMESCENT FIRE BLOCKS (CBJ-8013)

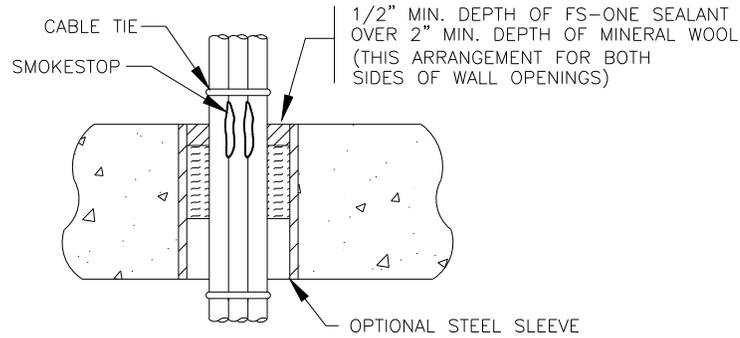


**FIGURE F-33 – FIRE STOPPING WALL OPENINGS MAX. 12” X 24”  
WITHOUT MESH OR COVER PLATE WHEN USING T-BAR  
(HILTI UL SYSTEM W-L-4049 CONFIG. C)**

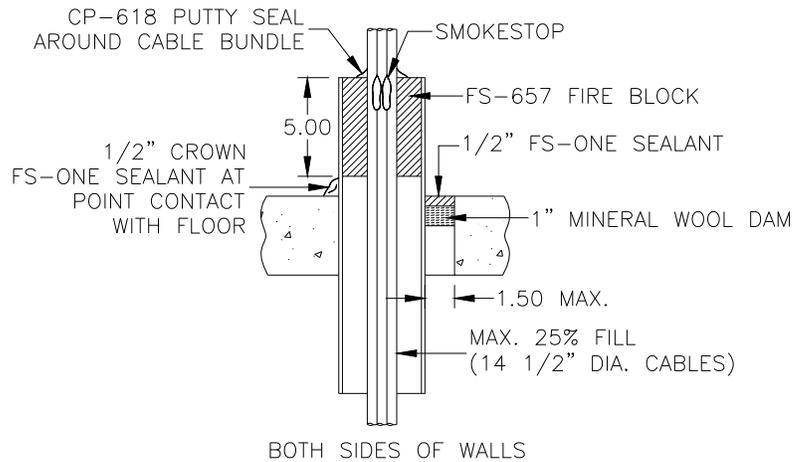


T-separator bar installed without screw fastening to Z-frame to accommodate future move. Rotating latches positioned across T-bar face to prevent T-bar dislodging. Wire mesh or cover plate not required on either side of penetration when T-bar is installed. Maximum height of Hilti FS-657 blocks cannot exceed 6 inches above or below T-bar and maximum opening height cannot exceed 12".

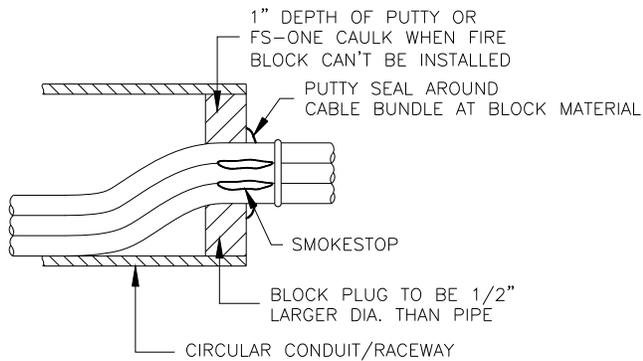
**FIGURE F-34 – FIRE STOPPING CABLE IN 6" MAX. DIA. OPENING  
 IN SOLID FLOORS AND WALLS**



**(A)**  
**(CAJ-3095)**

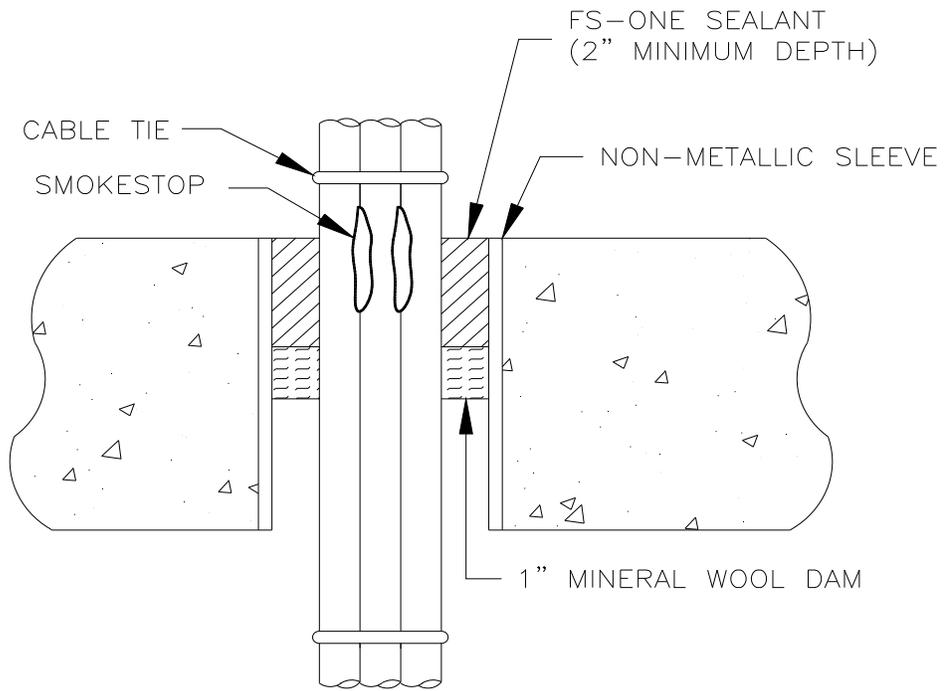


**(B)**  
**(CAJ-3152)**



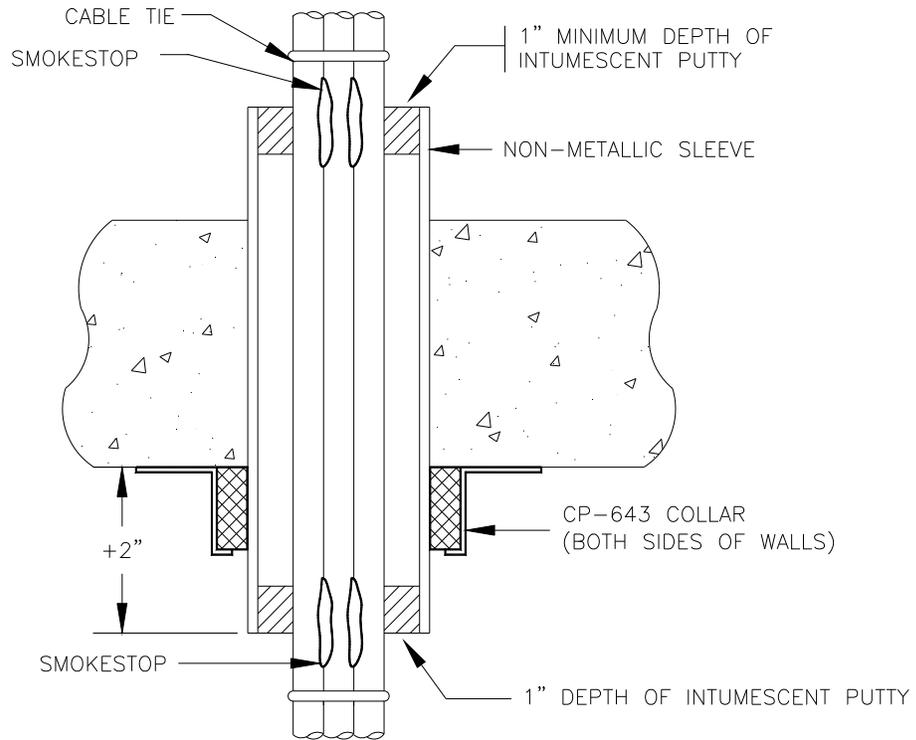
**(C)**  
**Conduit Dead-Ended Within Equipment Area**

**FIGURE F-35 – FIRE STOPPING CABLE IN 4" MAX. DIAMETER OPENING IN SOLID FLOORS AND WALLS EQUIPPED WITH NON-METALLIC SLEEVE (CAJ-3084)**

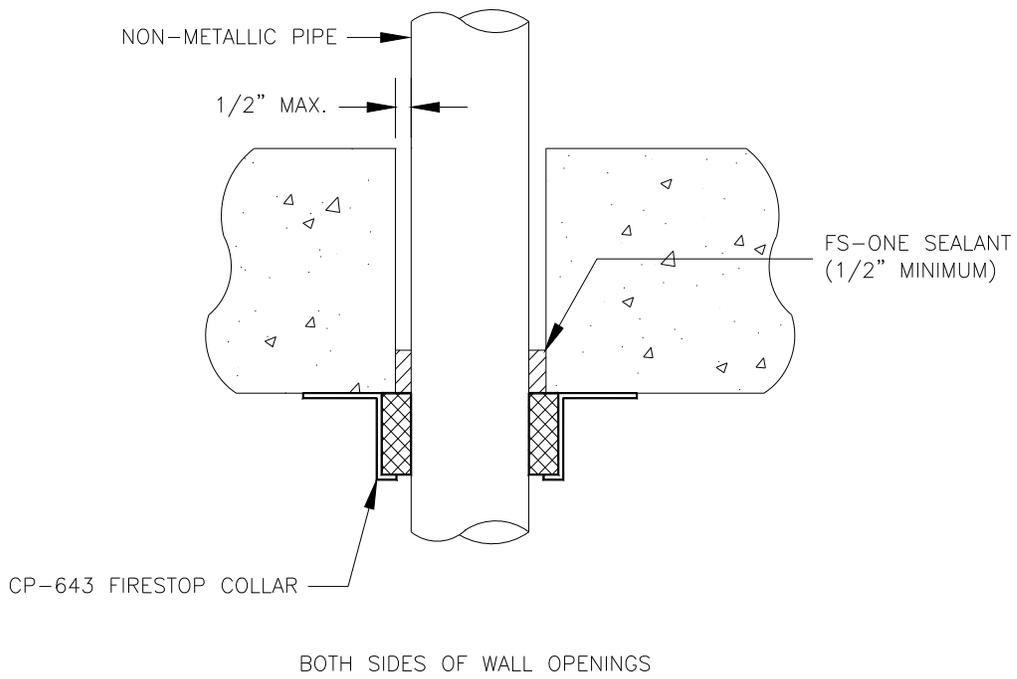


BOTH SIDES OF WALLS

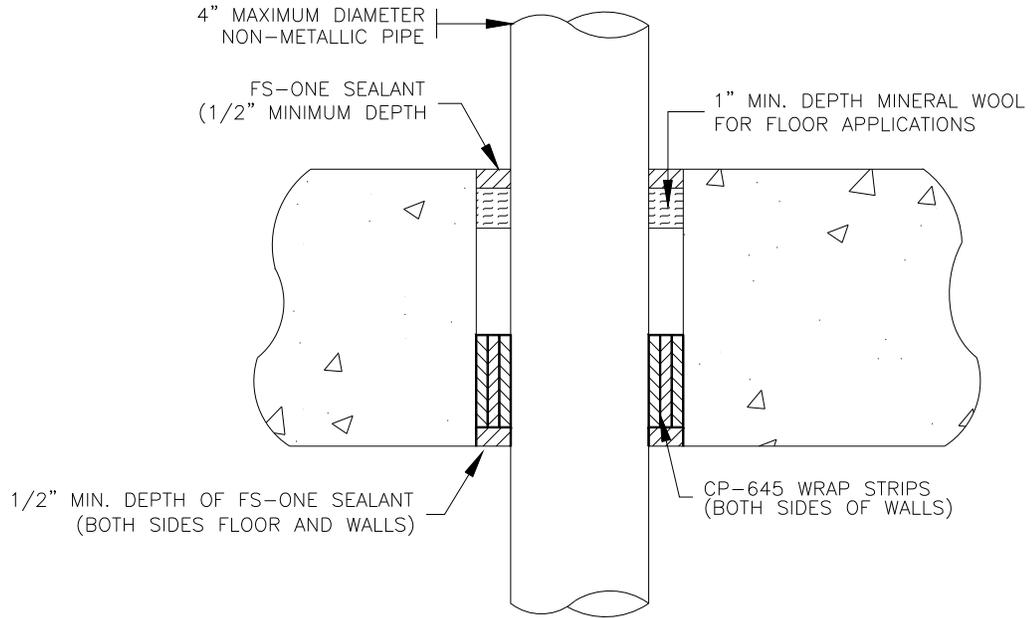
**FIGURE F-36 – FIRE STOPPING CABLE IN 4" MAX. DIA. OPENING IN SOLID FLOORS AND WALLS EQUIPPED WITH NON-METALLIC SLEEVE EXTENDING BEYOND BUILDING SURFACE (CAJ-3084 EJ)**



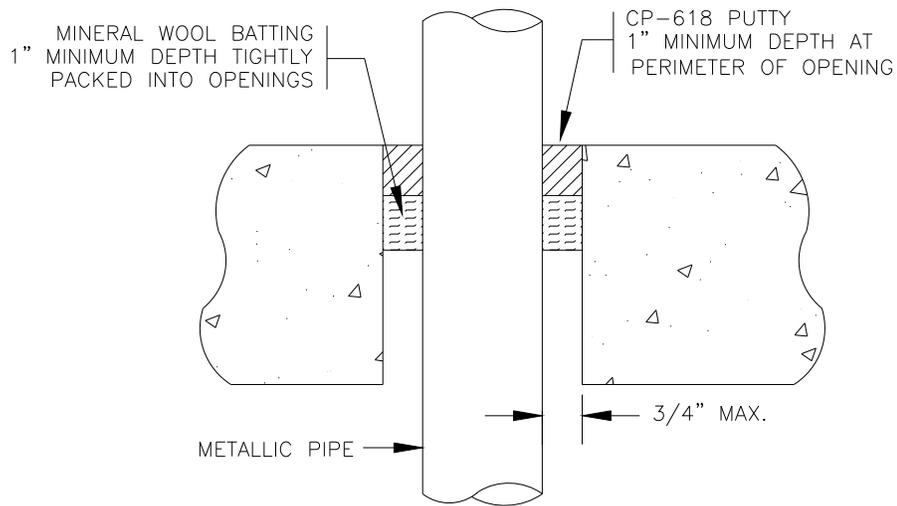
**FIGURE F-37 – FIRE STOPPING NONMETALLIC PIPE 7" MAX. DIA. OPENING IN SOLID FLOORS AND WALLS – SMALL ANNULAR SPACE (CAJ-2109)**



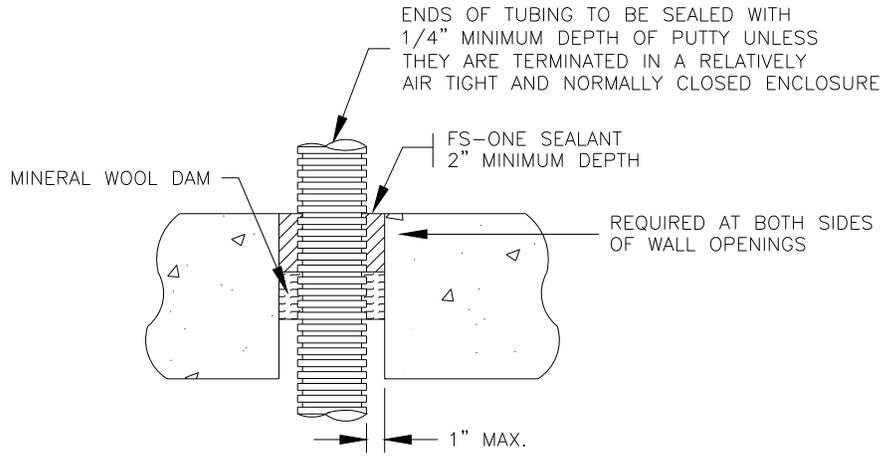
**FIGURE F-38 – FIRE STOPPING NON-METALLIC PIPE IN 6" MAX. DIA. OPENING IN SOLID FLOORS AND WALLS – LARGE ANNULAR SPACE (CAJ-2294)**



**FIGURE F-39 – FIRE STOPPING METALLIC PIPE IN 6" MAX. DIA OPENING IN SOLID FLOORS AND WALLS – LARGE ANNULAR SPACE (CAJ-1276)**



**FIGURE F-40 – FIRE STOPPING ENT IN 4" MAX. DIA. OPENING IN SOLID FLOORS AND WALLS (CAJ-3084 EJ)**

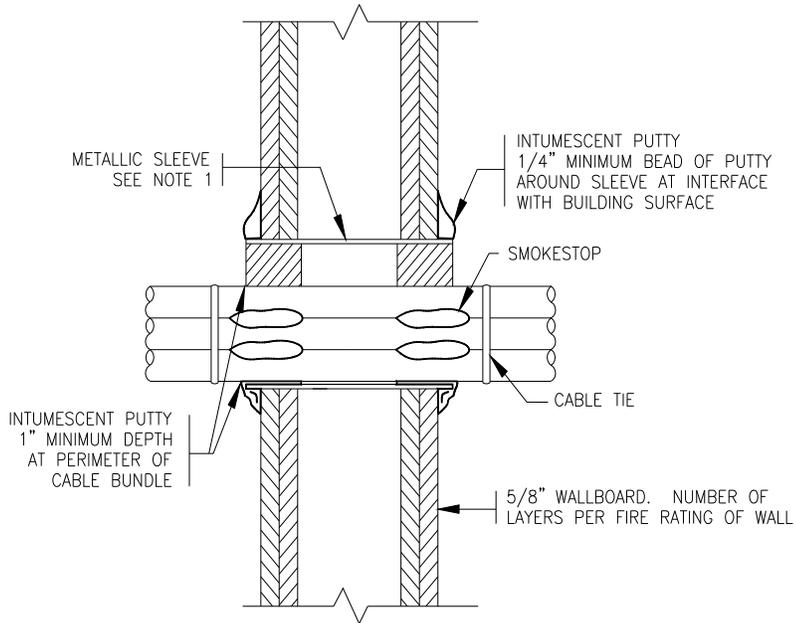


**FIGURE F-41 – FIRE STOPPING CABLE IN 4" MAX. DIA. OPENING  
IN HOLLOW WALLS (WL-3111, WL- 3112)**

NOTE 1. SLEEVE TO BE 4" MAXIMUM DIAMETER EMT OR NO.28 GAUGE GALVANIZED SHEET STEEL AND EXTEND A MINIMUM OF 1/2" BEYOND WALL SURFACES.

SHEET STEEL SLEEVE TO HAVE A 2" MINIMUM OVERLAP ALONG ITS LONGITUDINAL LENGTH AND BE EQUIPPED WITH CABLE PROTECTION SUCH AS A SLIT FLEXIBLE TUBING AT BOTH ENDS.

EMT SLEEVE TO BE PERMANENTLY GROUTED INTO OPENING. GROUT TO BE SAME THICKNESS OF WALLBOARD COVERING.



**FIGURE F-42 – FIRE STOPPING NON-METALLIC PIPE IN 4" MAX. DIA. OPENING IN HOLLOW WALLS ( WL-2075)**

- NOTE 1. SLEEVE TO BE 4" MAXIMUM DIAMETER EMT OR NO.28 GAUGE SHEET STEEL. SLEEVE TO EXTEND A MINIMUM OF 1/2" BEYOND WALL SURFACES.
- SHEET STEEL SLEEVE TO HAVE A MINIMUM 2" OVERLAP ALONG ITS LONGITUDINAL LENGTH AND BE EQUIPPED WITH CABLE PROTECTION SUCH AS SLIT FLEXIBLE TUBING AT BOTH ENDS.
- EMT SLEEVE TO BE PERMANENTLY GROUTED INTO OPENING. GROUT TO BE AS THICK AS WALLBOARD COVERING.

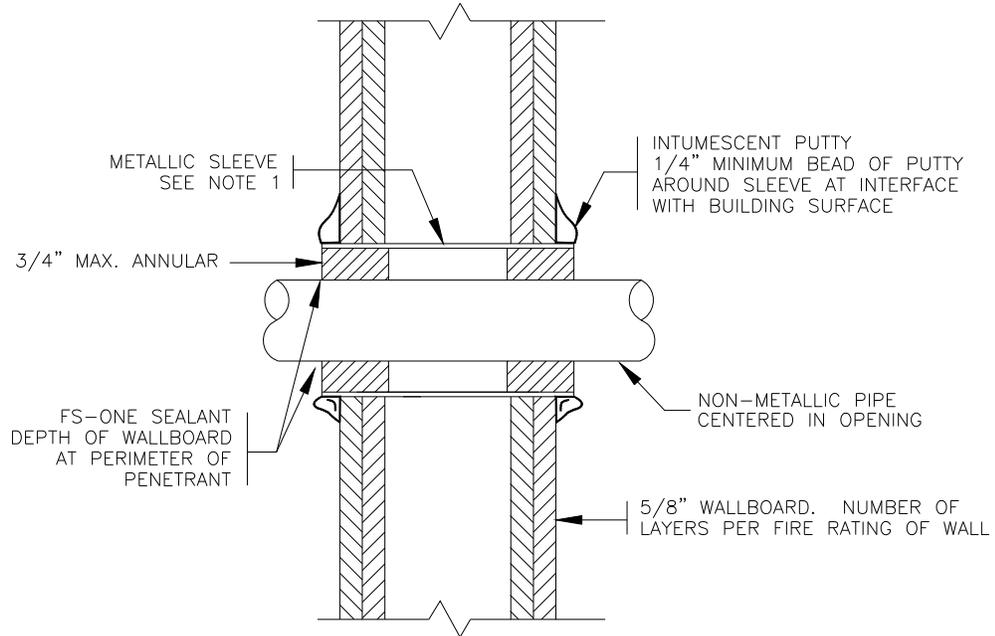
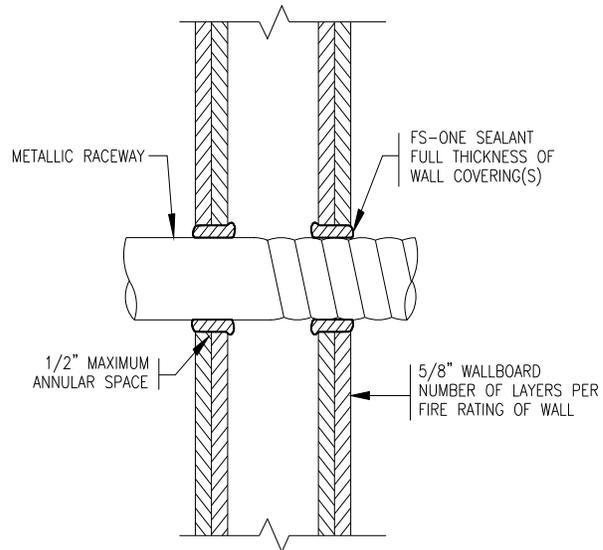
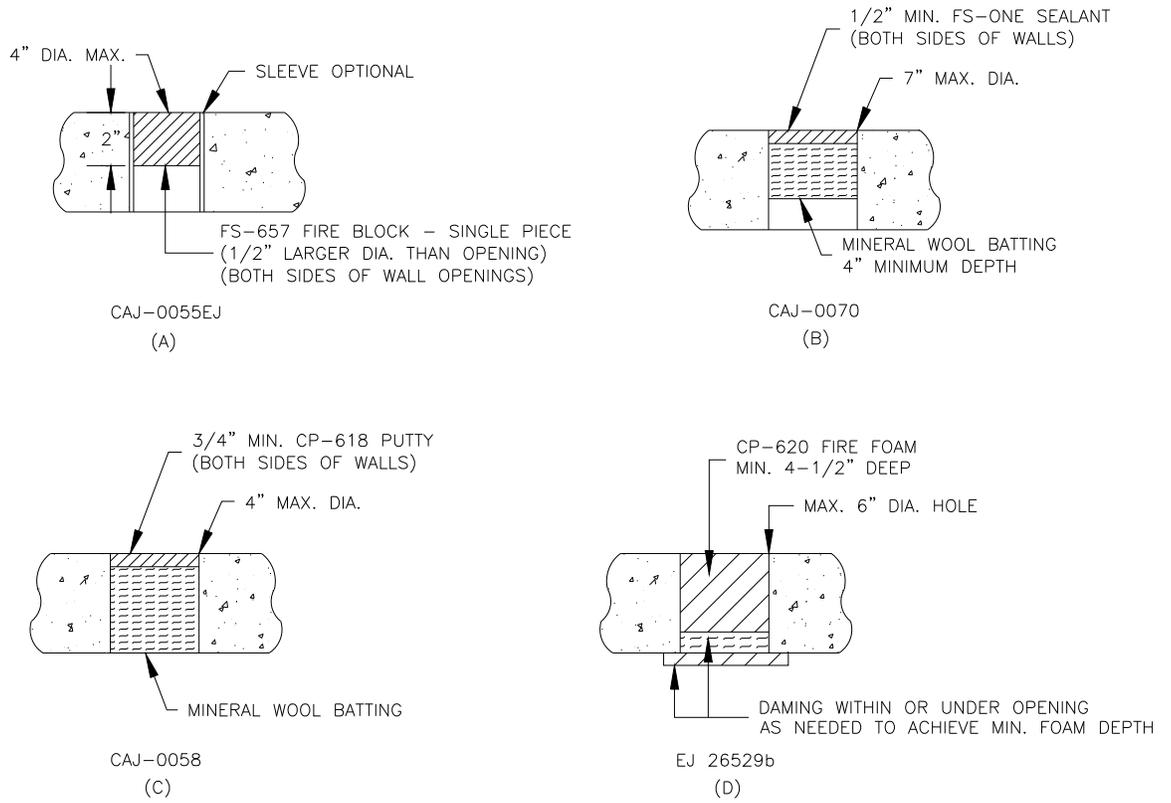


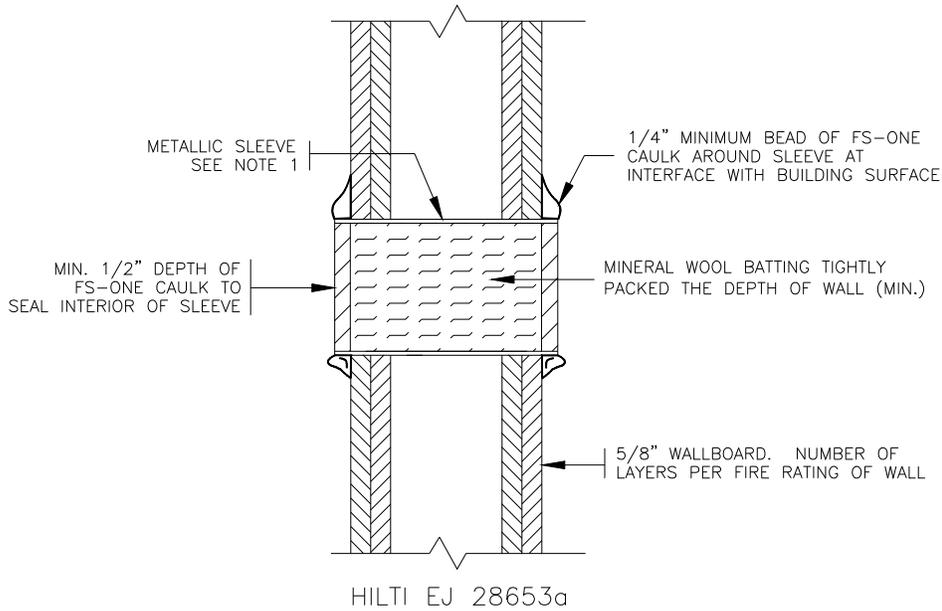
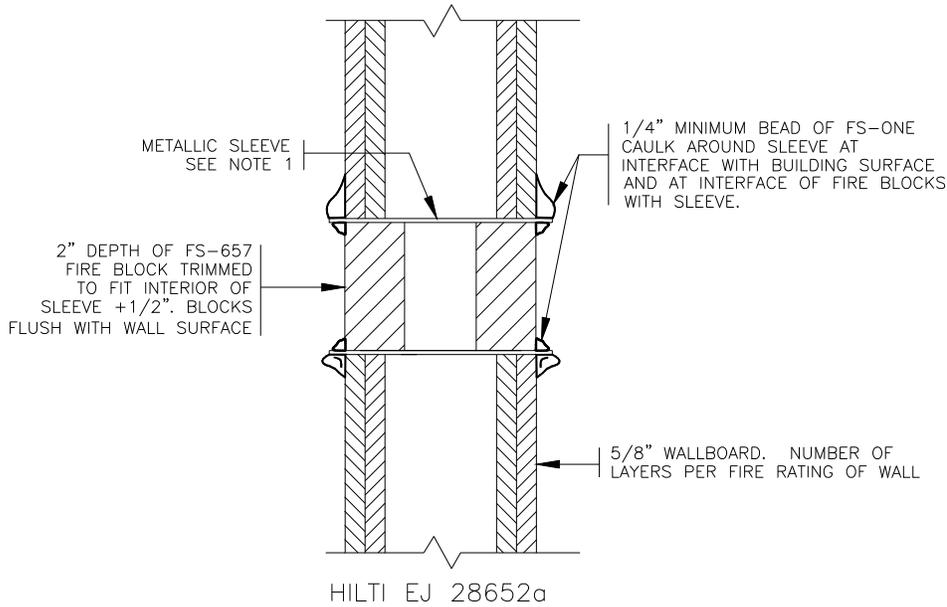
FIGURE F-43 – FIRE STOPPING METALLIC RACEWAYS IN HOLLOW WALLS (EJ)



**FIGURE F-44 – FIRE STOPPING VOID CIRCULAR OPENINGS IN FLOORS AND WALLS**



- NOTE 1. SLEEVE TO BE 4" MAXIMUM DIAMETER EMT OR NO.28 GAUGE SHEET STEEL. SLEEVE TO EXTEND A MINIMUM OF 1/2" BEYOND WALL SURFACES.
- SHEET STEEL SLEEVE TO HAVE A MINIMUM 2" OVERLAP ALONG ITS LONGITUDINAL LENGTH.
- EMT SLEEVES TO BE PERMANENTLY GROUTED INTO OPENING. GROUT TO BE AS THICK AS WALLBOARD COVERING.



(E)  
HOLLOW WALLS

FIGURE F-45 – FIRE STOPPING LARGE POWER CABLE ONLY OPENINGS IN FLOORS USING INTUMESCENT FIRE BLOCKS (CBJ-4026)

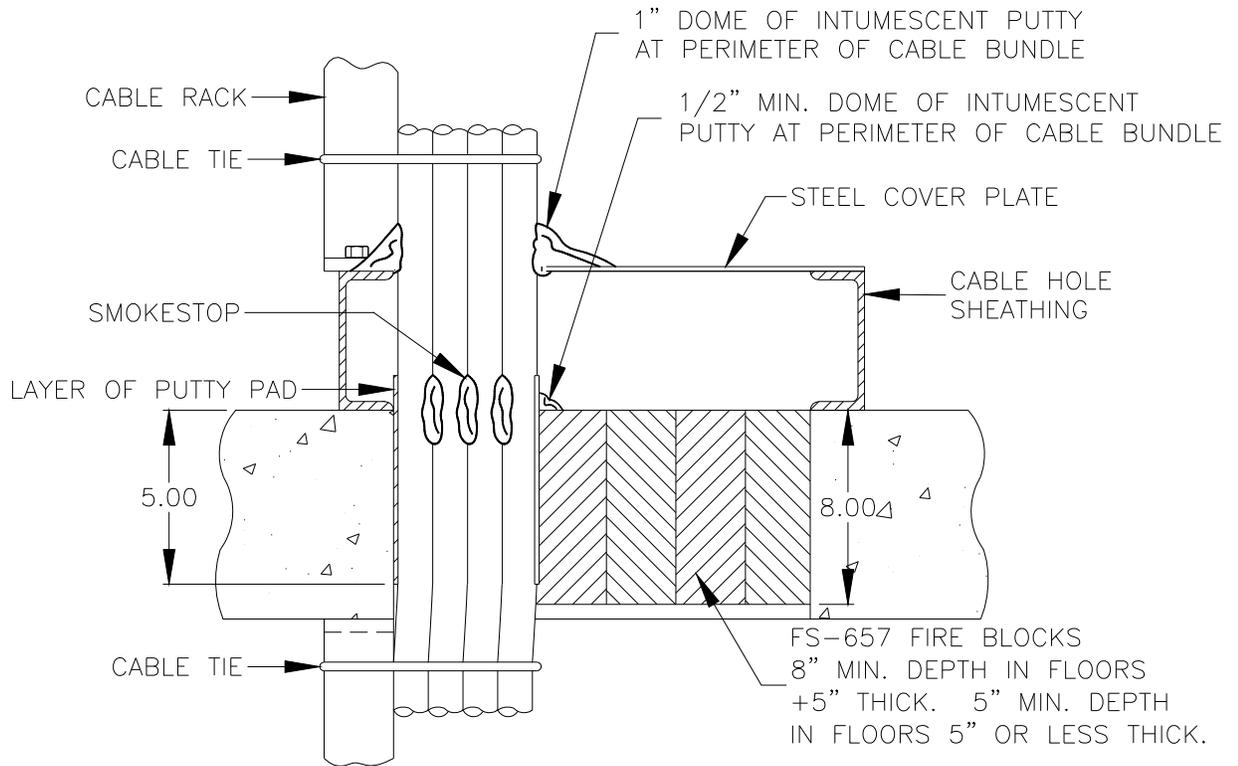
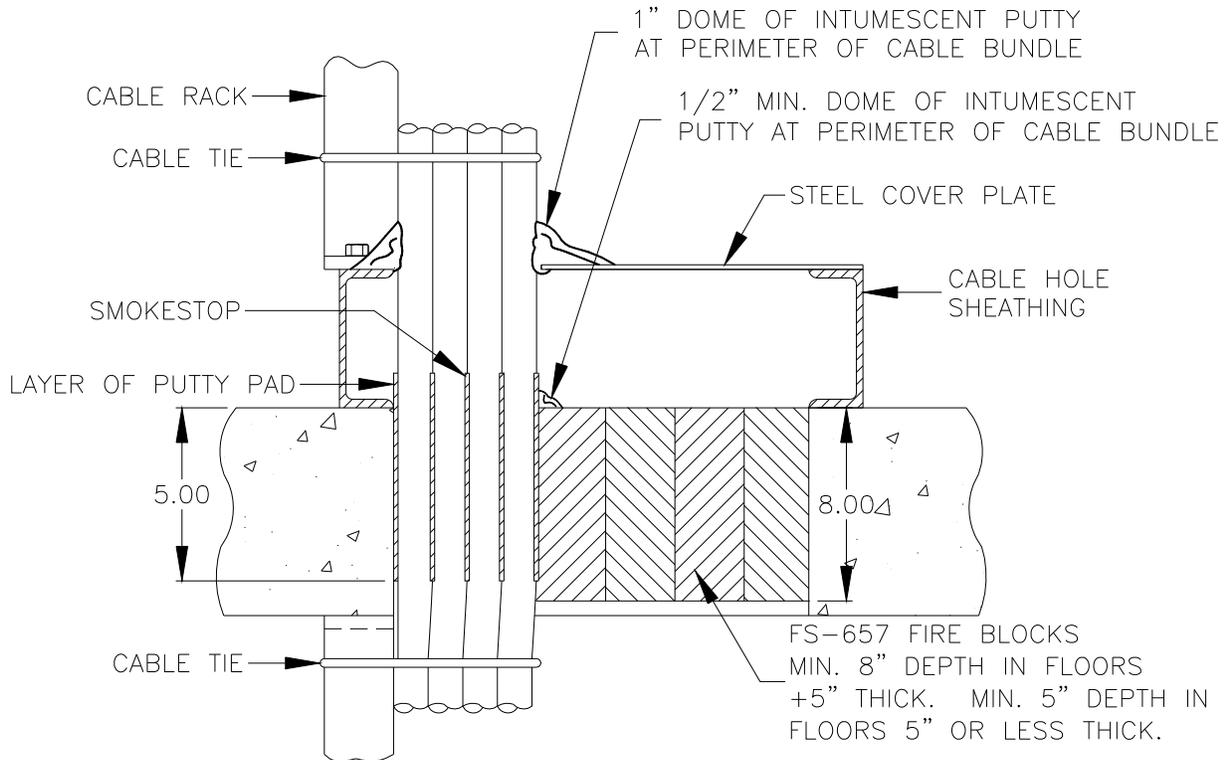
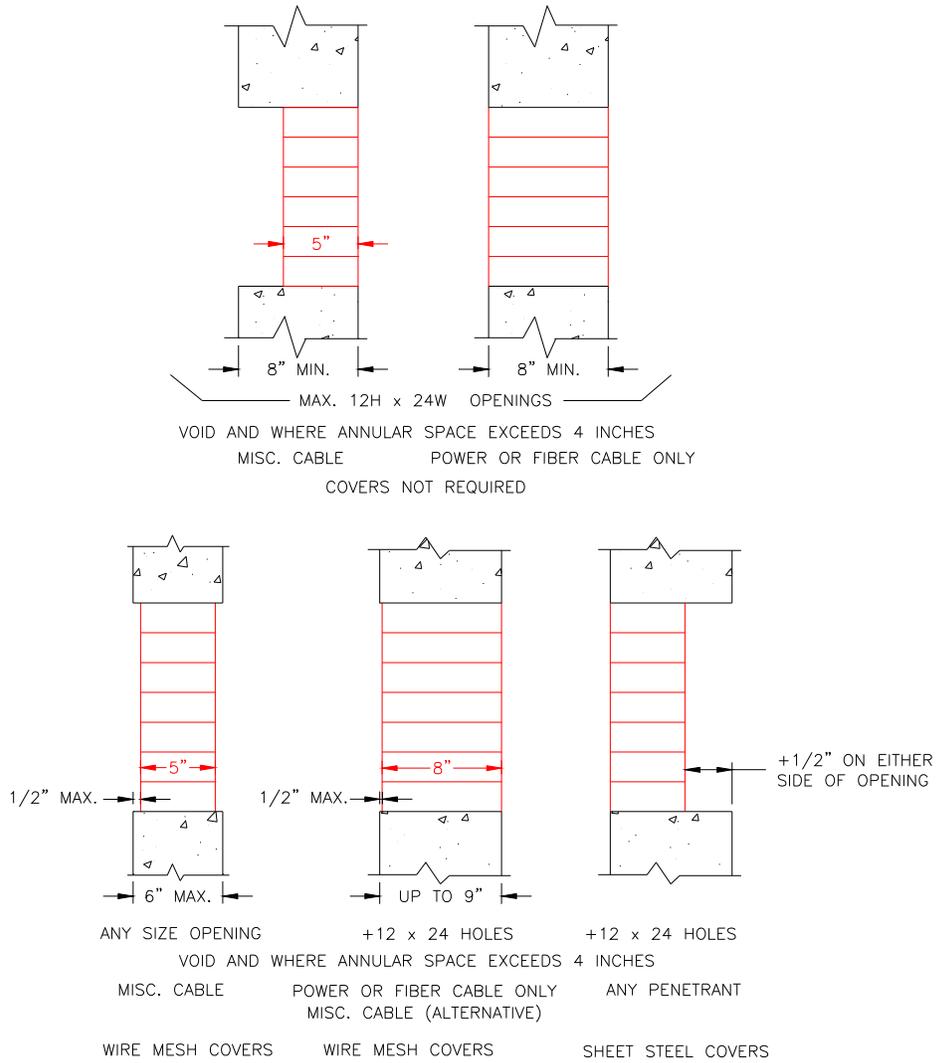


FIGURE F-46 – FIRE STOPPING LARGE FIBER CABLE ONLY OPENINGS IN FLOORS USING INTUMESCENT FIRE BLOCKS (CBJ-4026)

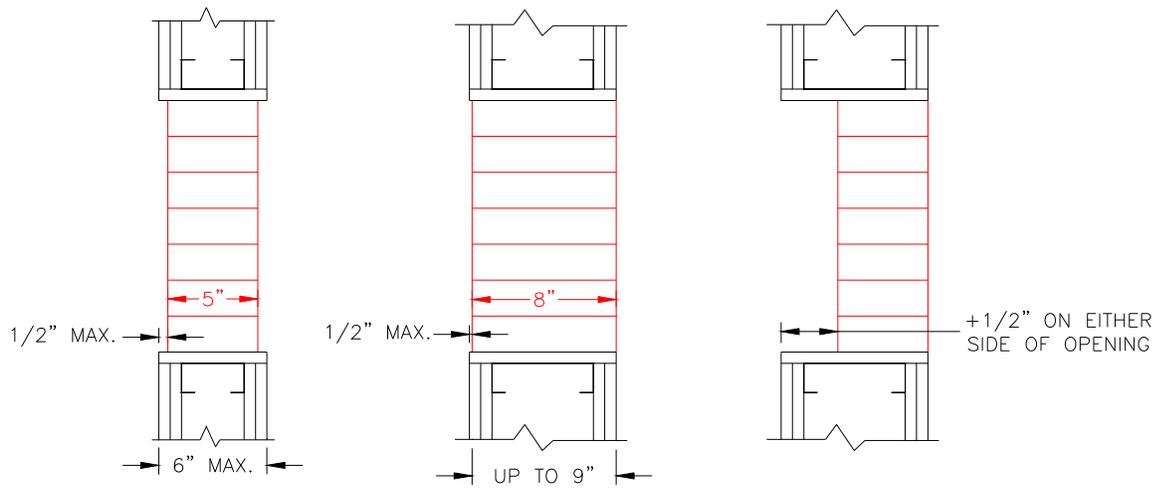


**FIGURE F-47 – TYPICAL ORIENTATION OF HILTI FIRE BLOCKS AT VARIOUS WALL CONSTRUCTIONS**



**(A)**  
**Concrete and Solid Filled Block Constructions**

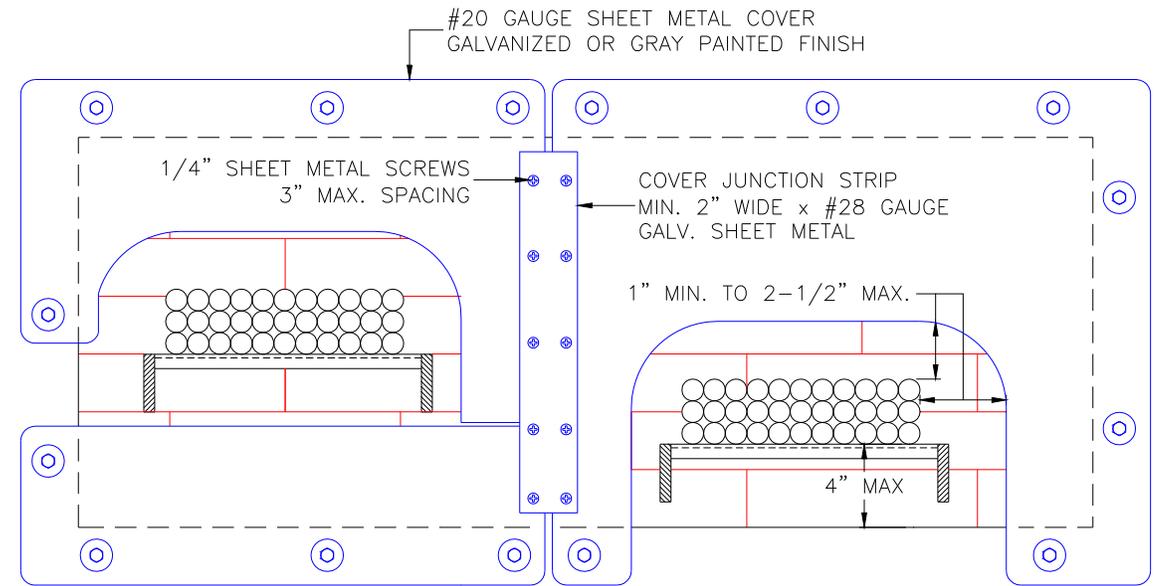
**FIGURE F-47 – Continued**



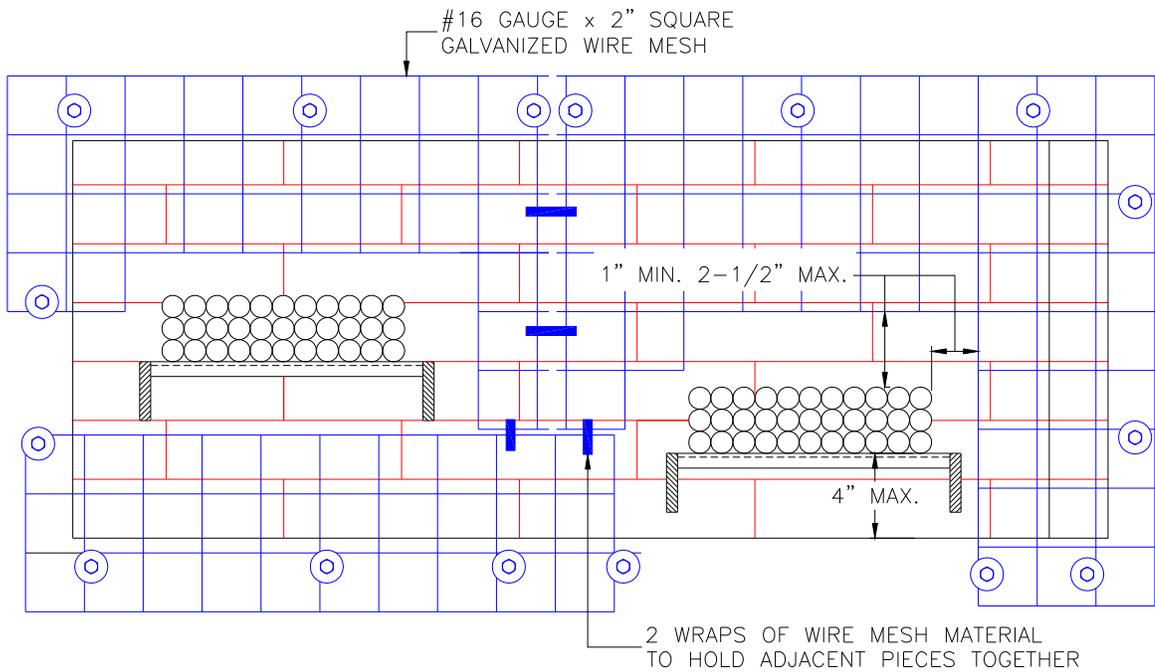
	ANY SIZE RECTANGULAR OPENING	
	VOID AND WHERE ANNULAR SPACE EXCEEDS 4 INCHES	
MISC. CABLE	POWER OR FIBER CABLE ONLY	ANY PENETRANT
	MISC. CABLE (ALTERNATIVE)	
WIRE MESH COVERS	WIRE MESH COVERS	SHEET STEEL COVERS

**(B)**  
**Hollow Wall Constructions**

FIGURE F-48 – TYPICAL COVER JUNCTIONING AT LARGE WALL OPENINGS

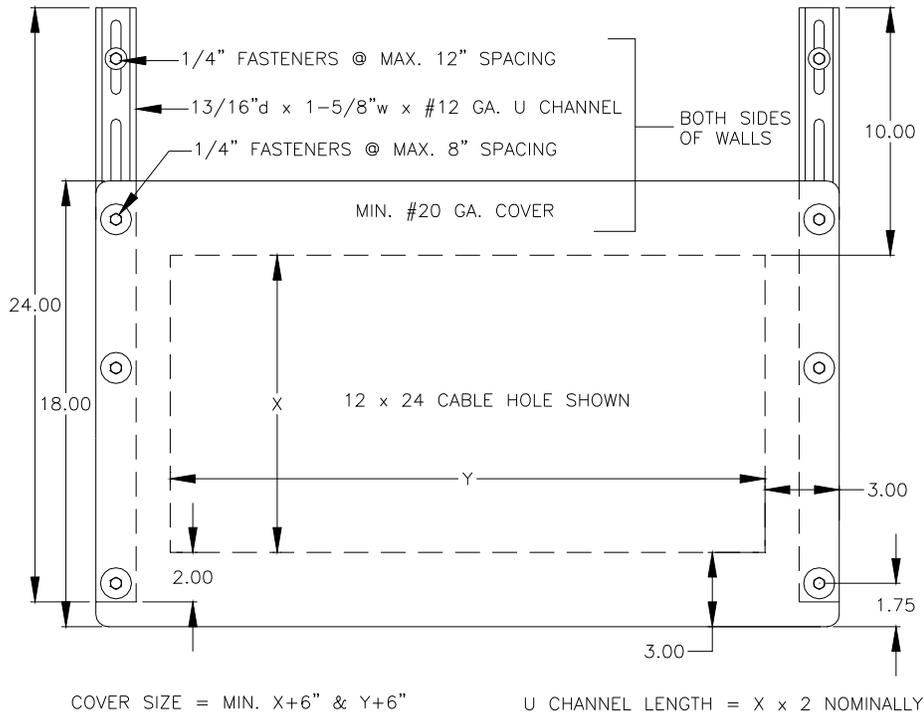


(A)  
Solid Covers

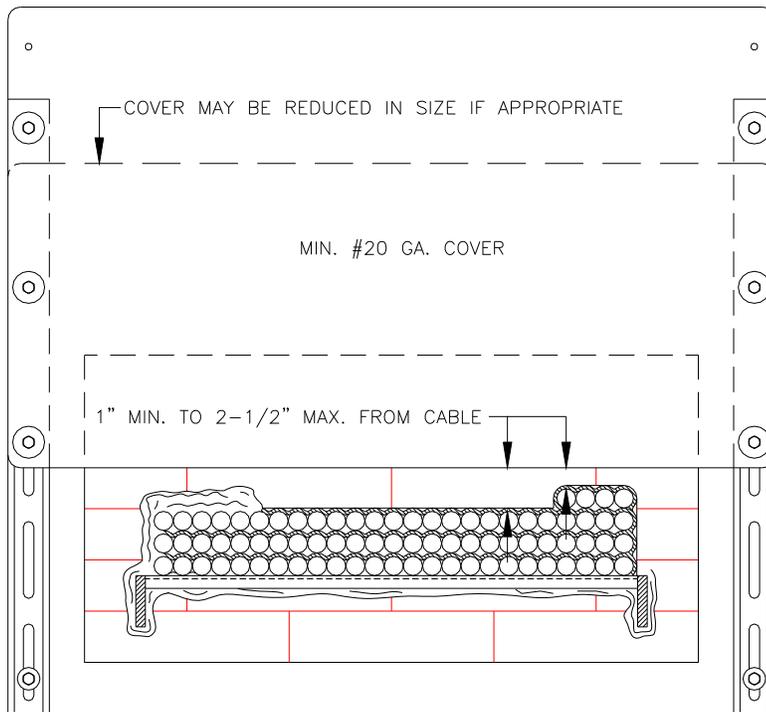


(B)  
Mesh Covers

**FIGURE F-49 – GENERAL APPLICATION OF HILTI STRUT COVER SUPPORTS (SINGLE HOLES ONLY)**

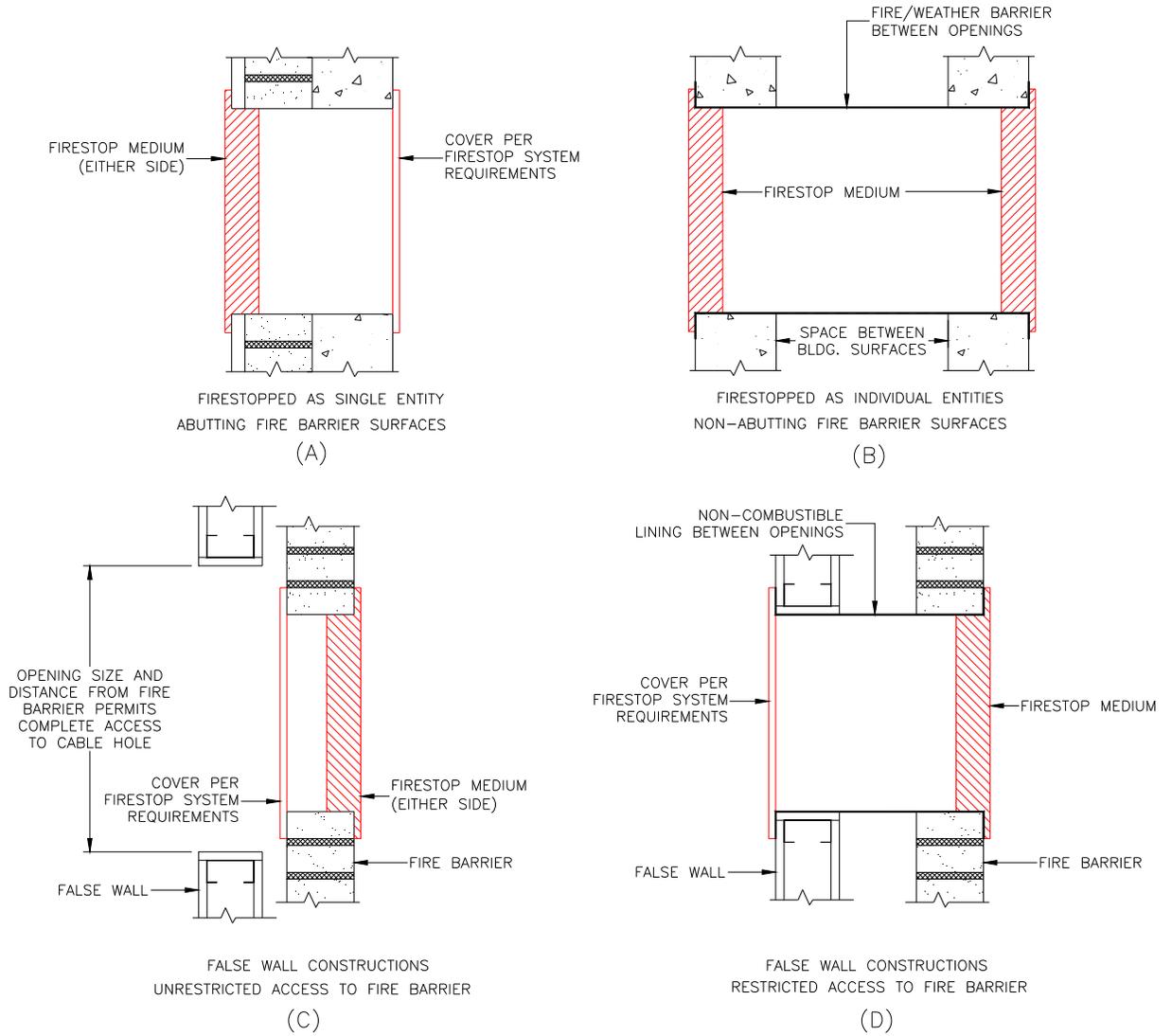


**(A)**  
**Void Cable Holes**



(B)  
 Occupied Cable Holes

**FIGURE F-50 – GENERAL APPLICATION OF FIRE STOPS AT ADJACENT BUILDING WALLS**



**FIGURE F-51 – FIRE STOPPING CIRCULAR OPENINGS UP TO 4” IN DIA. IN FLOORS/WALLS USING HILTI CP-658T FIRE STOP PLUGS (CAJ-0097 and CAJ-3216)**

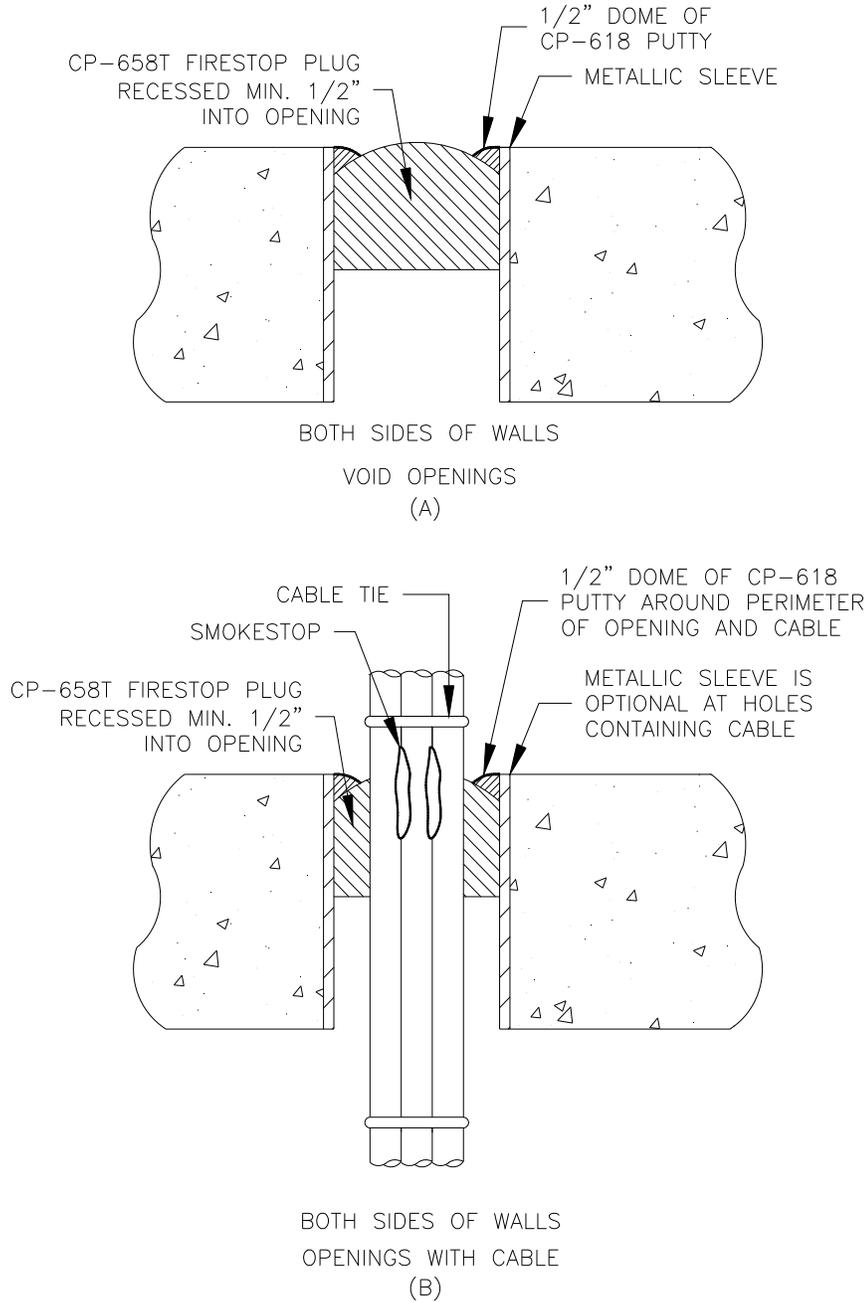


FIGURE F-52 – BUILDING SERVICES WALL OPENING FIRE STOPPING  
(W-J-4049)

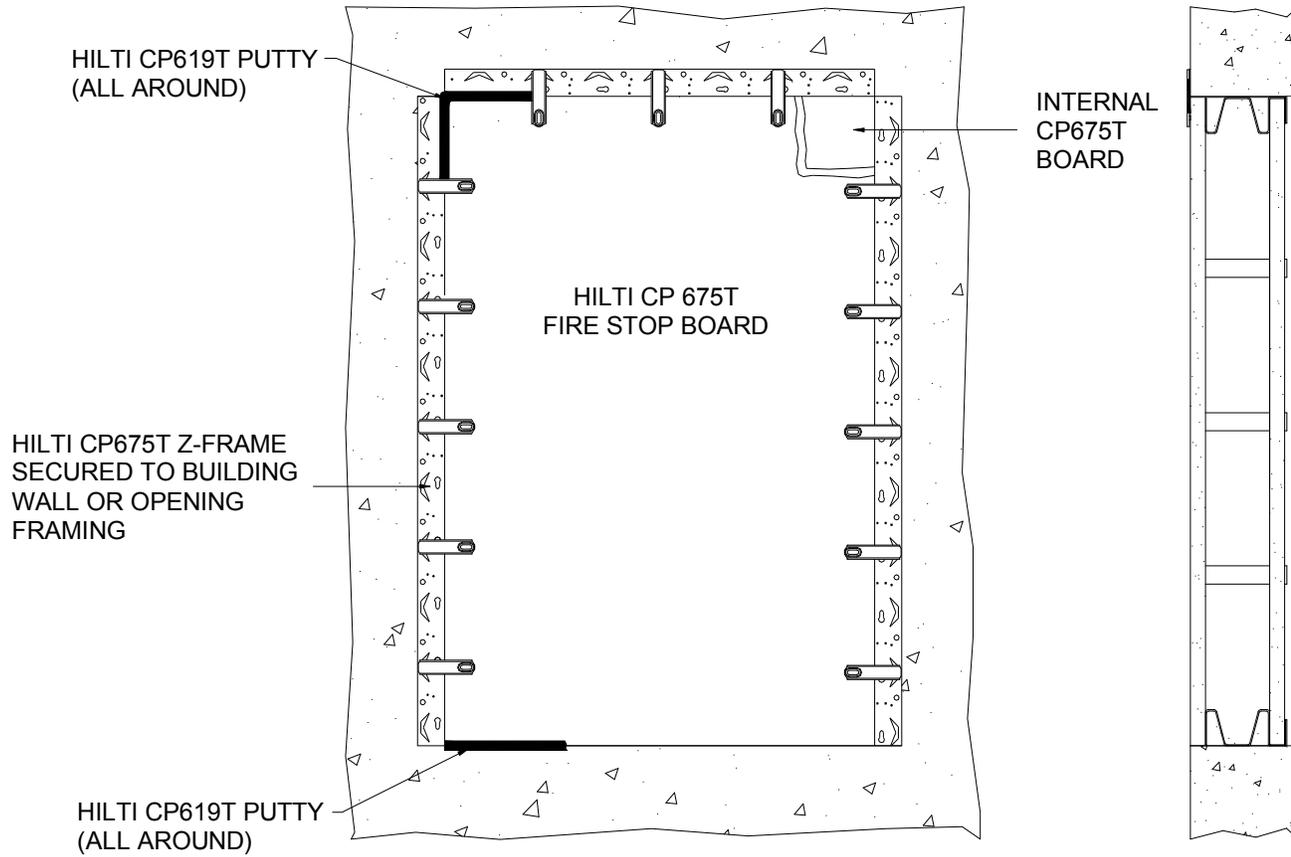
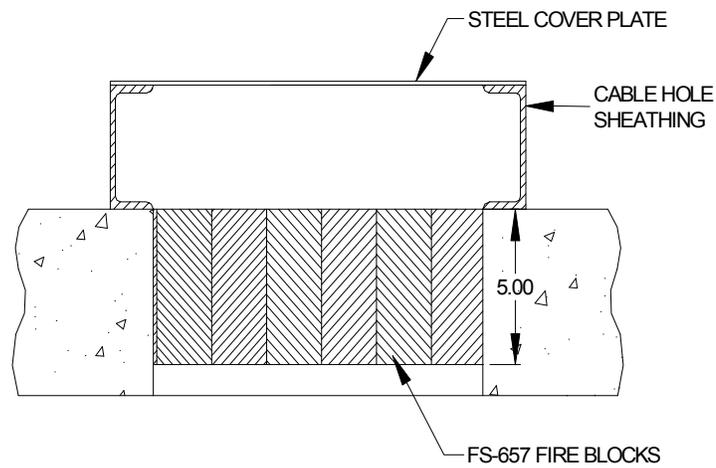
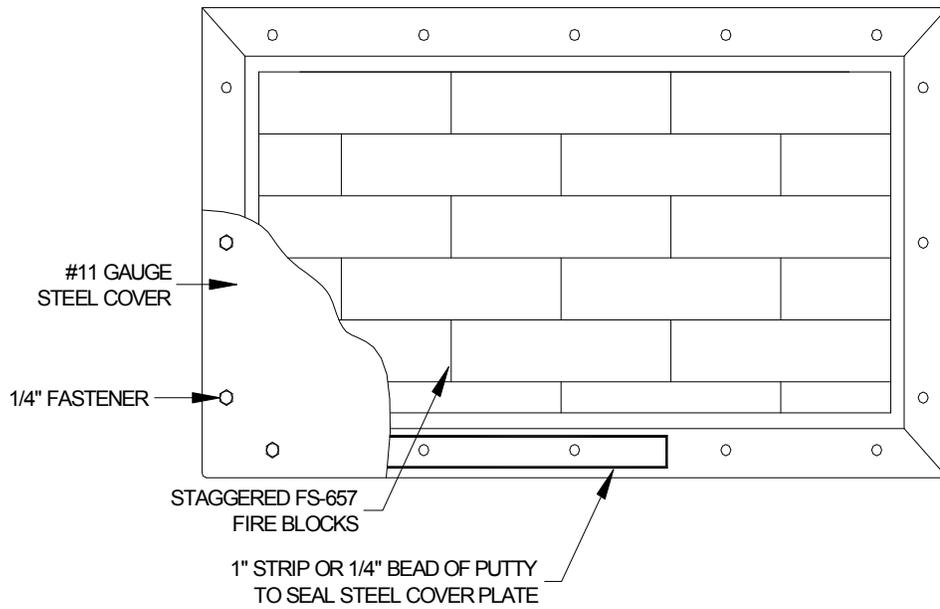
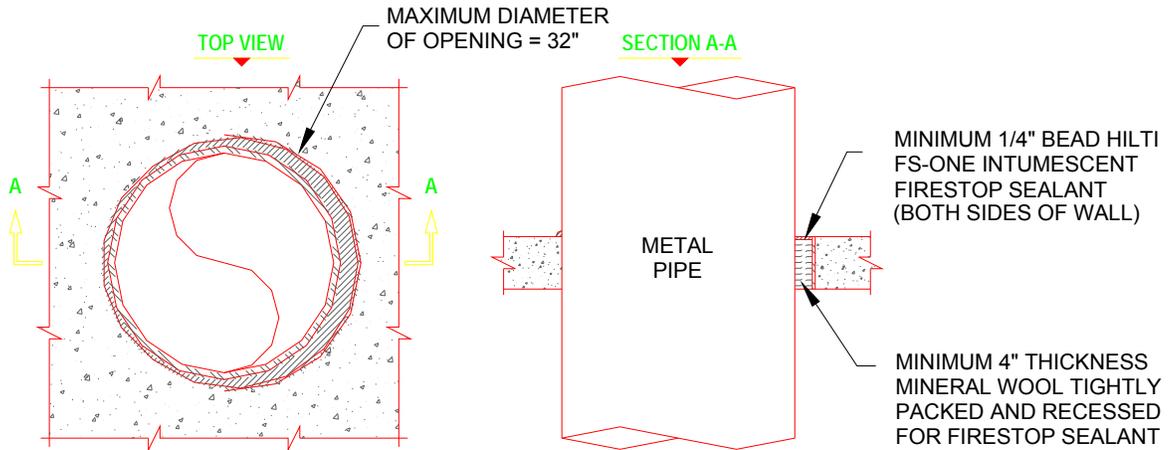


FIGURE F-53 – BUILDING SERVICES FLOOR OPENING FIRE STOPPING  
(C-BJ-4026)



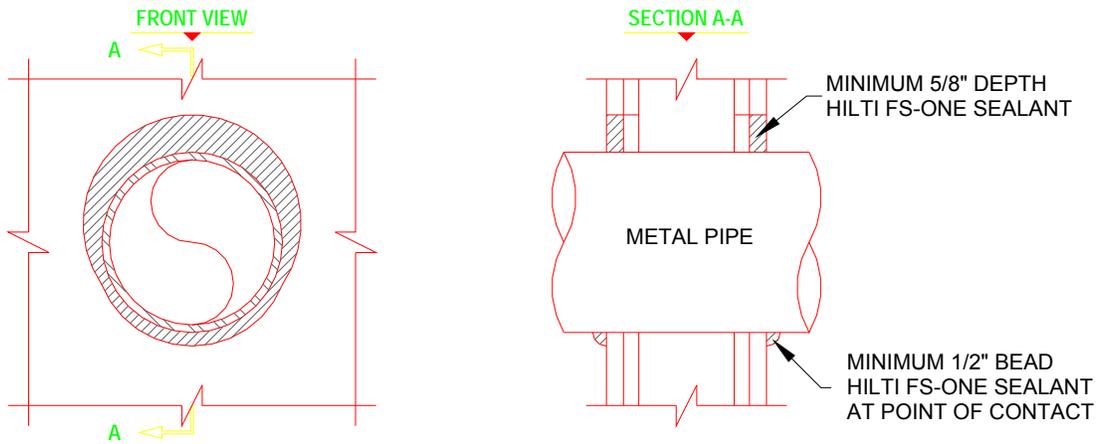
**FIGURE F-54 – BUILDING SERVICES PIPE THROUGH WALL/FLOOR**



PENETRATING ITEM TO BE ONE OF THE FOLLOWING:

- A. MAXIMUM 30" NOMINAL DIAMETER STEEL PIPE (SCHEDULE 10 OR HEAVIER)
- B. MAXIMUM 30" NOMINAL DIAMETER CAST IRON PIPE
- C. MAXIMUM 6" NOMINAL DIAMETER COPPER PIPE
- D. MAXIMUM 6" NOMINAL DIAMETER STEEL CONDUIT
- E. MAXIMUM 4" NOMINAL DIAMETER EMT

**(A) LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR OR WALL (C-AJ-1226)**

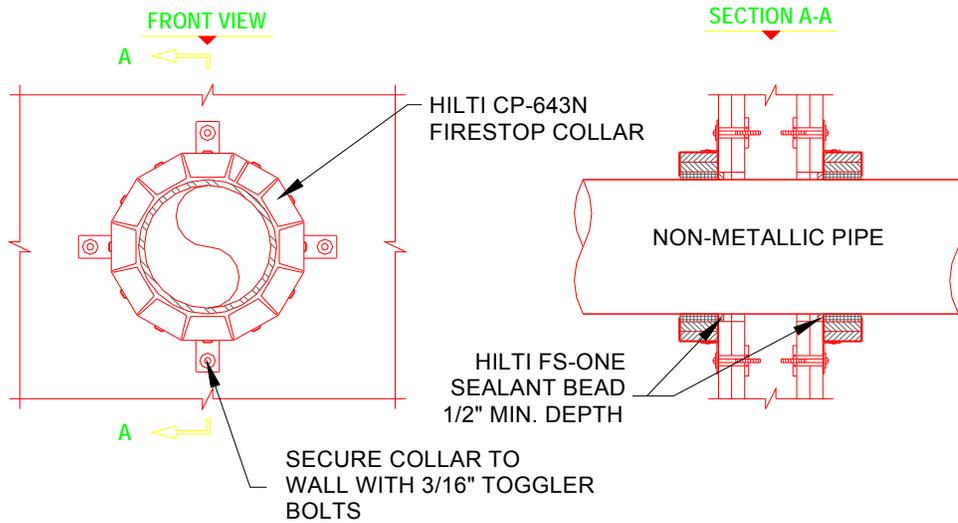


PENETRATING ITEM TO BE ONE OF THE FOLLOWING:

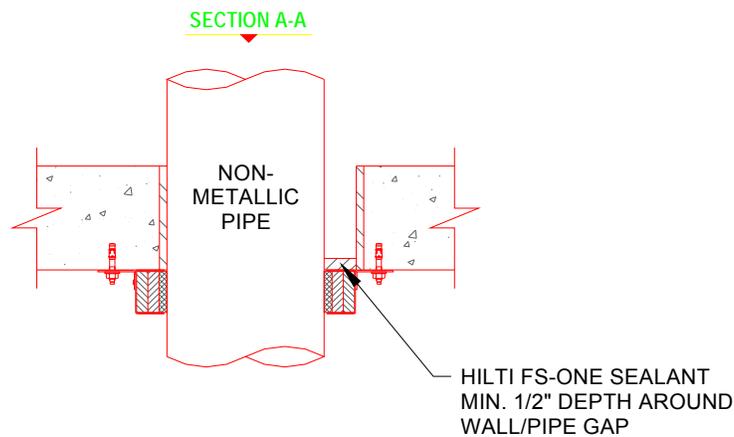
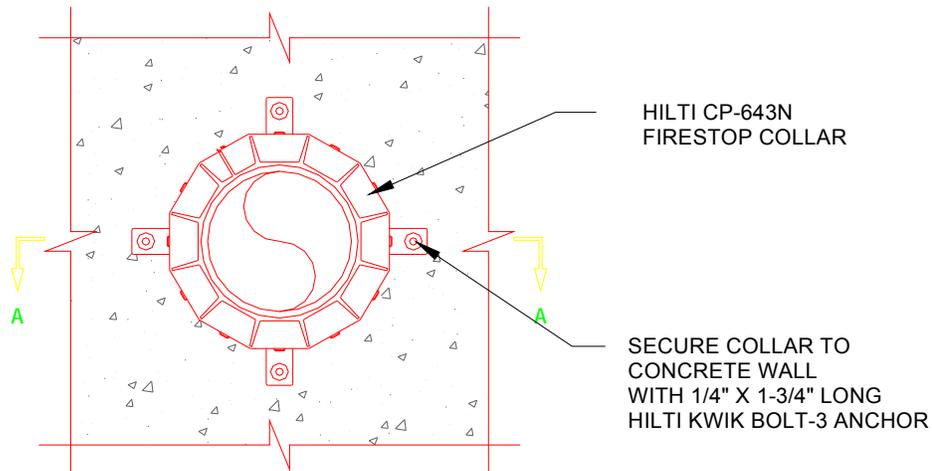
- A. MAXIMUM 30" NOMINAL DIAMETER STEEL PIPE (SCHEDULE 10 OR HEAVIER)
- B. MAXIMUM 30" NOMINAL DIAMETER CAST IRON PIPE
- C. MAXIMUM 6" NOMINAL DIAMETER COPPER PIPE
- D. MAXIMUM 6" NOMINAL DIAMETER STEEL CONDUIT
- E. MAXIMUM 4" NOMINAL DIAMETER EMT

**(B) GYPSUM WALL ASSEMBLY (1 HR. OR 2 HR. FIRE-RATING) (W-L-1054)**

**F-55 – BUILDING SERVICES NON-METALLIC PIPE THROUGH WALL/FLOOR**

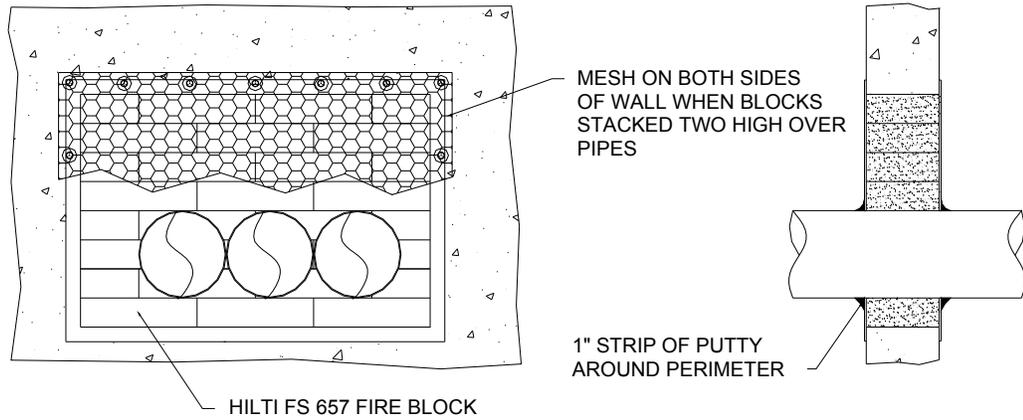


**(A) NON-METALLIC PIPE THROUGH GYPSUM WALL ASSEMBLY (W-L-2078)**



**(B) NON-METALLIC PIPE THROUGH CONCRETE FLOOR/WALL (C-AJ-2109)**

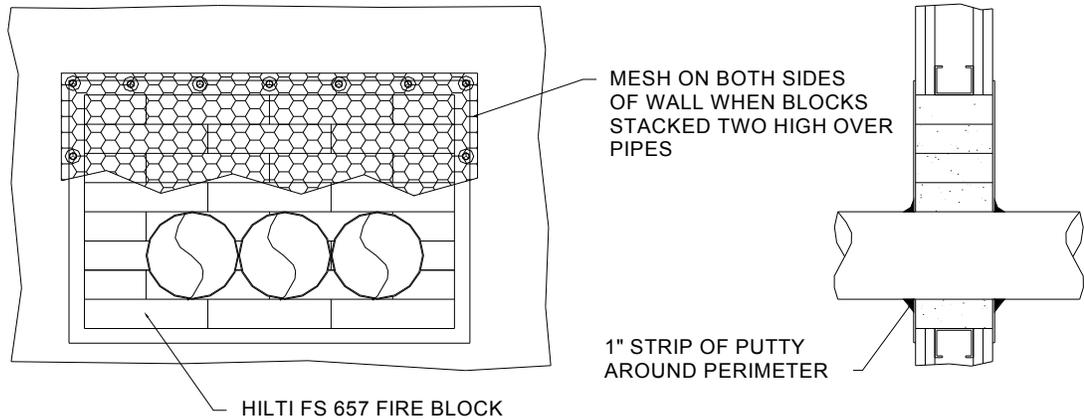
**FIGURE F-56 BUILDING SERVICES MULTIPLE ITEMS THROUGH WALLS**  
**(W-L-8114E)**



- A. MAXIMUM 12" NOMINAL DIAMETER STEEL PIPE (SCHEDULE 10 OR HEAVIER)
- B. MAXIMUM 12" NOMINAL DIAMETER CAST IRON PIPE
- C. MAXIMUM 6" NOMINAL DIAMETER COPPER PIPE
- D. MAXIMUM 6" NOMINAL DIAMETER STEEL CONDUIT
- E. MAXIMUM 4" NOMINAL DIAMETER EMT
- F. NOMINAL 1-1/2" THICK GLASS-FIBER PIPE INSULATION
- G. NOMINAL 2" DIAMETER STEEL CONDUIT OR EMT (MAX. QUANTITY = 13)

Maximum area of opening = 2495 square inches, with maximum dimension of 52".

**(A) 2-HR. CONCRETE WALL OR BLOCK WALL (W-J-8016b)**

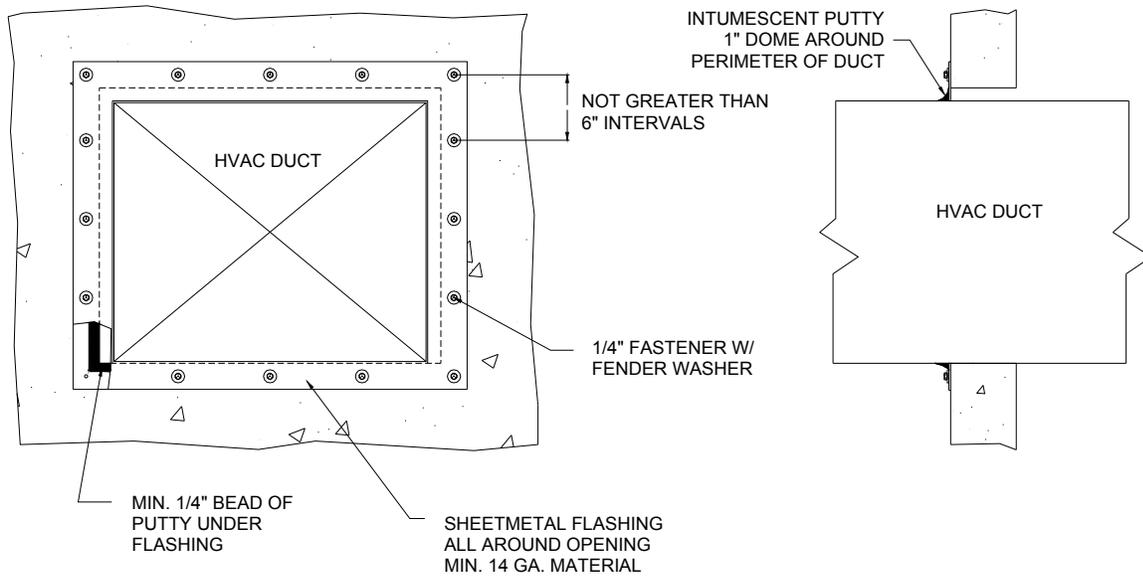


- A. MAXIMUM 3" NOMINAL DIAMETER PVC PLASTIC PIPE (SCHEDULE 40, SOLID CORE)
- B. MAXIMUM 6" NOMINAL DIAMETER STEEL PIPE (SCHEDULE 40 OR HEAVIER)
- C. MAXIMUM 4" NOMINAL DIAMETER STEEL CONDUIT
- D. MAXIMUM 4" NOMINAL DIAMETER EMT
- E. MAXIMUM 4" NOMINAL DIAMETER COPPER PIPE
- F. NOMINAL 1-1/2" GLASS-FIBER PIPE INSULATION MAY BE USED ON ANY OR ALL METALLIC PIPES.

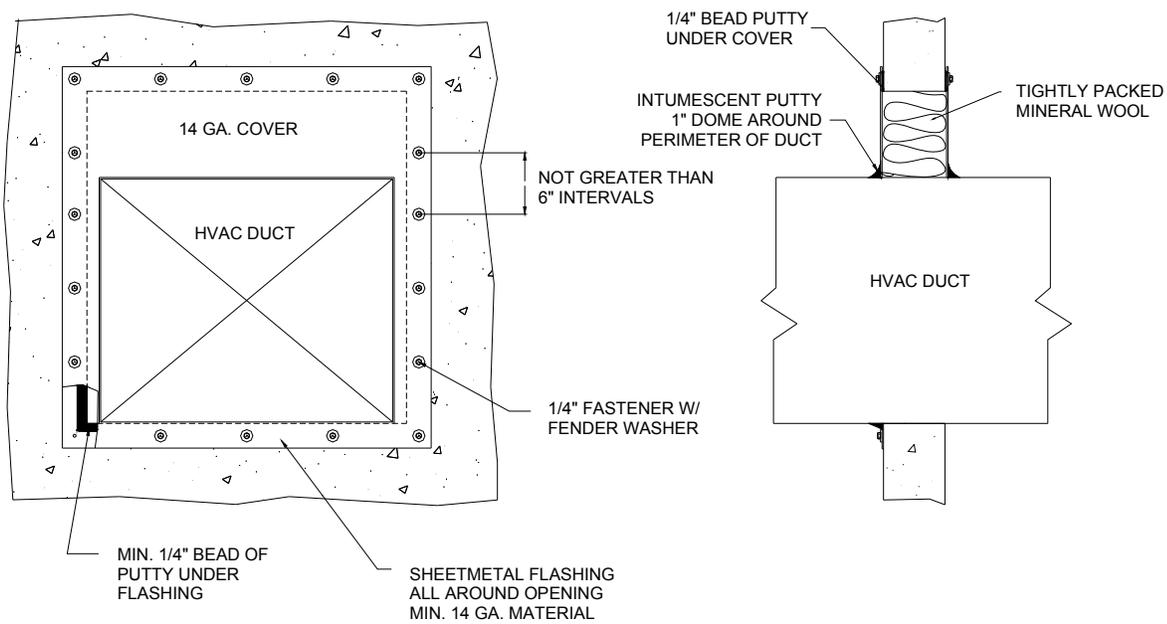
MAXIMUM SIZE OF OPENING = 22" X 16"

**(B) 1-HR. OR 2-HR. GYPSUM WALL ASSEMBLY**

FIGURE F-57 BUILDING SERVICES FIRE STOPPING HVAC DUCT



(A) WALL OPENING WITHIN 2 INCHES OF DUCT



(B) LARGER WALL OPENINGS AROUND DUCT

**[END OF SECTION]**

**SECTION G -- FLOOR DRILLING**

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3. FLOOR DRILLING HOLES IN FLOORS.....	G-3
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4.2 Cutting/Lifting Procedures.....	G-11
5.0 DOCUMENTATION.....	G-12
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5.2 Notice of Non-Conformance.....	G-12

**TABLE G-1 – SUMMARY OF CHANGES IN SECTION G**

Change	Item in most recent Issue	Item in this issue
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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 requirements for floor drilling and cutting/lifting procedures. These procedures shall be used to penetrate resilient vinyl floor coverings including floor tile or sheet/rolled goods (such as linoleum) that contain asbestos or are presumed to contain asbestos. Should a floor covering material suspected to contain asbestos other than the above are encountered (such as asphalt planking), it must be sampled and analyzed to establish content or otherwise presumed to be asbestos. Disturbance of materials other than floor tile or sheet/rolled goods (such as linoleum) containing asbestos or presumed to contain asbestos shall be conducted by a licensed asbestos professional.
- 1.1.4 Changes in this issue of Section G of ATT-TP-76300 are summarized in Table G-1.
- 1.1.5 These procedures shall be used when drilling in resilient vinyl floor coverings (i.e. floor tile and sheet/rolled goods such as linoleum) containing asbestos or presumed to contain asbestos and when cutting/lifting resilient vinyl floor coverings containing asbestos or presumed to contain asbestos.
- 1.1.6 The procedures shall also be used as a dust control practice when drilling in concrete and non-asbestos containing flooring.
- 1.1.7 The procedures described here apply as indicated in table 1.1.8
- 1.1.8 Table 1.1.8 details state by state requirements for using the procedures described in this section (TP76300, section G)

State	Use Drilling Procedure	Use Cutting/ Lifting Procedure
Alabama	Yes	Yes
Alaska	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only
Arizona	Yes	Yes
Arkansas	Yes	Yes
California	Yes	Yes
Colorado	Yes <sup>2</sup> (contact RRC for debris disposal)	Yes <sup>2</sup> (contact RRC for debris disposal)
Connecticut	Yes	Yes
Delaware	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only

State	Use Drilling Procedure	Use Cutting/ Lifting Procedure
District of Columbia	Yes	Yes
Florida	Yes	Yes
Georgia	Yes	Yes
Hawaii	Yes	Yes
Idaho	Yes	Yes
Illinois	Yes	Yes
Indiana	Yes	Yes
Iowa	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only
Kansas	Yes	Yes
Kentucky	Yes	Yes
Louisiana	No, Only Cutting/Lifting	Yes
Maine	Yes	Yes
Maryland	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only
Massachusetts	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only
Michigan	Yes	Yes
Minnesota	Yes	Yes
Mississippi	Yes	Yes
Missouri	Yes	Yes
Montana	Yes	Yes
Nebraska	Yes	Yes
Nevada	Yes	Yes
New Hampshire	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only
New Jersey	Yes	Yes
New Mexico	Yes <sup>2</sup> (contact RRC for debris disposal)	Yes <sup>2</sup> (contact RRC for debris disposal)
New York	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only
North Carolina	Yes	Yes
North Dakota	Yes	Yes
Ohio	Yes	Yes
Oklahoma	Yes	Yes
Oregon	Yes	Yes
Pennsylvania	Yes	Yes
Rhode Island	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only

State	Use Drilling Procedure	Use Cutting/ Lifting Procedure
South Carolina	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only
South Dakota	Yes	Yes
Tennessee	Yes	Yes
Texas	Yes	Yes
Utah	Yes	Yes
Vermont	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only
Virginia	Yes	Yes
Washington	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only	No <sup>1</sup> , if asbestos containing- licensed abatement contractor only
West Virginia	Yes	Yes
Wisconsin	Yes	Yes
Wyoming	Yes <sup>3</sup> (notification and disposal as asbestos waste required)	Yes <sup>3</sup> (notification and disposal as asbestos waste required)

<sup>1</sup>. In these states, if the covering is asbestos containing, the drilling or cutting/lifting procedure is NOT allowed to be performed by installation contractors. A licensed asbestos abatement contractor must remove the covering or drill the hole per this practice. If the tile can be verified to not contain asbestos through sampling of the material or record of previous sampling, the drilling or cutting/ lifting should be conducted per this section to control dust.

<sup>2</sup>. In these states the procedure is allowed to be performed by installation contractors, but the debris must be handled and disposed as an asbestos containing waste. The AT&T Equipment Engineer must contact AT&T's Resource Recovery Center, 800-KNOW-EHS, prompt 4. The RRC will assist with arranging a pick-up or instruct on alternate proper disposal method.

<sup>3</sup>. Wyoming requires a notification to the state 10 days before beginning a project disturbing any amount of asbestos. A notification form is available at <http://deq.state.wy.us/AQD/asbestos.asp>. Debris must be handled and disposed as an asbestos containing waste. The AT&T Equipment Engineer must contact AT&T's Resource Recovery Center, 800-KNOW-EHS, prompt 4. The RRC will assist with arranging a pick-up or instruct on alternate proper disposal method. The NEA Management Center should be contacted to assist with the 10-day notification process- [nea@titanengineering.com](mailto:nea@titanengineering.com).

1.1.9 The procedures described herein DO NOT apply to work within schools. Disturbance of materials containing asbestos or presumed to contain asbestos in schools shall be conducted by a licensed asbestos professional.

**1.2. REQUIREMENTS**

1.2.1 AT&T presumes all tile and sheet/rolled vinyl flooring to contain asbestos unless verified otherwise through sampling of the material. The Installation Supplier shall place written documentation in the job folder verifying the absence of ACM when the Installation Supplier cuts/drills in non-asbestos containing floors.

- a) States indicated in [table 1.1.8](#), where licensing is required applies only to floor coverings that actually contain asbestos. If the material can be verified to contain no asbestos, the Installation Supplier can perform the drilling or cutting/lifting process as outlined in this practice.

1.2.2 In states that require a licensed asbestos abatement contractor ([see table 1.1.8](#)), only an AT&T approved abatement contractor may be used to conduct the drilling or lifting cutting. The Installation Supplier is responsible for coordinating a contractor as part of the project. To determine which abatement contractors are approved in a state requiring a licensed abatement contractor, the Installation Supplier should contact:

Jennifer A. Lester  
Vice President - Marsh Environmental Practice  
500 W. Monroe 23rd Floor  
Chicago, IL 60661  
Ph (312)627-6897  
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- Jennifer Lester, the manager of AT&T's abatement approval process, can also assist in approving new abatement contractors if the existing list does not have a cost effective, geographically convenient contractor available at the location needed.

1.2.3 The following procedures shall be followed by the Installation Supplier for Drilling in Concrete and Non-Asbestos Containing Flooring

- a) To facilitate dust control, the Installation Supplier shall drill bare concrete and non-asbestos containing flooring in the same manner as the asbestos floor covering material; i.e., by utilizing debris encapsulant.
- b) The debris and the encapsulant, after being cleaned up with a wet cloth or paper towel, may be disposed of as ordinary trash.
- c) If a vacuum is used to clean up concrete dust remaining in the holes, it must be a High Efficiency Particulate Air (HEPA) vacuum cleaner.

1.2.4 Installation Suppliers, who perform this process on non-asbestos floors only, need not be trained in the Negative Exposure Assessment (NEA) floor covering drilling procedures.

1.2.5 The Installation Supplier shall adhere to all federal, state and local regulations regarding waste material in addition to AT&T installation requirements.

- 1.2.6 The Installation Supplier shall coordinate with the AT&T Representative before any activity related to hazardous material/waste is started.
- 1.2.7 Installation Suppliers shall follow the Negative Exposure Assessment (NEA) floor covering drilling procedures when drilling in floors and the Negative Exposure Assessment (NEA) cutting/lifting procedures when cutting/lifting floor coverings.
- 1.2.8 In the event of any of the following occurrences, the Installation Supplier shall immediately contact the AT&T representative who will contact the appropriate AT&T organization:

Type of Occurrence	AT&T Equipment Engineer will contact...
Regulatory agency inspector visit to site	AT&T EH&S (1-800-KNOW-EHS) (1-800-566-9347)
Accidental exposure to suspected asbestos	AT&T EH&S (1-800-KNOW-EHS) (1-800-566-9347)
Accidental release of suspected asbestos to the environment, or encountering material that can not be drilled, cut or lifted by NEA methods.	AT&T EH&S (1-800-KNOW-EHS) (1-800-566-9347)

**2.0 TRAINING**

**2.1 GENERAL**

- 2.1.1 Installation Suppliers who perform these procedures on suspected/presumed/confirmed asbestos floor coverings shall be trained in the NEA floor drilling procedures or the NEA cutting/lifting procedures by a primary trainer authorized by the NEA Management Center.
- 2.1.2 Unqualified Installation Suppliers shall not drill in or cut/lift suspected/presumed/confirmed asbestos containing floor coverings.
- 2.1.3 Training shall include, at a minimum:
  - a) Annual Asbestos Awareness training;
  - b) Annual floor covering drilling procedure training; and
  - c) Initial hands-on training of the NEA floor covering drilling procedure; and/or
  - d) Annual floor covering cutting/lifting procedure training; and
  - e) Initial hands-on training of the NEA floor covering cutting/lifting procedure.
- 2.1.4 The Installation Supplier shall obtain the training from an appropriate trainer.

**Important Note Regarding Qualified Trainers**

Effective January 1, 2002 Installation Supplier's Primary trainer(s) shall attend an annual refresher-training course administered by a Core training provider. Only Core Trainers and Primary Trainers shall conduct NEA drilling or cutting/lifting procedure training.

**Core Trainers** are trainers approved by AT&T to conduct Asbestos Awareness and NEA Floor Covering Drilling and Cutting/Lifting Procedures training. The list of Core trainers is available by contacting the NEA Management Center. Core trainers shall provide independent “Train the Trainer” courses valid for one year from the date the course is successfully completed.

**Primary Trainers** – Trainers who have attended the “Train the Trainer” course conducted by Core Trainers shall be considered “Primary Trainers.” Primary trainers are qualified to train and certify persons within their organization who will perform drilling or cutting/lifting of floor coverings using the NEA procedures. Primary trainers are also qualified to perform drilling themselves. Primary Trainers shall be qualified to conduct training for a period of one year from the date of training by Core Trainers.

- 2.1.5 Training shall be valid for a period of one year from the completion of training.
- 2.1.6 Training shall be documented on a Training Attendance Form ([Figure G-1](#)) and submitted to the NEA Management Center. The Training Attendance Form must be submitted to the NEA Management Center prior to the trainees performing work practices addressed in this section.
- 2.1.7 The Training Attendance form must contain a signature of a certified primary trainer, verifying that the training was conducted in accordance with this section. The form may be faxed or scanned and e-mailed to the NEA Management Center (address listed on form).

**3. DRILLING HOLES IN FLOORS**

**3.1 GENERAL**

- 3.1.1 The Installation Supplier shall use the NEA floor drilling procedure to drill in asbestos-containing or suspected asbestos-containing vinyl floor coverings.
- 3.1.2 The procedures shall also be used as a dust control practice when drilling in concrete and non-asbestos containing flooring
- 3.1.3 The Installation Supplier shall use the NEA floor drilling procedures as indicated in [table 1.1.8](#).
- 3.1.4 Records of the asbestos content in flooring materials may be available for review. To access these records, the Installation Supplier may call the following numbers to determine if the floor to be drilled can be verified to contain no asbestos:

<b>Table 3.1.4 Asbestos Records Contacts</b>	
Midwest - Illinois, Indiana, Michigan, Ohio, and Wisconsin Texas	Contact AT&T Design & Construction for specific locations (the Installation Supplier may need to coordinate with AT&T Equipment Engineer to determine proper contact)
Missouri, Oklahoma, Kansas, and Arkansas	314-235-5949
Connecticut	888-387-7638
California	Kevin Holloran 251-434-2456 kevin.holloran@parsons.com

Georgia	Kevin Holloran 251-434-2456 kevin.holloran@parsons.com
Alabama, Mississippi, Louisiana	Don Pippin 251-434-2455 don.pippin@parsons.com
Kentucky, Tennessee, North Carolina, South Carolina	Tom Walker 251-434-2453 thomas.walker@parsons.com
Florida	Jimmie Maughon 251-434-2456 jimmie.maughon@parsons.com
Nevada	775-333-4381 or 4382
States Not Listed	Contact the Building Manager

Unless verification is received from one of these sources that the floor covering is NOT asbestos-containing, the material shall be presumed to be asbestos-containing and treated as such.

- 3.1.5 Hole drilling in the state of Oklahoma shall be limited to vinyl floor tile only. This procedure shall not be used to drill other substances such as rolled or sheet floor coverings (e.g. linoleum) in these states. In Oklahoma the installation supplier shall contact the AT&T Equipment Engineer to arrange for a licensed asbestos abatement contractor to drill the holes or remove the asbestos-containing materials and properly dispose of the debris if the material is not floor tile.
- 3.1.6 The Installation Supplier shall use manual stops on drills to control the depth of the hole when drilling anchor holes. Tape or other types of non-mechanical stops are not permitted.

**3.2 Floor Drilling Procedure**

- 3.2.1 The following procedures shall be followed by the Installation Supplier for solid-bit floor drilling in asbestos containing vinyl floor coverings (drilling holes one-inch in diameter or less).
  - a) Complete the Negative Exposure Assessment (NEA) form ([Figure G-3](#)). The completed form shall be maintained on-site until all drilling activities have been completed. Page 3 of the completed form shall be sent or faxed to the NEA Management Center within two days of completion of the drilling activities. If the drilling activity last for numerous days form must be faxed within two days of the last day of drilling. The NEA form must accurately reflect the date range when the drilling activity occurred.
  - b) Place a copy of the completed NEA form in the job folder at the job site.

**The immediate area shall be clear of all people who have not completed the Asbestos Floor Covering Drilling training course.**

- c) The following equipment and supplies are required for this procedure: Impact drill with masonry bit, shaving cream, wet paper towels, marking pen, plastic sealable bags.
  - d) Mark the location where the hole is to be drilled. You may tear a small hole in the center of the wet paper towel; place the hole over the marked location where the hole is to be drilled. Position the drill on the marked location bit on the location of the hole to be drilled and apply an ample amount of debris encapsulant (LEPEC, shaving cream or shaving gel), covering a minimum of two inches in diameter and one inch deep around the drill bit.
  - e) Drill at slow speed until a hole is drilled into the concrete substrate to the required depth.
  - f) Stop the drilling and retract the bit slowly without disturbing the debris, concrete and encapsulant around the hole. Wipe the drill bit with a wet paper towel and place into a sealable plastic bag. Fold the corners of the wet paper towel over the mound of shaving cream which is covering the drilled hole; pick up the towel containing the encapsulant and debris, place into the plastic bag.
  - g) Wipe the floor around the hole with a wet paper towel, holding it flat against the floor with the palm of the hand. Wipe once in an S-pattern and place towel into the plastic bag. The towel shall not be reused.
  - h) Wipe the floor again in an S-pattern, at right angles to the direction that you wiped the first time. Place the used towel into the plastic bag. The towel shall not be reused.
  - i) Continue wiping in alternating S-patterns until you cannot see or feel any dust or debris. The towels shall not be reused. Place all used towels into a sealable plastic bag and seal.
  - j) Place the sealed bag into another bag and seal it also.
  - k) Vacuum cleaners, of any type, shall NOT be used by the Installation Supplier to clean up asbestos containing or presumed asbestos containing material.
  - l) High Efficiency Particulate Air (HEPA) vacuum cleaners may be used to clean up non-asbestos concrete dust remaining in the holes after the procedure outlined above has been completed.
  - m) Dispose of the double-bagged debris into the outside dumpster unless table 1.1.8 indicates the material must be disposed of by contacting the RRC. If disposing in dumpster, do not label the bag or include any paper work. Each day's debris must be disposed of at the end of that day. If table 1.1.8 indicates to dispose of by contacting the RRC, the Installation Supplier should coordinate with the Equipment Engineer to contact the RRC at 1-800-KNOW-EHS, prompt 4 to arrange for proper disposal.
- 3.2.2 The following procedures shall be followed by the Installation Supplier for Drilling in Other Asbestos-Containing Material:
- a) If it is unknown whether the floor covering material contains asbestos, it shall be presumed to contain asbestos.
  - b) If the Installation Supplier encounters an asbestos-containing floor covering other than resilient vinyl floor tile or a sheet/rolled product such as linoleum the Installation Supplier shall contact the AT&T Equipment Engineer to arrange for a licensed asbestos abatement

contractor to drill the holes or remove the asbestos-containing materials and properly dispose of the debris.

#### **4.0 CUTTING/LIFTING FLOOR COVERINGS**

##### **4.1 General**

- 4.1.1 These procedures are to be used for lifting pieces of intact or substantially-intact asbestos containing floor coverings in preparation for drilling through or into a concrete slab or otherwise drilling holes in excess of one-inch in diameter. Each operation consists of the removal of enough floor covering to core drill one hole. A maximum of one square foot of floor tile may be removed each day unless specific authorization given by AT&T EH&S Technical Support Manager. Contact John Malone @ 314-505-1461 or by e-mail at [jm7842@att.com](mailto:jm7842@att.com) for authorization.
- 4.1.2 The Installation Supplier shall not penetrate asbestos floor covering with a power coring tool. That would be considered mechanical chipping, which is prohibited by the OSHA asbestos regulations.
- 4.1.3 These procedures shall also be used as a dust control practice when cutting/lifting non-asbestos containing flooring
- 4.1.4 The Installation Supplier shall use the NEA cutting/lifting procedures as specified in [table 1.1.8](#).
- 4.1.5 Records of the asbestos content in flooring materials may be available for review. To access these records, the Installation Supplier should call the numbers listed in [table 3.1.4](#). *Unless verification is received from one of these sources that the floor covering is NOT asbestos-containing, the material shall be presumed to be asbestos-containing and treated as such.*
- 4.1.6 Cutting/lifting in the State of Oklahoma shall be limited to vinyl floor tile only. This procedure shall NOT be used to cut/lift other substances such as rolled or sheet floor coverings (e.g. Linoleum) in Oklahoma. In Oklahoma the Installation Supplier shall contact the AT&T Equipment Engineer to arrange for a licensed asbestos abatement contractor to or remove the asbestos-containing materials and properly dispose of the debris if the material is not floor tile.
- 4.1.7 The following equipment and supplies are required for these procedures:
- Bottle with soapy water or shaving cream (see 4.1.8)
  - Waterproof marker pen
  - Chisels or hole punch and hammer (see 4.1.9)
  - Heavy-bladed scraper
  - Silicone caulk
  - Wet paper towels
  - Sealable plastic freezer bags – one gallon size or larger
- 4.1.8 Use of chemical mastic removers is discouraged because of potential flammability and toxicity hazards. If the mastic cannot be removed with soapy water, use mastic remover in accordance with the Material Safety Data Sheet and manufacturer's instructions for the product. Soapy water will work better than shaving cream.
- 4.1.9 A chisel with a large (~2" wide) blade works best for cutting the covering when that much area is required to be lifted and one with a smaller blade works best for lifting the covering and for removing the mastic. A hole punch may also be used to cut and lift the covering, a small chisel

is still required to remove mastic. The chisels and hole punches shall be kept as sharp as possible.

- 4.1.10 The Installation Supplier shall not use any type of vacuum cleaner to pick up debris. An ordinary shop vacuum will not capture microscopic asbestos fibers and OSHA regulations do not allow their use.
- 4.1.11 The following procedures describe the use of a chisel or hole punch to cut through the covering. The choice of tool is left to the discretion for the installer and may depend on the covering being removed and where the hole is to be drilled relative to the edges of the covering. The procedures also differ slightly depending on the location of the hole, as defined below.
- 4.1.12 The installer shall endeavor to minimize breakage of the remaining flooring material surrounding the piece being removed.

## **4.2 Cutting/Lifting Procedures**

- 4.2.1 These procedures do not describe the actual drilling operation. If vibration from the drilling causes pieces of floor covering to come loose,
  - a) Stop the core drilling temporarily and vacate all persons who have not been trained on using these procedures from the immediate area;
  - b) Pick up the loose pieces of material, wet them and put them in sealable plastic bags;
  - c) Clean the mastic from the exposed concrete as described in these procedures.
- 4.2.2 Complete the Negative Exposure Assessment (NEA) form ([Figure G-2](#)). The completed form shall be maintained on-site until all cutting/lifting activities have been completed. Page 5 of the completed form shall be sent or faxed to the NEA Management Center within two days of completion of the cutting/lifting activities. Place the completed NEA form in the job folder at the job site. The NEA form must accurately reflect the date range when the activity occurred.

**The immediate area shall be clear of all person who have not completed the Asbestos Floor Covering Cutting/Lifting training course.**

- 4.2.3 Waste material generated by these procedures shall be disposed of in accordance with instructions provided in 4.2.12.
- 4.2.4 Place the bit on the location where the hole through the slab will be drilled. With the marking pen, draw a circle or square on the floor covering around the bit at least a half-inch larger than the diameter of the bit.
- 4.2.5 Apply a bead of shaving cream or amended (soapy) water over the lines.
- 4.2.6 Using a chisel or hole punch, cut through the floor covering through the shaving cream or amended water. It is not important to cut exactly on the lines.
- 4.2.7 Pry the piece of floor covering off the concrete with the heavy-bladed scraper, tapping the end of the scraper handle with the hammer. The piece should be removed intact when possible, however should the piece break – this is not a problem.
- 4.2.8 Wet the mastic on the back of the floor covering piece and put the piece of floor covering in a sealable plastic bag.

- 4.2.9 Wet the mastic on the concrete with shaving cream or amended water and scrape it off with the small sharp chisel. An asphalt stain may remain on the surface, but there should be no residue – the surface should be smooth to the touch.
- 4.2.10 Wipe the concrete with wet paper towels until it is clean. Fold the towel over every time you use it. Put the towels in the sealable plastic bag.
- 4.2.11 Seal the exposed edges of covering with the caulk
- 4.2.12 When the procedure is complete put the sealed bag into another bag and seal it also. Dispose of the double-bagged debris into the outside dumpster unless table 1.1.8 indicates the material must be disposed of by contacting the RRC. If disposing in dumpster, do not label the bag or include any paper work. Each day's debris must be disposed of at the end of that day. If table 1.1.8 indicates to dispose of by contacting the RRC, the Installation Supplier should coordinate with the Equipment Engineer to contact the RRC at 1-800-KNOW-EHS, prompt 4 to arrange for proper disposal.
- 4.2.13 Subsequent drilling of the concrete must be completed using wet methods (i.e. shaving cream method as described in Section 3. The drill must also fit within the area of covering removed area. If the rotating bit contacts the covering at any time, the procedure must be stopped and more covering removed per section 4.

## **5.0 DOCUMENTATION**

### **5.1 General**

The following forms shall be used to document the floor drilling procedures and cutting/lifting procedures described in this section:

- a) Training Attendance Form ([Figure G-1](#))
- b) Negative Exposure Assessment Form – Cutting/lifting ([Figure G-2](#)). This form may be submitted electronically, without a handwritten signature. Submission of this form to the NEA Management Center by e-mail will be considered equivalent to signing and faxing the form.
- c) Negative Exposure Assessment Form - Floor drilling ([Figure G-3](#)). This form may be submitted electronically, without a handwritten signature. Submission of this form to the NEA Management Center by e-mail will be considered equivalent to signing and faxing the form.
- d) Negative Exposure Assessment Form –Notice of Non-Conformance Form ([Figure G-4](#))

### **5.2 NOTICE OF NON-CONFORMANCE**

- 5.2.1 An Installation Supplier submitting invalid training or NEA documentation will receive a Notice of Non-Conformance ([Figure G-4](#)) which requires the Installation Supplier to correct the situation immediately.

5.2.2 Questions and requests for information may be forwarded to the NEA Management Center.

**FIGURE G-1 – TRAINING ATTENDANCE FORM**



**FIGURE G-2 – NEGATIVE EXPOSURE ASSESSMENT FORM  
LIFTING PIECES OF ASBESTOS CONTAINING FLOOR COVERING  
FOR HOLES LARGER THAN 1-INCH IN DIAMETER**



**FIGURE G-3 – NEGATIVE EXPOSURE ASSESSMENT FORM  
DRILLING HOLES IN ASBESTOS CONTAINING FLOOR COVERINGS  
HOLES UP TO 1 INCH IN DIAMETER**



**FIGURE G-4 –NOTICE OF NON-CONFORMANCE**



**[END OF SECTION]**

**SECTION H-- GROUNDING AND BONDING**

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**TABLE H-1 – SUMMARY OF CHANGES IN SECTION H**

Change	Item in Issue	Item in this Issue
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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&TIS 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 Grounding and Bonding requirements for Installation Suppliers performing services for AT&TIS.
- 1.1.4 Changes in this issue of Section H are summarized in Table H-1.
- 1.1.5 This section contains workmanship requirements. It is based on the engineering, installation and material requirements for grounding and bonding contained in the following documents:
  - a) ATT-TP-76403, *Grounding and Bonding Requirements for Internet Services Facilities*
- 1.1.6 Additional information on Grounding and Bonding (e.g. cabling, connectors, labeling, etc.) can be found in other sections of this document.

**1.2. Definitions**

- 1.2.1 The following terms are used throughout this Practice. The terms marked with an asterisk (\*) are consistent with the NEC and include the text from Article 100 of the NEC. Table 1-1 is located at the end of this section on definitions. It contains a cross-reference between grounding and bonding terms used in this Practice and equivalent terms used by standards bodies, equipment vendors and others. Network acronyms can be found in ATT-000-000-020, Network Acronyms Dictionary.

1.2.2

- AC** Alternating Current
- ACEG** Alternating Current Equipment Ground
- AG/EEE** Above Ground Electronic Equipment Enclosure
- AHJ** Authority Having Jurisdiction
- AWG** American Wire Gauge
- BDB** Battery Distribution Board
- BDCBB** Battery Distribution Circuit Breaker Board
- BDFB** Battery Distribution Fuse Board
- BG/EEE** Below Ground Electronic Equipment Enclosure

**Battery Return** – The battery return is one of two wires (the other is generally called “battery”) used to provide dc power to network equipment. The battery return wire is grounded to the IS POP/VHO GRD System via the battery return bus bar.

**\*Bonding** - The permanent joining of metallic sub-sections to form an electrically conductive path, which will assure electrical continuity and the capacity to conduct safely any current likely to be imposed.

**BSP** Bell System/Service Practice

**CBN** Common Bonding Network

**CDF** Combined Distributing Frame

**CEF** Cable Entrance Facility

**Central Office Ground (CO GRD) – (See Internet Services POP/VHO GRD)**The grounding system within a structure, including the Office Principal Ground Point (OPGP), the Vertical Riser, horizontal equalizers, CO GRD bus bars on each floor, the connections to AC and DC power systems, and the connections to equipment and other objects. The CO GRD system is often referred to as a *tree* since, in multifloor applications, the vertical conductors resemble a trunk and the horizontal conductors resemble branches extending from the trunk. This system is designed to:

- 1) Provide a fault current return path that permits effective operation of over current protective devices
- 2) Provide a low impedance reference to the building's principal ground point
- 3) Allow an interchange of ground currents to effectively maintain equal potential in communication circuits

**Central Office Ground Bus Bar** - A bus bar that references the principal ground point through the Vertical Riser. At least one of these bus bars is provided on each floor to permit the grounding of frames and power supplies, as required.

**Choke** - A metallic support that completely encircles a ground wire thereby increasing the inductive properties of the wire. Also known as “girdle”.

**Common Bonding Network (CBN)** - A set of interconnected objects that has one or more connections to a ground reference. This network, created by a multitude of connections, helps to ensure that the objects are at essentially the same potential when fault current flows through them. Building steel, water pipes, vertical and horizontal equalizer conductors, metallic raceways, raised floor systems, equipment frames and other conductive objects form a common bonding network when bonded together by intentional and incidental connections. This term is now used throughout this Practice in place of *integrated ground plane*.

**CRF** Cable Rearrangement Facility

**DC System Grounding Conductor** - The conductor used to connect one side of a dc power source to the site's grounding system. Example: In a -48 volt battery-type power plant serving

central office equipment, the conductor between the positive (+) side of the plant and a point on the IS POP/VHO GRD system.

**Daisy Chaining** - Daisy chaining is the unacceptable practice of extending a grounding connection by using the conductive mass of two or more components bonded together rather than using the acceptable method of installing a separate, dedicated grounding wire that has bonds to each of the components.

**Direct Current Equipment Grounding (DCEG) Conductor** - The conductor that bonds an equipment frame, cabinet or other enclosure to the IS POP/VHO GRD system. The DCEG conductor may also bond an equipment unit within a frame, cabinet or other enclosure to the IS POP/VHO GRD system. "DCEG conductor" is now used in place of *framework grounding conductor*.

**Driven Ground Electrode**

For company locations, this means a driven ground rod. Other publications may use the term *made electrodes*, which includes plate, pipe, or other electrode designs that may not be approved for use at central offices and other company structures.

**EEE** Electronic Equipment Enclosure

**EMT** Electrical Metallic Tubing

**EQPT** Equipment

**Equalization** - The process of connecting different ground reference sources together with an objective of providing a single ground reference.

**Equipment Ground (EG)** - Deliberately engineered conductors in communication systems and ac and dc power distribution systems to provide electrical paths of sufficient capacity to permit protective devices (e.g. fuses, circuit breakers) to operate effectively and to equalize potential between equipment.

**Exothermic Weld** - A mixture of aluminum, copper oxide and other powders are held in place with a graphite mold around the joint to be treated. The mixture is ignited and the heat generated (in excess of 4000 F) is sufficient to boil away contaminating films and foreign substances while joining the pieces with a continuous metallic bridge with electrical and mechanical properties similar to the individual items joined. Proprietary names include Cadweld and Thermoweld.

**Flash Over** - An unintended electric discharge.

**Framework Ground (FRWK GRD)** - That portion of the grounding system that provides a connection between the IS POP/VHO GRD system and frames, cabinets and metallic objects.

**GEC** Grounding Electrode Conductor

**\*Ground (GRD, GND)** - A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

**Ground Fault** - A conducting connection, whether intentional or accidental, between any of the conductors of an electrical system and the grounding conductor or conducting material which encloses the conductors (such as conduit) or any conducting material that is grounded or that may become grounded.

**\*Grounded** - Connected to the earth or to some conducting body that serves in place of the earth.

**\*Grounded Conductor** - A system or circuit conductor that is intentionally grounded. Example: The conductor usually referred to as the *grounded conductor* is the *neutral* conductor in ac circuits and the *battery return* conductor in dc circuits.

**\*Grounding Conductor** - A conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode or electrodes. Example: The alternating current equipment ground (ACEG), also called the *green wire*, used to provide a fault current return path in ac power systems or the grounding conductors used to interconnect frames, aisle grounds, horizontal equalizers, and vertical equalizers.

**Grounding Electrode** - A conductor (usually buried) for the purpose of providing an electrical connection to ground.

**\*Grounding Electrode Conductor (GEC)** - The conductor used to connect the grounding electrode to the equipment grounding conductor and/or to the grounded conductor of the circuit at the service equipment or at the source of a separately derived system. Example: In the ac service entrance switchgear of a building, the conductor between the insulated neutral bus bar and the office principal ground point bus bar.

**Grounding Electrode System** - An arrangement of intentionally bonded objects that furnish reference to earth and consist of one or all of the following:

- a) Specifically designed metallic objects such as driven ground rods, well casings, or other approved electrodes;
- b) Grounding electrodes of other systems (e.g., ac power, lightning protection);
- c) Most buried metallic objects that enter any portion of a structure

**Ground Window (GW)** - An imaginary spherical volume having a radius of 3 feet. This transition area contains the main ground bus (MGB), which is the physical interface between the building's common bonding network and isolated bonding network equipment. The Ground Window is the opening where grounding conductors serving isolated bonding network equipment are connected to the common bonding network.

#### **Hatchplate / Bulkhead**

The Hatchplate or Bulkhead is a solid copper plate used as a "window" through which antenna coaxial conductors pass utilizing hardware that grounds the sheath to the plate. The assembly can be installed in the side of a building, in a protected enclosure outside the building, or in close proximity to where the coaxial conductors exit the entrance conduits from outside the building. The lightning arrestors may also be installed on the hatchplate.

**Horizontal Equalizers**

Conductors of relatively low impedance (usually 750kcm) that interconnect:

- a) Vertical Risers in a building that is of a size that requires more than one Vertical Riser
- b) The IS POP/VHO GRD bus bar to equipment areas on the same floor
- c) Battery return bus bars in dc distribution systems for some electronic switching systems
- d) A horizontal equalizer conductor to an equipment unit or area on the same floor
- e) BDFB bus bars (non-insulated) to the IS POP/VHO GRD

**HSP** House Service Panel

**IBN** Isolated Bonding Network

**IDF** Intermediate Distributing Frame

**IMC** Intermediate Metal Conduit

**Incidental Ground** - Ground paths that exist within a building through contact between such items as structural steel, water piping, air ducts, conduits, superstructure, raceways, reinforcement rod, cable racks, and other conductive objects that are primarily installed for other purposes but secondarily provide an electrical path to ground.

**Integrated Ground Plane** (See Common Bonding Network)

**Internet Services POP/VHO Ground (IS POP/VHO GRD)** - The grounding system within a structure, including the Office Principal Ground Point (OPGP), the Vertical Riser, horizontal equalizers, ISO GRD bus bars on each floor, the connections to ac and dc power systems, and the connections to equipment and other objects. The ISO GRD system is often referred to as a *tree* since, in multifloor applications, the vertical conductors resemble a trunk and the horizontal conductors resemble branches extending from the trunk. This system is designed to:

- 1) Provide a fault current return path that permits effective operation of over current protective devices
- 2) Provide a low impedance reference to the building's principal ground point
- 3) Allow an interchange of ground currents to effectively maintain equal potential in communication circuits

**Internet Services POP/VHO Ground Bus Bar** - A bus bar that references the principal ground point through the Vertical Riser. At least one of these bus bars is provided on each floor to permit the grounding of frames and power supplies, as required.

**Isolated Bonding Network (IBN)** - A set of interconnected objects that is referenced to ground at a single point. This network is insulated from contact with any other conductive member not part of the same bonding network. With only one point of ground reference, the possibility that the equipment will be used as a conductive path for transient currents from

exterior sources is greatly reduced. This term is now used throughout this Practice in place of *isolated ground plane*.

**Isolated Ground Plane** (See Isolated Bonding Network)

**Isolated Ground Zone** (Same as Isolated Bonding Network)

**Isolated Return Bar** - This is a bus bar used when a power plant serves Isolated Bonding Network equipment but does not have its battery return bus bar insulated from the framework of the power plant. It consists of either a bus bar detail or a separate bus bar. When this is a bus bar detail, one end is mounted on an insulator and the other is bolted to the existing battery return bus bar. When it is a separate bus bar, both ends are mounted on insulators and at least one 750 kcmil conductor ties this isolated bar back to the battery return bus bar.

**kcmil** 1,000 Circular Mils

**Lightning Arrestor**

A coaxial lightning arrestor conducts transient voltages to ground in the same manner as a cable protector thus protecting the down stream equipment from damaging electrical stress.

**\*Listed** - Equipment or materials included in a list published by an organization acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets appropriate designated standards or has been tested and found suitable for use in a specified manner.

**LPCDF** Low Profile Combined Distributing Frame

**\*Main Bonding Jumper** - The connection between the grounded circuit conductor and the equipment grounding conductor at the service.

**Main Ground Bus (MGB)** - A bus bar located within the ground window that provides a physical means of connection between the Internet Services Office GRD system and the isolated bonding network served by the ground window.

**MCM** 1,000 Circular Mils (old term; see kcmil)

**MDF** Main Distributing Frame

**MTCE** Maintenance

**NEC** National Electrical Code

**NRTL** Nationally Recognized Testing Laboratory

**Neutral** - In ac power distribution, the conductor that is intentionally grounded on the supply side of the service disconnect and provides a current return path for ac power currents.

**Office Principal Ground Point (OPGP)** - A bus bar normally located near the AC entrance switchgear. It functions as:

- a) The connection point for all main grounding conductors and earth electrodes;
- b) The point of origin for the Vertical Riser;

c) If convenient, the Internet Services Office GRD bus bar for the floor (typically the basement) where it is located

**PBD** Power Board

**PBSD** Pacific Bell Standard Drawing

**PCF** Power Control and Fuse Distribution

**PD** Power Distribution

**PDC** Power Distribution and Control

**PDU** Power Distribution Unit

**PGP** Principal Ground Point

**Plating** - A coating of silver, nickel or tin that is applied to copper conductors to inhibit oxidation of the copper. Tin is the least expensive of these coatings and most widely used.

**\*Premises Wiring (as applied to a System)** - That interior and exterior wiring, including power, lighting, control and signal circuit wiring together with all of its associated hardware, fittings, and wiring devices, both permanently and temporarily installed, which extends from the load end of the service drop or load end of the service lateral conductors, or source of a separately derived system to the outlet(s). Such wiring does not include wiring internal to appliances, fixtures, motors, controllers, motor control centers, and similar equipment.

**\*Raceway** - An enclosed channel designed expressly for holding wires, cables, or bus bars, with additional functions as permitted in the National Electrical Code (NEC).

**Ring Ground (for earth electrodes)** - A buried conductor that forms a ring around a structure. The ring ground usually includes a series of driven ground rods bonded to the conductor.

**SBGL** Stranded Bay Ground Lead

**Separately Derived Source** - A power source that has no direct electrical connection, including a solidly connected grounded circuit conductor, to supply conductors originating in another system. This definition is similar to the NEC definition of *Separately Derived Systems*. Example: A standby ac reserve arranged so that the neutral is switched or power supplies with isolation between input and output such as most delta-wye transformers and some inverters and converters.

**Shall** – Use of the word “*shall*” in this Practice is a directive or mandatory requirement.

**Single Point Ground** - A method used to ground a circuit at only one physical point. It is important to note that “point” in this context actually refers to an area on a bus bar from which a common ground reference is obtained. It is a single point (area) for obtaining ground reference but there may be multiple conductors that terminate at this point for ground reference.

**Solidly Grounded** - A method of grounding either a power supply or a frame that uses a grounding conductor connection in which no additional impedance has been intentionally connected in series with the grounding path.

**UL** Underwriters Laboratories

**Vertical Riser (VR)** - This conductor, also called the Vertical Equalizer, extends ground reference from the OPGP to one or more Internet Services Office GRD bus bars on each floor of the structure. The portion of this conductor that is routed horizontally between the OPGP and the first connection to a Internet Services Office GRD bus bar is also called the vertical riser.

**Withstand Rating** - The maximum current an unprotected (no over current device) electrical component can sustain for a specified period of time without the occurrence of extensive damage.

Term Used in this Practice	Equivalent Terms
Battery Return (BR)	0 Volt Reference, -48 V Return, Battery Ground, DC Return, Power Return
Internet Services Office (ISO GRD)	Building Grounding System, Central Office Protection, COG
Internet Services Office Ground Bar	COG, COGB, FGW, Floor Ground Bar
Common Bonding Network (CBN)	Integrated Ground Plane, Integrated Ground System, Integrated Ground Zone
DC Equipment Grounding (DCEG) Conductor	Frame Ground Conductor, Framework Ground Conductor
Ground	Earth
Grounding Conductor	Earthing Conductor, Protective Conductor
Grounding Electrode System	Earthing Network
Ground Window	SPC Window
Isolated Bonding Network (IBN)	Isolated Ground Plane, Isolated Ground System, Isolated Ground Zone
Logic Ground	Logic Return, Signal Ground
Main Ground Bus (MGB)	Single Point Ground, Single Point Connection (SPC)
Office Principal Ground Point (OPGP)	Building Principal Ground, Facility Ground, Master Ground Bar, Main Earthing Terminal, OPGPB, PGP Bus, Principal Ground Point, Reference Point 0, Zero Potential Reference Point
Vertical Equalizer	IS POP/VHO Ground Riser, Equipment Ground Riser, Vertical Riser

**Table 1-1**  
**Cross Reference of Grounding and Bonding Terms**

**2. GROUNDING SYSTEM CONDUCTORS AND CONNECTIONS**

**2.1. General Requirements**

- 2.1.1 All equipment shall be bonded to the appropriate grounding network before any other conductors are connected.

- 2.1.2 All Common Bonding Network (CBN) grounding conductors shall be connected to the CBN side of the Main Ground Bus (MGB).
- 2.1.3 Except for hatch plate bonding conductors, vertical risers and horizontal equalizers described in this section, the direction of a grounding conductor's bend (e.g. towards a specific bus bar, etc.) is not restricted. The direction of the bend shall be made for ease of installation and to maintain an acceptable bending radius.
- 2.1.4 Grounding conductors larger than #1/0 AWG shall be spliced or joined with compression-type H-tap.
- 2.1.5 Compression-type butt splice (i.e., 180 degree) connectors shall not be used.
- 2.1.6 The free ends of insulated conductors shall be covered with heat shrink end caps.
- 2.1.7 H-tap compression connectors on grounding conductors shall be protected using fire-retardant hard-shell or soft-shell covers.
- 2.1.8 All newly installed grounding conductors covered by this practice and that requires insulation shall be green.. Conversion of existing insulation colors purely for the sake of uniformity is not warranted.

## **2.2. Horizontal and Vertical Equalizers**

- 2.2.1 All vertical and horizontal equalizer conductors shall be routed so that U shaped configurations are avoided.
- 2.2.2 Vertical and horizontal equalizers shall be run exposed so as to afford visual inspection of the entire system and to provide access for adding connectors.
- 2.2.3 Cable supports and sleeves provided for routing of horizontal and vertical equalizer conductors shall not be used for routing of any type of cable or conductor other than grounding conductors. Note: Horizontal equalizer conductors may be placed on the same cable brackets used to support other cables if secured to the opposite surface of the brackets.
- 2.2.4 Horizontal runs shall be supported along the exterior of cable rack stringers or from framing bars by means of clips or similar devices that do not form a closed metallic ring around the conductor. Short runs through walls shall be supported within 2" PVC plastic or other approved non-metallic conduit.
- 2.2.5 Vertical risers shall be run through floors in core-drilled holes or in 2" PVC plastic or other non-metallic conduit. If a cable hole is adjacent to the column supporting the vertical riser, the cable hole may be used in place of non-metallic conduit as long as a separation is maintained between the vertical riser and other conductors routed through the cable hole.
- 2.2.6 Vertical risers shall be secured to columns and walls using supports located approximately 2 feet from the floor, the ceiling, each side of any intervening bus bar, and at an interval of 2 feet (or less) between these points. The requirement (that applies to power cable) to provide a minimum of 20 feet of conductor supported on horizontal cable rack every third floor shall not be applied.

- 2.2.7 The vertical conductor may be supported by cable brackets or similar details fastened to Unistrut or other material that is anchored to a wall or column. An auxiliary support shall be provided on every other floor consisting of either wedge plugs in the top of sleeves or cable support grips suspended from J-bolts secured by anchors in the ceiling.
- 2.2.8 All cable connections to the vertical riser and horizontal equalizer shall be made with bends towards the COG/OPGP.

### **3. AC EQUIPMENT GROUNDING**

#### **3.1. Feeder and Branch Circuit Equipment Grounding System**

- 3.1.1 For enclosures that require terminations of an Alternating Current Equipment Grounding (ACEG) conductor, the conductor shall be connected to the enclosure by one of the means listed below:
- a) a ground bus bar
  - b) a terminal strip
  - c) a grounding bushing
  - d) a screw fastener
  - e) the enclosure is surface mounted and direct metal-to-metal contact exists between it and the receptacle's mounting yoke
  - f) the receptacle is cover-mounted and the enclosure and cover combination are listed as providing satisfactory ground continuity between the enclosure and the receptacle

Note 1: A screw fastener (machine screw, nut, bolt, stud, etc.) shall be used for no other purpose than to terminate ACEG conductors.

- 3.1.2 For enclosures that do not require terminations (pull boxes, T's, etc.) and when ground continuity is maintained via the conduit and bonding type bushings and lock nuts, termination of the ACEG conductor shall not be required.

#### **3.2. Extending ACEG Conductors**

- 3.2.1 Since AC distribution systems are of different ages, it is likely that a system not originally equipped with a separate ACEG conductor will be encountered. It is often not feasible to place an ACEG conductor in the existing upstream feeder conduit or raceway. However, the conduit or raceway may be able to serve as the ACEG conductor. The point from which an ACEG conductor is extended will usually be an enclosure such as a:
- a) Distribution panel
  - b) Pull box
  - c) Junction box
  - d) Receptacle box
  - e) Lighting fixture.

- 3.2.2 Before any ac distribution system is extended or rearranged from a point in a distribution system not equipped with a separate ACEG conductor, the integrity of the ACEG system upstream from the enclosure shall be verified. This is done by determining whether an acceptable type of conduit or raceway has been used and by verifying the tightness of the fitting(s) used to fasten the conduit or raceway to the enclosure.
- 3.2.3 For existing distribution systems not equipped with a separate ACEG conductor, only the following types of conduit or raceway shall serve as an ACEG conductor:
- a) Electrical metallic tubing (EMT)
  - b) Intermediate metal conduit (IMC)
  - c) Rigid metal conduit
  - d) Metal raceways listed for grounding.
- Note: If none of the above is present in the upstream feed to the enclosure, no circuit shall be extended from the enclosure until corrective action has been performed.
- 3.2.4 The ACEG conductors being added shall be terminated to the enclosure by one of the means described above.
- 3.2.5 If more than two ACEG conductors are being added (typically at a distribution panel), it is preferable to add a ground bus to the panel. This bus may be bonded to the panel using its mounting screws provided the paint is removed from the mounting surface of the panel and NO-OX-ID "A" anti-corrosive compound is applied to the bare metal.

#### **4. COMMUNICATION SYSTEMS & MISCELLANEOUS EQUIPMENT**

##### **4.1. Frames, Bays, Cabinets and Units**

- 4.1.1 All frames, bays, cabinets and units shall be properly grounded.
- 4.1.2 When a unit in a frame, cabinet or other enclosure requires a separate grounding conductor from the unit, the grounding conductor shall be extended from the unit to one or more of the following:
- a) A crimp type parallel tap to a grounding conductor of equivalent or larger size within the enclosure
  - b) The same point of connection on the enclosure metalwork as the framework grounding conductor if of equivalent or larger size
  - c) A grounding terminal (i.e. wire-wrap) within the frame or cabinet
  - d) A crimp type parallel tap to a grounding conductor of equivalent or larger size outside the enclosure.
- 4.1.3 The 1" galvanized pipe often used as a means of support between the framework and the auxiliary framing may be used as the lineup grounding conductor for the extension of existing applications only. This method is not allowed for new lineups.

- 4.1.4 The external chassis ground, if provided on a unit, shall be utilized to ground the unit, except where AT&T standard drawing indicates that the chassis ground connection is not required. If the AT&T standard drawing indicates that a chassis ground is not required, a copy of the drawing shall be left in the job folder.
- 4.1.5 Frame extensions shall be bonded to the existing frame via the threaded nut and bolt assemblies connecting the two sections. When frame extensions are provisioned with a #6AWG bond, this bond shall also be used.
- 4.1.6 BDFBs are used to distribute one or more dc voltages to network equipment. The battery return bus bars on early BDFBs were in electrical contact with the framework of the BDFB. All new BDFBs should have the bus bar insulated from the framework.
- 4.1.7 The DCEG conductor for BDFBs shall be a minimum #1/0 AWG conductor, and shall be connected directly to a IS POP/VHO GRD bus bar or tapped to a horizontal equalizer of equal or greater size.
- 4.1.8 When a #1/0 AWG conductor is added between the BDFB framework and a IS POP/VHO GRD bus bar, it may serve other BDFBs as well as other equipment lineups. If more than one BDFB is in a lineup, a single #1/0 AWG conductor may serve every BDFB in the lineup. Where applicable, this conductor may also serve in place of the #6 AWG lineup grounding conductor.
- 4.1.9 Equipment aisles shall be grounded with a minimum #2 AWG aisle ground conductor connected to the horizontal equalizer serving only one side of an aisle and with a maximum footage of 50 feet from the horizontal equalizer. Refer to TP76403 table 3-4 for distances greater than 50 feet.

## **5. INTERIOR RING GROUND SYSTEM**

### **5.1. Peripheral Conductor**

- 5.1.1 The peripheral conductor (also referred to as the "interior ring" or "halo ground") need not be installed as a single continuous conductor. Unnecessary splices shall be avoided, but when installation is simplified by installing the peripheral conductor in segments, and segments are joined by an exothermic weld (preferred) or crimp type parallel connector, such segmentation is permitted.
- 5.1.2 Routing of the peripheral conductor through metallic objects that form a ring around the conductor, such as metallic conduits or sleeves through walls or floors, shall be avoided whenever possible. Non-metallic material such as PVC conduit is preferred for floor or wall penetrations. If non-metallic conduit is prohibited by local code, the peripheral conductor shall be bonded to each end of the metallic conduit.
- 5.1.3 To minimize impedance and incident of arcing, the peripheral conductor shall be installed with a minimum number of bends. Bends shall be made with the greatest practical radius, with a preferred radius of no less than 1 foot. When this is impractical, the minimum radius shall not be less than 6 inches. Use of 90-degree bends to avoid obstructions shall be avoided when lesser bends (e.g., 45 degrees) can be adequately supported.

- 5.1.4 The peripheral conductor shall be run exposed to allow inspection of the system and connection of branch conductors. PVC conduit shall not be used for support.
- 5.1.5 The peripheral conductor shall be located at a height from the floor that allows for convenient bonding of supplementary conductors. For 9'-0" frames, the recommended height is 9'-8".
- 5.1.6 Supports shall be provided at an interval of between 12 and 18 inches. Extra supports may be provided where the peripheral conductor may be distorted, such as at bonding points. When the peripheral conductor is not located on a wall, it shall be supported from cable racks or auxiliary framing channels.
- 5.1.7 Supplementary conductors may be supported from cable rack stringers or framing channels using 9-ply waxed polyester twine, cable ties, clamps or clips. If clamp or clip supports are used, a type that does not require drilling of channels and stringers is preferred. All supports shall be placed at an interval of 12 to 18 inches. Removal of paint from the channel or stringer is not required when clamps or clips are used. Scratches in the finish shall not be painted, and clamps or clips shall not be painted. A job-fashioned detail may be used to route the conductor around obstructions at cable rack junctions or other points interfering with the conductor.
- 5.1.8 To minimize impedance, special attention shall be paid to the direction of turns at all junctions of supplementary and peripheral conductors. At the junction nearest a hatch plate, the supplementary conductor shall turn in the direction of the hatch plate. The other end of the conductor shall turn in the opposite direction, toward a bond between the exterior ring ground and the peripheral conductor more remote from the hatch plate than the connection of the supplementary conductor.
- 5.1.9 When there is no significant difference in the length of the bond paths to a hatch plate from either end of a supplementary conductor, both ends shall turn in the direction of the hatch plate. When the building is equipped with more than one equipped hatch plate, the end of the supplementary conductor shall turn in the direction of the nearest hatch plate.
- 5.1.10 If one or more hatch plates are not equipped with waveguides, the supplementary conductor shall turn in the direction of the nearest equipped hatch plate. When coax or waveguide is added to the unequipped hatch plate, a second bond shall be made at the turn, in the opposite direction, to create a bi-directional turn. Note: Where doubt exists as to the correct direction for a turn, a bi-directional arrangement may be used. Universal application of bi-directional bonds is not recommended.

**5.2. Unit Bonds**

- 5.2.1 Grounding conductors routed along interior walls and units located next to such walls may be in proximity to other conductors or units mounted on the other side of the wall. When the peripheral or supplementary conductors that run on either side of a wall are bonded together at both ends, intermediate bonds may be omitted. Bonds to conductors on both sides of a wall shall be made to objects such as conduits or pipes that penetrate the wall.
- 5.2.2 Bends shall be made with the greatest practical radius. The bend radius shall not be less than 1 foot.

5.2.3 Where unit bond conductors join peripheral or supplementary conductors, they shall turn in the direction of the nearest hatch plate. A single conductor connecting two units to a peripheral or supplementary conductor may be used without regard to the direction of turns.

**6. POWER PLANT GROUNDING**

**6.1. Frames, Cabinets and other Components**

6.1.1 All frames, cabinets and other components of a power plant shall be equipped with a minimum #6 AWG to the CO GRD System. This includes frames in a power board line up, rectifier bays, metal battery stands, etc.

**6.2. Grounding Conductor**

6.2.1 The power plant line up conductor shall be sized to accommodate the maximum expected primary distribution. For 600A distribution, the power plant line up conductor shall be a #1/0 AWG minimum and shall be connected to the nearest:

- a) DC System Grounding Conductor
- b) MGB (when MGB is part of the power plant battery return)
- c) Horizontal Equalizer of equal or greater size
- d) CO GRD or OPGP bus bar.

DCEG conductors for power plant frames, cabinets and other equipment shall be branched from a power plant lineup conductor. A typical power area grounding arrangement is shown in Figure H-1.

6.2.2 The DC system Grounding Conductor extends from the battery return bus bar to the CO GRD (or OPGP) for all power plants except shared power plants with a remote MGB. This shall be a 750 kcmil conductor.

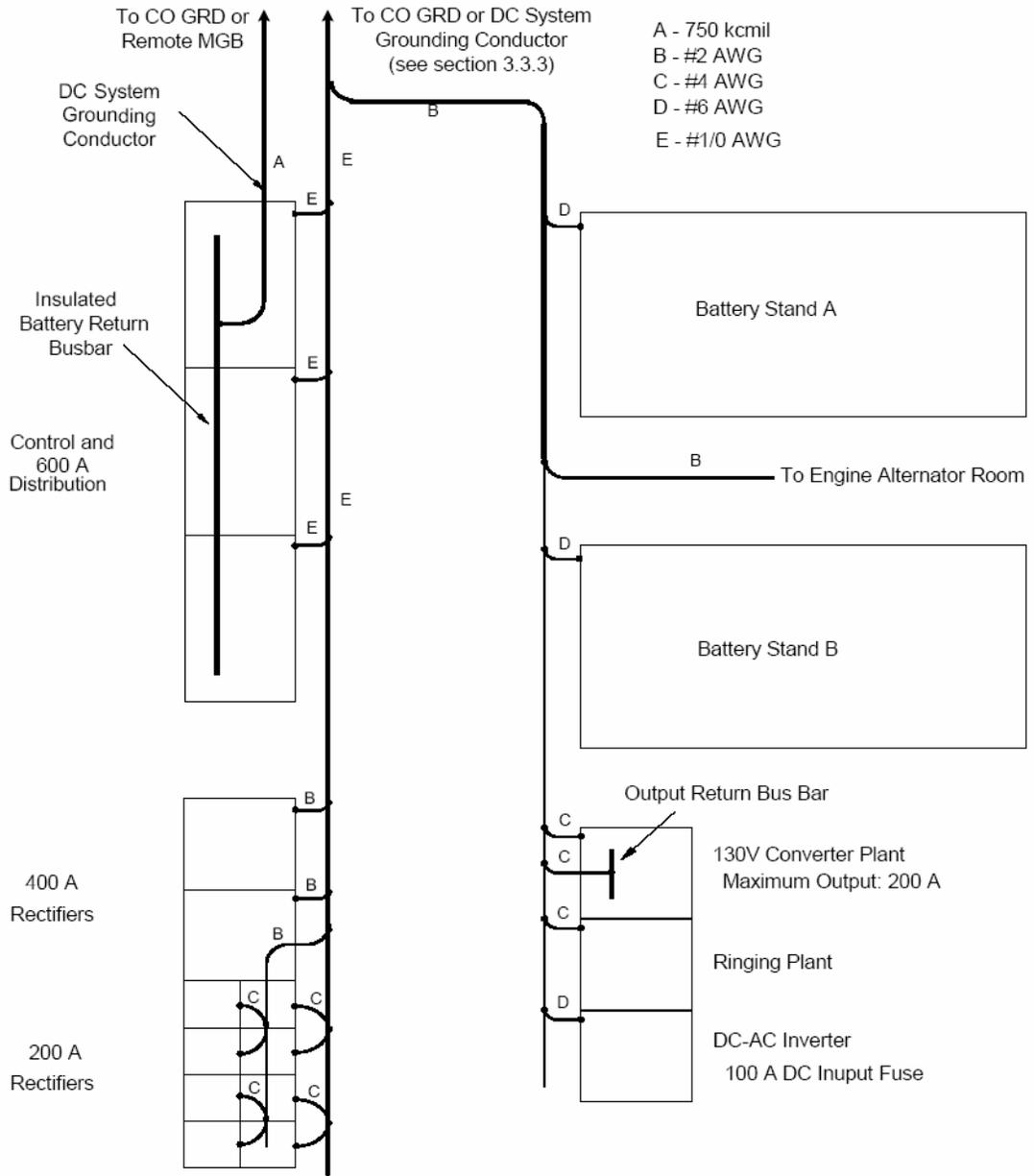
6.2.3 For any equipment frame, cabinet or other enclosure containing rectifiers, the minimum size for a DCEG conductor shall be #6 AWG. Table H-4 below shall be used to determine the size of the framework ground conductor based on the size of the output rating of the largest rectifier in the framework. The current limiting or over-current protection feature of rectifiers may not activate until 110% of the rated current output is reached. For example, a 400-ampere rectifier may not shut down until reaching 440 amperes. The conductor size in Table H-4 is based on Table 250-122 from the NEC.

Table H-4

Rectifier/Inverter Output Rating (Amperes)	Rectifier/Inverter Current Limit (Amperes)	DCEG Conductor Size:
Up to 100	Up to 110	6 AWG
200	220	4 AWG
400	440	2 AWG

- 6.2.4 The DCEG conductor for any DC-to-AC inverter shall be a minimum #6 AWG:
- a) Table H-4 shall be used to determine the minimum size for the DCEG conductor based on the rating or setting of the DC input circuit's over current protective device. This requirement applies to all stand-alone inverters and to all bay-mounted inverters. This DCEG conductor is required in addition to the ACEG conductor for the AC input and/or output circuits.
  - b) If the inverter is the source of a separately derived system, this conductor shall be required in addition to the Grounding Electrode Conductor.
- 6.2.5 Power Plants shall be grounded per Figure H-1

**Figure H-1 Typical Power Plant Grounding Arrangement**



**[END OF SECTION]**

**SECTION I -- IRONWORK**

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**TABLE I-1 – SUMMARY OF CHANGES IN SECTION I**

Change	Item in 09/08 Issue	Item in this Issue
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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&TIS 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 general requirements for the location, assembly and erection of cable and relay racks.

- 1.1.4 Changes in this issue of Section I are summarized in Table I-1.
- 1.1.5 This section delineates workmanship requirements. The following Bell Service Practices provide additional assembly details:
- |                   |   |
|-------------------|---|
| ATT-TP-76201      | Hardware Products and Materials Specifications                                  |
| BSP 800-000-101MP | Anchoring Requirements  |
| BSP 800-000-102MP | Equipment Framework Design Requirements   |
| ATT-TP-76305      | Cable and Wire Installation and Removal Requirements - Cable Racks and Raceways |
| ATT-TP-76408      | Auxiliary Framing and Bracing Requirements                                      |
| ATT-TP-76409      | Network Facility - Cable Rack Requirements                                      |
| BSP 800-006-152MP | Floor Stanchion Supported Cable Rack System Requirements                        |
| BSP 800-068-150MP | Equipment Framework Support Requirements  |
| BSP-800-068-151MP | Storage Unit Bracing Requirements   |

## **2. REQUIREMENTS**

### **2.1. General**

- 2.1.1 All ironwork installation described in this section shall conform to AT&T seismic requirements. Except when noted otherwise, the requirements stated herein apply to all seismic risk zones.
- 2.1.2 Cut ends of auxiliary framing, cable racks, bolts, etc., shall have sharp or jagged edges removed.
- 2.1.3 Cut ends and damaged painted surfaces shall be repainted.

### **2.2. Auxiliary Framing**

- 2.2.1 Auxiliary framing shall be uniform in length, at the correct height, properly located and level.
- 2.2.2 Clip type or through bolt splices can be utilized only in low seismic areas, If clip type splices are utilized they shall be:
- staggered at alternate runs between supports, horizontally and vertically
  - Limited to one splice between supports.
- 2.2.3 Where the ends of low level auxiliary framing (first level above the frame work) extends beyond a support, the ends shall be equipped with a rubber finishing cap.
- 2.2.4 When short sections of auxiliary framing are used below the regular framing, rubber finishing caps shall be installed on the exposed ends.
- 2.2.5 Superstructure bracing shall be installed within the 30/60 degree slope maximum.
- 2.2.6 There shall be a minimum 5 inch clearance between the ends of auxiliary framing and any building surface or apparatus (e.g., HVAC ducting). Any building surface or apparatus shall be installed with a minimum 5-inch clearance to the auxiliary framing.
- 2.2.7 Auxiliary framing shall be supported at intervals not to exceed 6 feet and shall not extend more than 30 inches beyond the last support. The support shall be:
- From the ceiling using 5/8 inch threaded rods or

- b) From the floor using 2 inch pipe stanchions or
  - c) Wall supports using batten boards or
  - d) Other approved methods.
- 2.2.8 Pipe stanchion floor flange shall be fastened to the floor with a minimum of two 1/4-20 flat head machine screws and associated floor anchors.
- 2.2.9 Auxiliary framing heights shall be measured from the floor to the bottom of the paired channels.
- 2.2.10 Auxiliary framing shall be installed in 20-foot lengths whenever possible. Auxiliary framing channels shall be run in pairs of equal length with flat side facing outward
- 2.2.11 When through bolt splicing is utilized for auxiliary framing channels, six feet and longer in length, they shall be drilled or punched with splicing holes at both ends before the auxiliary framing is installed into overhead environments.
- 2.2.12 Holes in auxiliary framing for splice purposes may be enlarged or elongated if, after drilling or punching, the holes do not line up with the splice. When the holes have been enlarged or elongated, flat washers shall be installed on splice bolts. The separation between the ends of spliced auxiliary framing shall not exceed 1/4 inch.
- 2.2.13 When a square tube floor stanchion system is used, it shall be installed in accordance with instructions given in BSP 800-006-152MP.
- 2.2.14 Auxiliary framing splices shall not be made past the last hanger support.
- 2.2.15 Spliced lengths of auxiliary framing channels that are connected by a positive through-bolted type of splice, as shown in TP76408, Figure 3, High Seismic Risk Areas, would be considered a continuous run of auxiliary framing and can be installed and designed to requirements of a continuous run.
- 2.3. High Seismic Risk Zone Requirements**
- 2.3.1 Splices shall be the positive (through bolt) type.
- 2.3.2 The end of the auxiliary framing shall extend at least 3 inches beyond the last point of support. If the distance from the end of the auxiliary framing to the last point of support (e.g. hanger rod, brace or cable rack attachment, etc.) is less than 3 inches, a 3/8"-16 or larger bolt shall be installed through the ends of the auxiliary framing.
- 2.3.3 Stiffening clips shall be installed on no more than 2-foot centers between auxiliary framing supports. Stiffening clips may be omitted at locations where an earthquake brace, cable rack, or other clipped fastening, of 1/2 inch or larger, has been located.
- 2.3.4 Cable racks supported directly by auxiliary framing shall be attached with two J-bolts at each support.
- 2.3.5 Auxiliary framing supported conduit shall not be extended to wall-mounted switches, lights, outlets, etc. Approved flexible conduit, i.e. JMC, or cable shall be utilized for this application.

**2.4. Cable Racks**

- 2.4.1 Where cable racks are directly attached to auxiliary framing, both stringers shall be bolted to the framing at each end of a run:
- a) At intermediate points, only one J-bolt shall be required at each auxiliary framing intersection. (Low Seismic Risk Locations)
  - b) The J-bolts shall be staggered so that adjacent fastenings along the rack can be made on opposite sides of the rack. (Low Seismic Risk Locations)
  - c) When short pairs of auxiliary framing are used to support cable rack extending beyond regular framing, or are used for the support of a frame, two J-bolts shall be used.
- 2.4.2 Space between ends of cable rack stringer shall not exceed 5/8 inch at splices.
- 2.4.3 Except for transitions between levels, only one cable rack splice is permitted between any pair of supports and spliced sections are not permitted to extend beyond the last support.
- 2.4.4 Cable rack should be supported at 5 foot intervals and shall not exceed 6 feet.
- 2.4.5 Cable rack shall not extend more than 30 inches beyond the last support.
- 2.4.6 There shall be a minimum 5-inch clearance between the ends of the cable rack and any building obstruction.
- 2.4.7 Formed fiber tubing shall be placed on all hanger rods directly supporting cable rack. The tubes shall be long enough to adequately protect the cabling to the ultimate height of the cable build up.
- 2.4.8 Metallic cable rack pan shall be installed using the following guidelines:
- a) All junctions shall be overlapped a minimum of 3 inches. The bottom section of "pan" shall not extend more than three inches past the common cross member.
  - b) Pans shall not extend past the end of the cable rack stringer or closing detail.
  - c) An overlapping arrangement of pans shall be utilized to avoid cutting of pans. The ends of pans that must be cut in the field shall be equipped with edge protection and have a 1/4" radius at their corners (refer to Part 8 and Fig. 22 of ATT-TP-76409).
  - d) Cable retaining horns on "panned" cable rack shall be installed on both sides of the cable rack on 18-inch centers, except at cable rack intersections where they shall be omitted/removed.
  - e) Pans on inclined cable racks are not permitted.
  - f) Installed cable rack horns that are not the straight formed wire design shall not be reused.
  - g) Horns installed on runs of cable rack shall have a common design, except that, straight formed wire horns may be used when extending existing racks that are equipped with a different horn design
  - h) Non-metallic cable pans the and shall be manufactured of a fire resistant material with obvious marking that will be visible from the underside of the cable rack identifying the pan as conforming to UL Standard 94 V-0 or V-1 rating.
- 2.4.9 Cable rack shall not be extended through a floor.

- 2.4.10 Distance between cable rack straps shall not exceed 9 inches. Additional support shall be provided as necessary to keep the cable from sagging.
- 2.4.11 The ends of cable rack sections shall be protected with rubber finishing caps or closing details.
- 2.4.12 Cable racks shall not be supported by their cross straps.
- 2.4.13 Vertical racks on walls or columns shall be supported at the floor and shall have intermediate support with a maximum spacing not to exceed 5 feet.
- 2.4.14 Cable racks placed on floors shall be fastened with Z-clips on the inside of the rack stringers, at intervals not to exceed 5 feet.
- 2.4.15 For horizontal cable runs, the cable rack shall be placed with the cross-straps upward. A cable rack with solid bar-type stringers, smaller than 25 inches in width, may be inverted to gain necessary cabling heights due to fixed obstructions. Cable rack with reinforced straps shall not be inverted.
- 2.4.16 The flat bar of a cable rack turn assembly shall be secured by simple stitching to the cable rack.
- 2.4.17 Cable rack shall be constructed of solid rectangular stringers only for switchboard, fiber optic, and primary power cable runs. No further application of bar-type, hollow or C-Channel stringer cable racks shall be installed.

## **2.5. Conduits**

- 2.5.1 Conduit shall be supported with material designed for the support of conduit, such as U-bolts, conduit clamps, conduit straps, etc. Hose clamps, cord, tie wraps, beam clamps (unless supporting it directly to a beam), and other similar material shall not be used to support conduit.
- 2.5.2 AC conduit troughs shall be mounted and secured per the NEC and local municipality requirements.
- 2.5.3 Rigid metallic conduit (RMC), intermediate metal conduit (IMC), EMT or JMC shall be utilized for all AC circuits.
- 2.5.4 PVC type conduit shall not be used as an AC raceway.
- 2.5.5 Rigid conduit and Electrical Metallic Tubing (EMT) shall be secured on a wall or ceiling a minimum of every 10 feet and shall be supported within 3 feet of each outlet box, junction box, or cabinet. An outlet junction box or cabinet that is secured is considered a support. The use of EMT is permitted in applications where the EMT will not be subject to physical damage.
- 2.5.6 Liquidtight flexible metal (LFMC) conduit shall be secured and fastened to a support within 12 inches on each side of each outlet box, junction box, cabinet or fitting. No support is required when liquidtight flexible metal conduit is installed inside the base angle of frameworks. Three feet of unsupported liquidtight flexible metal conduit from a fitting is acceptable when flexibility of the equipment is necessary or (6 feet is allowable) when the liquidtight flexible metal

conduit serves lighting fixtures. (6'-0" of unsupported LFMC is acceptable for luminare connectivity NEC 350-30A Exc.# 3) Cord/tie wrap may be used to hold liquidtight metal conduit in place within a frame (not for support).

- 2.5.7 JMC flexible metal conduit shall not be used as a main fixed raceway for power conductors, except under raised floors, or for interconnection (not to exceed 3') of raceway.
- 2.5.8 Conduit serving a junction box shall be supported as follows:
  - a) A junction box with threaded entries/hubs, that do not contain a device and do not support fixtures, shall have the conduit supported within 36 inches of the box on two or more sides.
  - b) A junction box with threaded entries/hubs, containing a device or fixture, shall have the conduit , all conduits shall be supported within 18 inches of the box on two or more sides.
  - c) A junction box with knock outs, that do or do not contain a device or fixture, shall have the conduit supported within 36 inches of the box on two or more sides.
- 2.5.9 A junction box with knock outs shall be secured to insure support.
- 2.5.10 A junction box with only one conduit entry shall be secured.
- 2.5.11 Conduits secured to ironwork shall be securely fastened at intervals not to exceed 6 feet. Conduit shall not extend more than 30 inches beyond the last support.
- 2.5.12 Unused knockouts in boxes and cabinets and all un-terminated conduit ends and junction box covers shall be closed.
- 2.5.13 Conduit shall be placed so as not to block future cabling, ladders and equipment. Conduit placed under floor in raised floor environment shall be supported off building floor as high as possible to avoid blocking other cables.
- 2.5.14 Proper clearance from pipes, duct work or heat generating equipment will be maintained to eliminate possible damage to cable.
- 2.5.15 Insulated couplings shall not be installed in AC conduit or raceways.
- 2.5.16 Conduit fittings shall be tight.
- 2.5.17 Steel compression type fittings shall be used in high seismic risk areas (zones 3 & 4) on EMT conduit. Steel compression or steel set screw type fittings shall be used in low seismic risk areas (zones 0, 1 & 2) on EMT conduit.
- 2.5.18 All fluorescent type lighting fixtures over equipment areas shall be rigidly attached and shall not be supported with chains.

**2.6. Frames, Bays, Battery Stands and Equipment Cabinets**

- 2.6.1 All frames taller than 7'-0" shall be top supported by attachment to the office superstructure. Top supports shall be provided along equipment lineups at each location where a primary run of office superstructure crosses the equipment lineup. A minimum of two top supports is required for each group of frames that do not span two runs of primary office superstructure.

A frame group, or group of frames is defined as any number of individual frames that are rigidly bolted or otherwise junctioned together to form a structurally continuous unit of frames.

- 2.6.2 Frames 9'-0" and taller use a one-inch galvanized pipe to supplement adjacent frame junctioning requirements and for alignment and grounding purposes. One-inch pipes shall be clamped to the underside of each frame's top angle at two locations. The V bolts shall be located to the left and right of frame center a minimum 12 inches apart. Any attachments to overhead framing shall be in addition to the pipe supports. One-inch galvanized pipes will be furnished in 20-foot lengths whenever possible. Extra length not used for current fastening of frames shall be left for future frames. A minimum of 15 inches of pipe shall always extend beyond the last frame installed for future growth unless that last frame is at the end of the lineup. The unused length of pipe shall be fastened to the auxiliary framing with frame support hardware above future frames. Where the pipe extends beyond the end of an existing or planned group of frames, it shall be fastened to the auxiliary framing with U bolts. The junction of the pipes shall be bonded in accordance with Section H of ATT-TP-76301.
- 2.6.3 When the 1 inch galvanized junction pipe extends beyond the end of the frame, the end of the pipe shall be capped with a rubber finishing cap.
- 2.6.4 A frame taller than 7'-0" installed as an individual frame, i.e. not junctioned to any adjacent frames, or installed with spacers on both sides, shall have at least two points of support to the overhead superstructure.
- 2.6.5 AT&T policy is for deployment of any new equipment to be high seismic freestanding frames designed for Zone 4 service, 7 feet tall, and shall be secured with 4 floor anchors to the building floor. Use appropriate style of anchors for zone requirements of the site. All frames in a common lineup are to be junctioned to each adjacent frame.
- 2.6.6 7 foot frames, bays or cabinets shall not be top supported except when adding to an existing 7 foot line-up that is top supported. Lineups of equipment frames where cable racks are supported by the top of the equipment frames may continue to have existing and future frames installed to support the cable rack. Frames that are top supported shall be secured to the building floor with 2 anchors along the center line of the frame uprights.
- a) In lineups where 7'-0" or 9'-0" frames are the primary or only support for overhead cable rack, the equipment frame shall be secured to building floor with four anchors and junctioned to adjacent frames in accordance to paragraph 2.6.2. Cable rack shall not be considered a top support and cannot be relied upon to provide structural support of equipment frames.
- 2.6.7 7 Foot, Low seismic frames or frames installed that can not meet the high seismic framing requirements in BSP 800-000-101MP shall be secured with a minimum of 2 floor anchors in conjunction with top support. When this securing method is utilized all frames installed as individual frame i.e. not junctioned to another frame, or installed with spacers shall have at least 2 top supports to the overhead superstructure.
- 2.6.8 Unequal flange and network bay equipment frames taller than 7'-0" are secured by bracing to overhead auxiliary framing and floor anchored. Two floor anchors shall be placed as close as possible along centerline of uprights.

- 2.6.9 The uprights of adjacent frames and cabinets shall be joined together per manufacturer's specifications and at the top and bottom to form a continuous lineup.
- 2.6.10 All frames, bays and cabinets to be installed shall be measured from reference points as identified on the floor plan.
- 2.6.11 Frames and cabinets shall be plumb and aligned to adjacent frames and cabinets to within 1/4 inch.
- 2.6.12 Frames and cabinets shall be level within 1/16 inch per foot. If shims are required, there shall be no more than a 1-inch shim stack.
- 2.6.13 If more than 50 holes in the floor are to be drilled for the job, the Installation Supplier shall scan for embedded metallic obstructions before drilling.
- 2.6.14 If an embedded obstruction (e.g., reinforcing bar) is encountered during floor drilling, drill another hole at an alternate location. If relocating the hole is not possible, contact the AT&TIS Equipment Engineer.
- 2.6.15 Frames, bays, cabinets, etc. shall be bolted to the floor using AT&T approved floor anchors.
- 2.6.16 When attaching frames, bays, cabinets, etc. to raised floor refer to ATT-TP-76402.
- 2.6.17 End guards shall be secured in the front and rear and at the top and bottom and at the intermediate locations provided by the manufacturer.
- 2.6.18 End panels or end shields shall be installed on all frame uprights not adjacent to another frame or a building obstruction.
- 2.6.19 End guards, end panels or end shields that do not match the same depth or overall foot print of the adjacent bay framework shall require a transition device (guard rail closing detail). This transition device shall be required either on the front, rear or both sides of the end guard, end panel or end shield, whichever is appropriate.
- 2.6.20 When the depths of frames are different, transition devices shall be used from one frame to the next.
- 2.6.21 End guards, end panels and end shields shall be the same height as the frames they are installed on.
- 2.6.22 When spacers, (i.e. spacer junction, frame extender, cable spacer, spacer box) are required between equipment frames, the space between frames shall include a base filler matching the guard box details of adjoining equipment frames and a full height filler panel covering the space between frame uprights (unless an AT&T standard drawing indicates that a filler panel is not required for a specific project). The base filler shall be secured to the building floor with similar floor anchor hardware as used for equipment frame installation. The filler panel shall be secured to the equipment frame uprights with junction plates and mounting hardware at intervals no greater than 3 feet increments. Filler panel(s) and base filler(s) shall be finished to match color of added equipment frame(s).

- 2.6.23 Hinged doors or covers of cabinets shall not bind with adjacent covers or doors to such an extent that any cover or door cannot be readily opened without causing the adjacent cover or door to move. In addition, hinged doors shall not come in contact with any working equipment.
- 2.6.24 Where equipment frames/cabinets shall not be side junctioned, a space of 5 inches minimum shall be provided between frames/cabinets. Frame/cabinets placed near building walls, columns or other structural members shall have a 5 inch space between the frame/cabinet and the building member.
- 2.6.25 When equipment frames or cabinets are associated with hot slides, they shall be bolted to the floor in the temporary location.
- 2.6.26 All equipment shelves mounted in frames, cabinets, or bays shall have a minimum of four screws used to secure the unit to the frame/cabinet/bay upright for shelves up to 50 pounds. A minimum of two additional screws for each 100 pounds or fraction thereof above the first 50 pounds shall be installed beyond the four screws. Exception: Single mounting space plate units may be mounted with two screws.
- 2.6.27 Battery stands, shall be secured with Hilti 16mm HSL anchors for high seismic risk locations or Hilti HDI ½ anchors for low seismic risk locations in accordance to quantities specified by the equipment manufacturer. Hilti 12mm HSL anchors in high seismic risk locations may be necessary under special circumstances with approval of Seismic Protection Engineer. For more information, refer to Section M of ATT-TP-76300.
- 2.6.28 BDFBs, DC power distribution bays, rectifiers, and other network power equipment bays shall be anchored with a minimum of 4 Hilti 12mm HSL size anchor.
- 2.6.29 Distributing frame blocks shall be installed with 4 mounting bolts when the holes on the distributing frame are available.
- 2.6.30 Equipment frames, BDFB's and any other network equipment frames installed on a raised access floor system shall be secured down to the building floor with threaded rods to floor anchors in high seismic locations or equipment frames may be clamped to underside of stringers in areas established for that method of securing in low seismic risk locations. New sites to be established should have stronger raised access floors installed permitting through bolting frames to floor panel.
- 2.7. Threaded Rods, Bolts, Nuts, Screws And Cotter Pins**
- 2.7.1 Bolts, nuts and screws used to secure parts or units shall be tight.
- 2.7.2 The appropriate size bolt or rod shall be utilized.
- 2.7.3 The Installation Supplier shall cut the end of a bolt or rod that extends into the equipment or wiring area, or presents a personnel hazard.

- 2.7.4 The exposed end of the bolt or rod shall not exceed the diameter of the bolt or rod, except where personnel safety or equipment protection will not be compromised.
- 2.7.5 Bolts, screws or rods shall not be more than one thread under flush.
- 2.7.6 Both ends of bolts, screws or threaded rods shall be free of sharp edges and burrs.
- 2.7.7 The tips of all cotter pins shall be bent back until resting against the rod or bolt to prevent injury.
- 2.7.8 Self-locking nuts that have been loosened or removed shall not be reused.
- 2.7.9 Split nuts shall not be used in any auxiliary framing or cable rack support applications.
- 2.7.10 Any threaded rods that are cut shall have cut end(s) covered with grey enamel paint so there would be no bare steel surface exposed.

**2.8. Unistrut Incorporated Within Auxiliary Framing**

- 2.8.1 Where unistrut extends more than three inches beyond a clip or support, the unistrut shall be equipped with a finishing detail.
- 2.8.2 When additional unistrut is placed below the regular framing, the ends shall be equipped with finishing details.
- 2.8.3 There shall be a minimum 5-inch clearance between the ends of the unistrut and any building obstruction.
- 2.8.4 Unistrut sections shall have at least 2 supports unless otherwise specified. The supports shall be at intervals not to exceed 6 feet and shall not extend more than 30 inches beyond the last support.

**2.9. Ceiling Hanger Rods**

- 2.9.1 Hanger rods shall be inserted into ceiling inserts seven full turns .
- 2.9.2 If ceiling inserts are rusty or filled with concrete, the inserts shall be cleaned out with a 5/8"-11 tap.
- 2.9.3 A 5/8"-11 hex nut and a 1-3/4 inch outside diameter washer shall be used at the ceiling on all hanger rods and bolts, regardless of ceiling construction.
- 2.9.4 When hanger rods are installed through ventilating ducts additional 1-3/4 inch washers and 5/8"-11 hex nuts shall be installed at the top and the bottom of the duct. Add sealing compound to seal any air leakage.
- 2.9.5 Under no circumstances shall more than one splice be installed on a hanger rod. In no case shall threaded rods used for the support of mezzanine platforms be spliced.
- 2.9.6 Ceiling hangers shall be installed vertically plumb to within 2 degrees and hanger rod straight to within 1.5 inches over 5 feet run.
- 2.9.7 Hanger rods shall be installed in a single piece to full length whenever possible. Where splice is necessary only one splice is permitted in a hanger run.

- 2.9.8 Hanger rods anchored to surface mounted or embedded Unistrut channels shall be secured to inside channel Unistrut nut threaded at minimum to 7 full turns and hanger rod locked in place with an additional nut and washer on outside of Unistrut channel.

**[END OF SECTION]**

**SECTION J -- CABLING**

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**TABLE J-1 – SUMMARY OF CHANGES IN SECTION J**

Change	Item in 09/08 Issue	Item in this Issue
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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&TIS 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 provides general and workmanship requirements pertaining to cable installation.
- 1.1.4 Changes in this issue of Section J are summarized in Table J-1.
- 1.1.5 Refer to the respective sections of ATT-TP-76301 for additional requirements for power cable (Section M), CO grounding cable (Section H) and fiber optic cable (Section O).

**1.2. General Requirements**

- 1.2.1 Standing on or applying excessive stress/pressure to cable on racks or equipment is not acceptable when installing, removing or securing cable and wire. Walking on top of installed cables shall be avoided.
- 1.2.2 Refer to Section F of ATT-TP-76301 for instructions on fire and smoke stoppage, which shall be applied when cables are installed through any penetration.
- 1.2.3 Refer to Section O of ATT-TP-76301 for instructions on fiber optic cable.
- 1.2.4 For cabling and panning purposes, vertical cable rack is defined as any cable racking that is not horizontal.

**1.3. General Cable Routing**

- 1.3.1 No deviations shall be made from the job cable routing specifications without the approval of the AT&TIS Equipment Engineer.
- 1.3.2 Storing excess cable on or in cable racks, compartments or ducts shall be avoided, except for the following reasons:
  - a) When the excess cable is five feet or less.
  - b) When the excess cable is required for proper equipment operation the excess cable shall be distributed on or in cable racks, compartments or ducts so the pile-up is not concentrated at a single location.
  - c) When the excess cable is associated with equipment located in temporary locations and the excess cable will be used when the equipment is moved to its ultimate location, the excess cable shall be coiled banded, identified and secured to the cable rack above the equipment frame. This type of stored cable shall be repositioned on subsequent cabling operations to avoid burial.

- d) When cable is equipped with apparatus that cannot be disconnected and reterminated in the field.
  - e) When storing all cable designated "Future" on the cable racks. Provide adequate length for ultimate termination.
- 1.3.3 Cables 100 feet or less and connectorized on both ends by the factory shall not be longer than 10 percent over the measured length for the route of the installed cable. The maximum additional length shall be 10 feet.
- 1.3.4 For formed or connectorized cable, the Installation Supplier shall install the connectorized or formed end of the cable first; then trim excess cable to the measured length for the route of the installed cable.
- 1.3.5 For bulk cable, the Installation Supplier shall install the cable and cut off the excess to the proper length.
- 1.3.6 Excess cable associated with installation of equipment in a temporary location (such as in preparation for a hot slide) shall be stored or removed as directed by the AT&TIS Representative:
- 1.3.7 Cable slack shall not be stored on or near cable racks over distributing frames or DSX frames.
- 1.3.8 Cable shall be dressed away from sharp corners or edges and/or heat producing devices, and shall not interfere with the addition of future equipment.
- 1.3.9 Switchboard and power cables installed on vertical cable racks shall be limited so that the cable is not closer than 3 inches from the side of the cable hole.
- 1.3.10 The Installation Supplier shall support cable at cable rack breakoffs such that the maximum length of unsupported cable does not exceed 3 feet.
- 1.3.11 Vertical cables in floor openings do not require support within the opening.
- 1.3.12 Cables shall not run over building obstacles (such as water pipes, conduit, air ducts, etc.).
- 1.3.13 Cable that has been previously in service shall not be reused unless directed otherwise by the AT&T Engineer subject to the following restrictions.
- 1.3.14 Power wire and cable shall only be authorized for reuse subject to the following limitations due to safety and fire hazard concerns associated with the longevity of the cable insulation:
- a) In-service, or previously in service or installed primary or secondary DC Power cable that is still in the cable rack and is less than 15 years old may be re-terminated in the same bay or in a bay closer to the power source as directed by the AT&T Engineer.
  - b) In-service, or previously in service or installed primary or secondary DC Power cable that is still in the cable rack that is between 15 and 25 years old can only be reused if physically inspected, tested if necessary, and approved by the local METS or Power Technical Support representative.
  - c) Power cable more than 25 years old shall not be reused. If the age of the power cable cannot be verified, it shall not be re-terminated.

- d) The Installation Vendor shall notify the AT&T Engineer if any signs of physical compromise of the reused power cable are detected.
- e) In-service, or previously in service or installed primary power cable shall not be extended via an inline-tap or other transitional device in order to reach bays farther from the power source.
- f) If there is no way to provide a temporary power feed for an in-service cutover to an existing power bay termination bar, the last two feet of in-service primary power cable (regardless of age) may be reused for cut over to an existing power bay. The existing cable stubs shall have two layers of tape applied from the power bay termination to the H-Tap.
- g) Under no circumstances shall primary or secondary DC power cable that has been removed from cable racking be reused.

#### 1.4. Cable Diversity Requirements

- 1.4.1 When diversity is required, cable shall be routed as described below, in order of preference.
  - a) Two separate and distinct cable routes between the network elements, via existing cable racks. No new racks shall be added just to provide diversity.
  - b) A common cable route with cables runs on opposite sides of the cable rack. For ladder type cable racks, the cables shall be secured every third strap. When panned cable racks are provided, the cable shall be loosely tied to the inside of the cable rack stringer or the cable rack horn every six feet.
  - c) If the requirements listed above cannot be met, one of the cables shall be run in flex tubing/inner duct. Flex tubing/Inner duct shall be of the fire-retardant; solid (un-slit, unless split is specified) corrugated design having a maximum 1.25-inch diameter and shall be riser rated (minimum).
- 1.4.2 Diverse leads run vertically within a bay/cabinet shall be run down opposite sides of the bay/cabinet.
- 1.4.3 Diverse leads, to the same network element, shall not cross at any point if physically possible.

#### 1.5. Temporary Installations

- 1.5.1 All temporary cabling and wiring shall be run, in order of preference, on:
  - a) Temporary racking
  - b) Cable straps
- 1.5.2 Cabling shall not be suspended by lacing cord or nylon cable ties at any locations.
- 1.5.3 All temporary fiber optic cables shall be run using temporary raceways (spiral wrap, split harness protective sheathing, etc.; will be acceptable for this application). Cables shall not be run over auxiliary bars, ladder tracks, light fixtures, threaded rods, etc.

## 2. CABLING REQUIREMENTS

**2.1. Common Items**

- 2.1.1 When installing switchboard cable, the Installation Supplier shall tape both ends, unless the cable is being fed off of a cable reel. In this case, the loose end shall be taped. The Installation Supplier shall not allow the end to protrude into the equipment.
- 2.1.2 When Multiple Conductor 734C coaxial cable is placed within the cable management space of the cabinet or unequal flange equipment bay, the outer jacket sheath of the cable shall be removed as close to the top of the bay as possible in order to minimize the additional cable congestion caused by this sheath. The individual 734C cable members do not require any sheet fiber protection and may be secured, in a bundle, directly with waxed twine or approved hook and loop.
- 2.1.3 Cable shall be formed and dressed so as not to allow cables to protrude out past the footprint of the bay or cabinet
- 2.1.4 Installed cables, hanging unterminated in equipment areas, shall be neatly coiled above the floor level and have their exposed ends insulated.
- 2.1.5 Cable and wire shall be installed neatly within the stringers of the cable rack.
- 2.1.6 P-wire and switchboard cable shall not be installed on dedicated power cable racks unless directly associated with power circuits.
- 2.1.7 The Installation Supplier shall remove all cable tags before job completion, except tags designated "future" or tags left as directed by the AT&TIS Equipment Engineer.
- 2.1.8 Ribbon cable shall not be installed on cable rack. Panduit type plastic trough (or equivalent) shall be provided for interbay installation.
- 2.1.9 Cable entering equipment frames shall enter the framework in a manner that will not block access of future cable.
- 2.1.10 Cables within an equipment unit (i.e.; switch, etc.) shall meet the manufacturer's requirements and may be non-tinned if so designated by the manufacturer.
- 2.1.11 Shop (pre-assembled bays) cabling requirements within the "foot print of the equipment" shall be as defined by the manufacturer. If these requirements conflict with the requirements given in ATT-TP-76301, the manufacturer's requirements shall apply.
- 2.1.12 Exposed ends of power cables shall be insulated with heat shrink caps or wrapped with a minimum of two layers of electrical tape.
- 2.1.13 Exposed ends of grounding cables shall be insulated with electrical tape or heat shrink caps during installation.
- 2.1.14 Transitional devices installed on grounding and power cables shall be placed between cable rack straps, and shall not be adjacent to each other, but staggered, so the heat shrink or clear cover shall be against cable insulation.
- 2.1.15 Cables shall not be installed on blocked cable racks or runs.

- 2.1.16 All cable butts on coaxial and switchboard type cable shall be taped or have heat shrink placed around the butt. The tape and heat shrink shall be placed a minimum of 1 inch above and below the butt."

**2.2. Cable Protection**

- 2.2.1 When installing cable, the Installation Supplier shall provide adequate protection to prevent damaging new and existing cable.
- 2.2.2 When cable and wire come in contact with sharp metal edges, the Installation Supplier shall use formed fiber or two layers of sheet fiber to protect against damage at the point of contact.
- 2.2.3 The Installation Supplier shall protect all cable at break-offs when attached directly to the cable rack stringers with formed fiber or two layers of sheet fiber.
- 2.2.4 Waterfall devices similar to Panduit CMW-KIT10 may be used for protection of cables in place of wrapping stringers with sheet fiber where cables transition off side of cable racks. Waterfall devices fabricated of materials other than steel shall be made of flame resistant materials conforming to UL 94 V-0, V-1 or V-2 fire rating. Manufacturer shall be able to provide documentation verifying fire rating when requested. Waterfall devices and other related components shall be positively secured to the cable rack with fastening hardware or nylon tie wraps rather than reliance on friction joints or spring clipped designs. Where nylon tie wraps are used, tie wrap head shall be positioned away from path of cable runs.
- 2.2.5 Cable rack straps shall be protected with formed fiber or two layers of sheet fiber for power cable dropping through the cable rack.
- 2.2.6 When rubber, neoprene and other non-textile jacketed power cable are secured, 2 wraps of insulating fiber protection shall be applied to the cable sheath at each secured or banded location. This requirement does not apply to power wire or cable within a bay.
- 2.2.7 Fiber protection shall be placed on the cable rack cross straps at outside bends or offsets in cable racks.
- 2.2.8 Cable shall be protected with fiber at points of contact with the flange side of cable rack cross straps. This condition may be encountered where inverted cable racks are used, or where cable must be placed on the flange side of cable racks.
- 2.2.9 Individual 735C type cables (see Table J-4 or J-5) shall be protected where they are to be secured or banded. This protection shall be accomplished by the use of two layers of sheet fiber or one layer of outer sheathing from multiple coaxial cables (i.e., six-pack or twelve-pack). Coaxial cables within a multiple cable package (i.e., six-pack or twelve-pack) and individual 734C type cables do not require this additional protection, since the outer sheathing of the package provides sufficient protection.
- 2.2.10 Under no circumstances shall the securing stitch, nylon cable ties or hook and loop tape, be pulled so tightly as to deform the cable sheathing.

**2.3. Damaged Cables**

- 2.3.1 Damaged cable sheathing shall be repaired with electrical tape. The tape shall be applied in two half lapped layers with the final two wraps applied without tension and over lapping. The tape shall extend a minimum of 2 inches past the damaged section in both directions.
- 2.3.2 Seriously damaged sections of cable sheathing shall be repaired by removing the damaged section and replacing it with the covering from a similar cable. Apply a single half lapped layer of electrical tape over the new section to secure it in place.
- 2.3.3 Damaged power cable sheathing shall be repaired by wrapping with a minimum of two half lapped layers of rubber tape then two half lapped layers of electrical tape. The rubber and electrical tape shall extend a minimum of 2 inches past the damaged section in both directions.
- 2.3.4 A run of cable shall be replaced if the number of damaged or spliced conductors exceeds 5% of total conductors.
- 2.3.5 Cat 5E/Cat 6 cables with damaged sheathing shall be replaced.

**2.4. Securing Cable and Bundling**

- 2.4.1 Methods for securing cable include the use of 9 ply polyester twine, nylon cable ties or hook and loop tape.
- 2.4.2 When shielded cables are bundled, bundling shall facilitate cable management and cable identification and shall meet all cable installation requirements, including minimum cable bend radius. Cable bundles shall not be greater than 1 ½" diameter or 4 ¾" circumferences, bend radius, support, identification, and management.
- 2.4.3 Hook and loop tape (e.g. Velcro tie wrap)
  - a) Hook and loop tape may be used at IS sites to bundle all braided coaxial cable; 4-8 pair conductor, unshielded twisted pair (UTP); 4-8 pair conductor, shielded screened twisted pair (STP) 4 - 8 pair conductor, shielded twisted pair (STP) and AC power cables.
  - b) Hook and loop tape shall not be used to secure DC power, switchboard, or fiber cables.
  - c) Only hook and loop tape approved by Common Systems shall be used. The tape shall meet a minimum of UL-94 V-0 fire rating and have a minimum width of ½ inches.
  - d) Hook and loop tape overlap shall be the greater of an inch or half of the bundle diameter.
- 2.4.4 Cables and wires on horizontal unpanned cable racks shall be secured at the first and last strap, and at uneven intervals not to exceed 3 feet. When securing with 9 ply polyester twine, refer to Table J-4
- 2.4.5 Chicago or Kansas City stitches shall be used when securing cable with 9 ply polyester twine. See Figures J-3 through J-6.

- 2.4.6 Cable installed on horizontal ladder type cable racks shall be secured at break-off.
- 2.4.7 On vertical and inverted horizontal cable racks, cables shall be secured at every strap. See Table J-5.
- 2.4.8 All cables shall be dressed to avoid congestion and to permit accessibility to equipment.
- 2.4.9 All cables and wires shall be secured at the first support of frame or bay with 9 ply polyester twine.
- 2.4.10 All cables shall be secured at the butt location of the cable:
  - a) Unequal flange type bays shall use 9 ply polyester twine or nylon cable ties. If the butt is not within 1 inch of the cable bracket, it shall be banded to the existing cables in the form.
  - b) Equipment cabinets/enclosures shall use 9 ply polyester twine, nylon cable ties or hook and loop tape.
- 2.4.11 When the cable butt is located below the lowest cable bracket in an equipment frame or bay, the length between the butt and the last bracket shall be no more than 10 inches.
- 2.4.12 The cables shall be secured at all cable brackets provided with the manufacturer's equipment. The cables at these intermediate brackets may be secured with 9 ply polyester twine, nylon cable ties or hook and loop tape.
- 2.4.13 If cable is terminated at a point above the top bracket in the bay, the cable shall be banded to the other cables at the point of break off, at the top of the bay or an L-type securing bracket.
- 2.4.14 Cable and wire shall be banded halfway between the cable rack and top support on the frame or bay when distances exceed 3 feet.
- 2.4.15 On cable racks with horns and pans the cable and wire shall be secured only at break-off.
- 2.4.16 P-wire on panned cable racks shall be banded with 2 strands of twine every 5 to 6 feet to prevent curling or drooping.
- 2.4.17 P-wire on panned cable racks shall be banded at points where the wire changes direction.
- 2.4.18 Cables on ladder type cable racks having retaining brackets used to separate high and low level transmission leads in carrier systems, shall not be sewn, except at turn-off points.
- 2.4.19 Excess 9-ply polyester twine shall be trimmed to a maximum length of 1/2 inch.
- 2.4.20 The Installation Supplier shall secure cables to the cable securing brackets, if provided, at the rear of the shelf every two inches. This is required for cables transversing across the back of the shelf.

- 2.4.21 Cable runs on vertical cable rack shall have cables secured at each cross strap with twine. Cable clamps may be used as supplemental support to the twine securing when required. Cable clamps shall be provided when vertical cable racks of 15 inches and wider extend between more than two floors.
- a) Where the runs are in exposed locations, one set of clamps shall be installed per floor. The clamps shall be located near the ceiling and the cable shall be sewn at each alternate cable strap.
  - b) Where the runs are located in shafts or other enclosures, two sets of clamps shall be installed per floor, one just above the cable hole sheathing and the other about half the distance to the ceiling. The upper clamp shall not be less than 7 feet from the floor. Cables shall be secured in an orderly manner immediately above each clamp.
  - c) Clamps are not required if vertical cable runs are secured by sewing with twine at every cable rack cross strap.
- 2.4.22 Inverted horizontal cable racks shall be equipped with supplemental cable support. These supplemental supports shall clamp the cables firmly but not so tight as to distort the cables. The supports shall be placed along the run at approximately 10-foot intervals for runs that can ultimately contain less than 100 square inches of cable and at approximately 6-foot intervals for larger runs of cables.
- 2.4.23 The installation supplier shall secure cables as shown in Tables J-2 through J-5.

**2.5. Coaxial Cables**

- 2.5.1 Coax cables on panned cable racks with cable horns are not required to be secured to cable rack cross straps. Bundling of cables may be necessary and cables can be grouped on cable racks.
- 2.5.2 Coaxial cable runs in cabinets shall be secured with approved flame resistant hook and loop tape.
- 2.5.3 Coaxial cables in supported vertical runs shall be secured by hook and loop tape at a minimum of every 12 inches unless a larger distance is necessary for uneven spacing. Then ties shall be placed no further than every 18 inches.
- 2.5.4 Coaxial cables in unsupported vertical runs shall be bundled with hook and loop tape a minimum of every 8 inches.
- 2.5.5 Coaxial cable shall not be unsupported for greater than 30 vertical inches except when installed in conduit.
- 2.5.6 Where coaxial cables waterfall off the cable rack, they shall be secured using an approved sweep device with hooks and loop ties when possible. When a sweep device cannot be used, coaxial cables shall be secured with waxed cord and sheet fiber and waterfall in a loop to required radius.

- 2.5.7 Coaxial cables on unpanned cable racks without horns shall be secured by hook and loop or waxed cord, using sheet fiber as protection, to cross straps of every 12 to 30 inches. Securing ties shall be unevenly spaced.
- 2.5.8 Only hook and loop tape shall be used to bundle coaxial cables on panned and unpanned cable racks.
- 2.5.9 Adjacent cable bundles may be fastened together with overall Hook and Loop tape. During installation temporary nylon cable ties may be used to manage coaxial cable paths, but must be removed and replaced with Hook and Loop tape for final installation. Nylon ties shall only be placed loosely.
- 2.5.10 Coaxial cables (i.e.; 500, 625, etc) mounted on antenna masts, towers or other vertical structures shall be secured using a Valmont type cushion hanger and appropriate standoff hardware. Cushion sleeve shall be provided with holes sized to outside diameter of cable where all cables will not be overly tight or possess any play between cushion and cable.
- 2.5.11 Coaxial cables (i.e.; RG6, RG11, etc) mounted on antenna masts, towers or other vertical structures shall be secured using a Panduit type coated stainless steel strap and cushion sleeve. The supplier shall install the maximum width strap available. Coaxial cables shall first be bundled using the coated stainless steel strap and cushion sleeve, then the bundle shall be secured to the vertical structure using the coated stainless steel and cushion sleeve. When securing the bundle to the structure, the securing strap shall be 1 inch above or below the bundle strap.
- 2.5.12 The installation supplier shall use the manufacturer's recommended installation tools for the installation of the coated stainless steel straps. The installation supplier shall not exceed the manufacturer's recommended tensioning specification nor shall the installation supplier deform the cables(s). Hardware securing straps to the tower shall not require drilling, cutting or cause deformation of structural members of the tower.
- 2.5.13 Cable management systems the transition coaxial cables from antenna masts, towers or other vertical structures to their entry point within the site shall be provided with a rigid weather-resistant, wind-resistant cover for protection of cables from weather and falling debris.

**2.6. AC Power Cords in Equipment Cabinets**

- 2.6.1 Hook and loop tape or nylon tie wraps shall be used to secure and bundle all power cords in cabinets.
- 2.6.2 Plenum rated Hook and Loop tape, waxed cord or plenum rated nylon cable ties shall be used under raised floors

**2.7. Formed Cable**

- 2.7.1 Formed cable shall be secured at a level that affords access to the equipment.
- 2.7.2 Wiring added to existing formed cable shall be secured at 2-inch intervals.

**2.8. Nylon Cable Ties**

- 2.8.1 Nylon cable ties can be used in place of 9 ply waxed polyester twine except as specified below. Cord is always preferred over nylon cable ties and applications found where cable ties are cutting into cable jackets will be replaced by contractor when requested by AT&T.
- 2.8.2 Nylon cable ties may be used for temporary securing during the job. Upon completion of installation, nylon cable ties SHALL NOT be used for:
  - a) Banding or securing cable on cable racks
  - b) Banding together of cable installed in compartmentalized troughs/racks.
  - c) Banding or securing of coaxial cables
  - d) Banding or securing fiber optic jumpers
  - e) Securing cable to the top cable securing bracket on equipment frames
  - f) Securing battery and battery return cables at any location.
- 2.8.3 Nylon cable ties shall be of an adequate size, type, strength, etc. for the particular application.
- 2.8.4 The Installation Supplier shall use a tool specifically designed for tensioning and cutting of nylon cable ties. Side cutters or equivalent shall not be used.
- 2.8.5 Nylon cable ties shall be tensioned around cable or wire forms tightly enough to hold the cables or wire together and/or properly positioned, but not so tightly or at such angles so as to cause possible damage to the insulation of the cable or wire.
- 2.8.6 Nylon cable ties, banded around cables or wire, shall be capable of being rotated with slight to moderate pressure applied with the thumb to the head of the tie. If banded cables or wire, under and/or adjacent to the nylon cable tie, twist or deform when pressure is applied to the head of the tie, then the tie has been applied to tightly.
- 2.8.7 Under no circumstances shall nylon cable ties have sharp or jagged cut ends protruding from the locking head. A nylon cable tie is considered to have sharp or jagged ends when it is sharp to the touch.
- 2.8.8 The locking head of nylon cable ties shall be positioned so as not to interfere with the installation or removal of apparatus or equipment.
- 2.8.9 When cables/wire is added to a bundle secured with nylon cable ties, the existing tie shall be removed and the entire bundle secured with a new tie or 9-ply polyester twine. This requirement does not apply to firestopping banding requirements (see Section F).
- 2.8.10 Where cable or wire forms are secured to cable securing brackets, the locking head of nylon cable ties shall be positioned on the side of the bracket opposite the side on which the cables or wire are installed.

- 2.8.11 Adhesive-backed tie wrap bases that rely only on the adhesive backing to attach to walls, columns, equipment, auxiliary framing, etc., shall not be used to secure cable or wire outside the confines of a frame.

## 2.9. Bending Radius

- 2.9.1 Cables shall not be sharply bent or twisted during a forming operation.
- 2.9.2 The minimum inside bending radius of switchboard, shielded and twin conductor cable is 5 times the cable diameter.
- 2.9.3 The minimum inside bending radius of non-bundled coaxial cable and bundled 734 type coaxial cable is 7 times the cable/bundle diameter.
- 2.9.4 The minimum inside bending radius of bundled coax (735 type) cable is 10 times the bundle diameter.
- 2.9.5 The minimum inside bending radius of power wire and cable is 7 times the cable diameter.
- 2.9.6 The minimum inside bending radius of fiber jumpers or patch cords is 1.5inches.
- 2.9.7 The minimum inside bending radius of fiber optic cable (OFNR) is 1.5 inches or 10 times the cable diameter, whatever is larger.
- 2.9.8 CO grounding system conductors shall be installed with a minimum radius of one foot. If the one foot radius objective can not be met, a smaller radius is acceptable based on the following conditions:
- a) For the #2 AWG peripheral conductor at a radio site the minimum bend radius shall be 6 inches.
  - b) For all other conductors, the minimum bend radius shall not be less than 5 times the finished diameter of the cable. Table J-7 provides the minimum bending radius, rounded up to the nearest inch, for the most common grounding conductor sizes based on the approximate diameter for rubber-covered wire (type, RHH, RHW).

## 3. POWER CABLING

### 3.1. General

- 3.1.1 Primary or secondary DC power cable that is removed from cable racking shall not be re-used. Deactivated primary or secondary DC power cable that is still in the cable rack and is less than 10 years old may be re-terminated in the same bay or in a bay closer to the power source. If the age of the cable cannot be verified it shall not be re-terminated. Deactivated DC power cable shall not be extended via an h-tap in order to reach bays farther from their power source.
- 3.1.2 Where possible, the Installation Supplier shall install all leads in continuous lengths from the power source to the equipment termination. In-line reduction-taps shall be used when the size of the cable is too large for the equipment termination. H-taps shall

not be used for this purpose. In-line reduction-taps are the preferred method to terminate the cable.

- 3.1.3 Exposed ends of power cables, while being installed, or transitioned, shall be insulated with an electrical tape secured heat shrink cap or a heat shrink cap that has been heat shrunk onto the end of the cable(s).
- 3.1.4 The secondary battery and battery return leads are a pair and shall be installed closely coupled.
- 3.1.5 The secondary battery and battery return leads shall be installed on existing dedicated secondary power cable racks whenever possible.
- 3.1.6 For special synchronization power requirements, see Section T of ATT-TP-76301.
- 3.1.7 When connecting battery return cables to the return bus bar in BDFBs/SPDUs, the Installation Supplier shall terminate the cables in such a manner as to allow future access for cable connections to the bus bar.
- 3.1.8 When connecting to BDFB/SPDU fuse position studs, the Installation Supplier shall arrange cable in such a manner so as to not block access of future terminations.
- 3.1.9 Conductors serving AC powered equipment shall be installed in metallic conduit or trough to meet NEC code and local municipality requirements.

**3.2. Sewing And Securing**

- 3.2.1 DC Power cable leaving cable racks, supports, and entering frames, racks or other equipment shall be supported at least every 3 feet.
- 3.2.2 The Installation Supplier shall comply with Table J-2 and Table J-3 for sewing DC power cable to the cable racks. The requirements apply to uniform size leads.
- 3.2.3 DC Power cable shall be secured on unpanned cable rack immediately before and after turns and changes in elevation.
- 3.2.4 DC Power cables on unpanned racking shall be secured at every strap or flat bar at every turn.
- 3.2.5 For vertical power cable runs, the Installation Supplier shall install one power cable clamp per floor where three or more floors are involved. No clamps are required when power cable runs are one or two floors.
- 3.2.6 The Installation Supplier shall insulate the cables from the clamping bar by using an angle type insulator or by wrapping the cables with two (2) wraps of insulating fiber at the clamp.
- 3.2.7 DC Power cables terminations shall be supported and/or secured in such a manner as to prevent stress on the connection.

**3.3. DC Power Cable Routing**

- 3.3.1 Unfused battery conductors and their accompanying battery return leads, such as those between the batteries and power boards, shall not be run on panned racks.

- 3.3.2 Unfused battery conductors and their accompanying battery return leads, such as those between the batteries and power boards, shall not be run with other conductors.
- 3.3.3 Primary battery and battery return leads shall be run on unpanned dedicated power cable rack and labeled as un-fused power cables.
- 3.3.4 Unless authorized by the AT&TIS Equipment Engineer, power cable within the primary distribution system (within the power plant or between the power plant and the first point of distribution) shall not be run on cable racks equipped with cable retaining brackets or horns.
- 3.3.5 The battery and battery return leads are a pair and shall be run closely coupled.
- 3.3.6 The BDFB/SPDU battery conductor need not be paired with the battery return conductor for the portion of the run to and from the MGB if a significant amount of additional cable for the battery conductor is required to maintain pairing. See Figure J-2 (b) and (c). The return conductor shall be closely coupled (to itself) along the route to and from the point where it leaves the route of the battery conductor and the connection to the MGB. Where significant conductor length is not a factor, the battery and battery return conductors shall remain paired. See Figure J-2 (a).

Note: When the battery return conductor is longer than the battery conductor, the size of the battery return conductor shall be adjusted, if necessary, to meet any voltage drop requirements.

- 3.3.7 The battery return conductors of a circuit serving common bonding network equipment may be connected directly to the Common Bond Network (CBN) side MGB as in Figure J-2 (b) or, to save space on the MGB, they may be bonded to the MGB with a conductor not exceeding 3 feet in length. This is shown in Figure J-2 (a) and (c).

Note 1: One bonding conductor may be serially connected, using crimp type parallel connectors (H-Tap), to more than one battery return conductor, provided the bonding conductor is no longer than 3 feet.

Note 2: The bonding conductor shall be the same size as the battery return conductor for sizes up to #1/0 AWG. Larger conductors may be bonded using a #1/0 AWG.

- 3.3.8 BDFBs/SPDUs are used to distribute one or more DC voltages to network equipment. The battery return bus bars on early BDFBs were in electrical contact with the framework of the BDFBs. All new BDFBs/SPDUs shall have the return bus bar insulated from the framework.
- 3.3.9 Secondary power feeds shall not be installed on the dedicated primary power cable rack.
- 3.3.10 The secondary battery and battery return leads are a pair and shall be installed closely coupled except when being referenced to the Ground Window.

- 3.3.11 Secondary power feeds that are installed on panned cable racking shall be banded every six feet.
- 3.3.12 When connecting battery return cables to the return bus bar in BDFBs/SPDUs, Power Boards (PBDs etc.), the Installation Supplier shall terminate the cables in such a manner as to allow future access for cable connections to the bus bar.
- 3.3.13 Battery return cables terminating on the battery return bus bar shall not be reduced.

**3.4. AC Cable Routing**

- 3.4.1 Metallic Armored Clad (MAC) and BX cable shall be replaced with Jacketed Metallic Clad (JMC) cable or conduit whenever AC circuits are rearranged, except within bay end guards and AC outlet extensions within the base of the bay.
  - a) All final AC equipment connections, or conduit transitions from walls or columns in Seismic Zones 3 & 4, with Jacketed Metallic Clad (JMC) flex (Seal-Tite® or Liquidtight® rated UL 94 V-0) shall not exceed three feet (including 6" of slack).
  - b) All final AC lighting fixture connections with Jacketed Metallic Clad (JMC) flex (Seal-Tite® or Liquidtight® rated UL 94 V-0) shall not exceed six feet.
  - c) Jacketed Metallic Clad (JMC) flex (Seal-Tite® or Liquidtight® rated UL 94 V-0) may be run a distance greater than three feet only within bay end guards and bases to connect light switches and bay test receptacles. The JMC shall not have excessive slack or be coiled within the bay end guard or base.
  - d) Jacketed Metallic Clad (JMC) flex (Seal-Tite® or Liquidtight® rated UL 94 V-0) may be run a distance greater than three feet when utilized as whips in a raised floor environment.
- 3.4.2 AC power cable placed in metallic conduit, flexible raceways or JMC shall not be run through cable hole penetrations containing switchboard or DC power cables.
- 3.4.3 Romex shall not be used in AC circuits.

**4 CABLE RACK LOADING**

**4.1 Blocked Cable Runs**

- 4.1.1 When blocked cable runs in cable racks or cable penetrations are encountered, the Installation Supplier shall contact the detail engineer for instructions.
- 4.1.2 A cable hole shall not be filled beyond 75 percent of its capacity, and cables shall not be placed closer than 3 inches from edges.
- 4.1.3 When a cable hole reaches capacity no more cable shall be run through the cable hole and the floor plan shall be marked to reflect blocked conditions.
- 4.1.4 The Installation Supplier shall report a blocked cable hole to the AT&T Engineer and the AT&T Space Planner, fill out a JIM reporting the blocked condition and place a copy of the JIM in the yellow wallet or job folder.

**4.2 Cable Pileup**

- 4.2.1 Installation Suppliers shall immediately notify the AT&TIS equipment engineer when 75 percent of the cable pileup capacity of a cable rack or a portion of a cable rack has been reached. See Table J-6.
- 4.2.2 Cables run on panned racking equipped with cable horns shall not exceed the height of the cable horn or the requirements that are stated in Table J-6, whichever is less. Cable rack horn extensions shall not be installed.
- 4.2.3 No new applications of Bar-type cable rack shall be installed in offices or reapplied in other parts of office. Existing Bar-type cable racks shall be used with cable pileups below height of side bar. At intersections of Bar-type cable racks, side bars extending through the intersection and in path of cables shall be cut off and remaining stub covered with firmly secured rubber cap or the bar may be bent out of way of cables.

## 5 DC POWER GROUNDING SYSTEM CONDUCTORS

- 5.1.1 All grounding system conductors shall be routed on and secured to:
  - a) A cable rack or cable bracket containing only grounding conductors
  - b) The side or bottom of ironwork details or cable rack containing other cable types
  - c) The surface of ceilings, columns, or permanent walls.

Note 1: Grounding conductors may be placed on the same cable brackets used to support other cables if the grounding conductors are secured to the surface of the bracket opposite that used to secure the other cables.

Note 2: Some equipment manufacturers allow grounding conductors routed within their equipment systems to be routed with other conductors, typically DC power conductors. When a system is approved for use, the routing requirements of the equipment vendor may apply.

- 5.1.2 When grounding conductors are routed on the side or bottom of cable racks or other ironwork or surface of ceilings, columns or walls, the conductors shall be secured at intervals of 11 to 12 inches. When cable brackets are used for support, they shall be placed at intervals of 18 to 20 inches.
- 5.1.3 When a horizontally run grounding conductor is placed on or under a cable bracket or other support detail, the conductor shall be secured to each bracket or support detail using nylon cable ties or 9-ply waxed polyester twine. (See Figure J-1): In addition:
  - a) Grounding conductors up to and including #1/0 AWG may be secured to the sides of cable rack stringers, auxiliary framing bars, threaded rods and other ironwork details with nylon cable ties or 9-ply waxed polyester twine.
  - b) Grounding conductors larger than #1/0 AWG shall be secured to the sides of cable rack stringers, auxiliary framing bars, threaded rods and other ironwork details with 9-ply waxed polyester twine.
- 5.1.4 Grounding conductors secured to the underside of cable racks shall be secured to alternate cross straps with 9-ply waxed polyester twine.

- 5.1.5 The exterior surface of conduits or raceways containing AC power conductors shall not be used to support grounding system conductors.
- 5.1.6 Several methods of supporting grounding conductors, including vertical and horizontal equalizers, and typical material are shown in ED-97729-11, *Protective Grounding Systems for Central Office Equipment*. The use of support methods similar to those shown in this drawing is acceptable.
- 5.1.7 Unless expressly required by local code, grounding system conductors (other than ACEG conductors) shall not be run in metallic conduit. If a grounding system conductor is placed in metallic conduit, raceway or sleeve more than three feet in length, it shall be bonded to the conduit, raceway or sleeve at each end with a minimum #6 AWG conductor.
- 5.1.8 When metal clamps are used to support or secure grounding conductors, the clamps shall not completely encircle the conductor. The metallic continuity shall be interrupted by non-metallic hardware, a cable tie or 9-ply waxed polyester twine. The phrase *completely encircle* applies primarily to ferrous metal cable clamps. It does not apply to an opening or "ring" formed by a combination of interconnected metallic objects such as cable racks, auxiliary framing, threaded rods, etc., unless the length (l) of this opening is more than 3 times its diameter (D). Examples of openings that do not create complete encirclement of a grounding conductor are:
  - c) Where the conductor is routed through a metal cable hole cover instead of a floor sleeve (l is typically < 1/4", D is typically > 1 1/2")
  - d) Where the conductor is on a cable rack and passes through the opening formed by the cable rack's stringers and straps (l is typically < 3", D is typically > 18")
  - e) Where the conductor passes through an interior wall constructed with sheet metal studs (l is typically < 8", D is typically > 48")
  - f) Arrangements similar to (a) through (c) above.
- 5.1.9 The DC Electrical Ground (DCEG) conductor for BDFBs/SPDUs shall be a minimum #1/0 AWG conductor, and shall be connected directly to a GRD bus bar or tapped to a horizontal equalizer of equal or greater size.

TABLE J-2--HORIZONTAL RESTING RUNS (POWER)				
Size of Copper Cable	Sew at Strap	Number of Cord Strands	Ultimate Number of layer	Cable Per Stitch
400 MCM-750 MCM	alternate	4	any number	2
No. 1/0-350 MCM	alternate	2	any number	2
No. 6-1	every	2	any number	4
No. 14-8	every	2	any number	any number bundled

TABLE J-3--VERTICAL RUNS AND/OR INVERTED HORIZONTAL RUNS (POWER)				
Size of Copper Cable	Sew at Strap	Number of Cord Strands	Ultimate Number of layer	Cable Per Stitch
300 MCM-750 MCM	every	4	any number	1
No. 1/0-4/0	every	4	any number	1
No. 6-1	every	2	any number	2
No. 14-8	every	2	any number	1 inch diameter bundle max

TABLE J-4--HORIZONTAL RESTING RUNS (SWITCHBOARD AND COAXIAL)				
Diameter of Cable	Type	Sew at Strap	Number of Cord Strands	Cable Per Stitch
Up to 1/2"	round	every fourth	2	6
over 1/2" to 3/4"	round	every fourth	2	5
over 3/4" to 1"	round	every fourth	2	3
over 1"	round	every fourth	2	2
(735 type)	mini-coax	every fourth	2	16
(734 type)	coax	every fourth	2	8

TABLE J-5--VERTICAL RUNS (EXCEPT POWER) AND/OR INVERTED HORIZONTAL RUNS (SWITCHBOARD AND COAXIAL)				
Diameter of Cable	Type	Sew at Strap	Number of Cord Strands	Cable Per Stitch
Up to 1/2"	round	every	2	5
over 1/2" to 3/4"	round	every	2	2
over 3/4"	round	every	2	1
(735 type)	mini-coax	every	2	16
(734 type)	coax	every	2	8

TABLE J-6--CABLE CAPACITY OF STANDARD CABLE RACKS (5'-0" Support Spacing)								
Rack Width	Normal Capacity				75% Rule Capacity			
	Capacity (In. <sup>2</sup> )		Pileup (inches)		Capacity (In. <sup>2</sup> )		Pileup (Inches)	
	Sec.	Unsec.	Sec.	Unsec.	Sec.	Unsec.	Sec.	Unsec.
1'-0"	132	<b>132</b>	12	12	99	<b>99</b>	9	9
1'-3"	168	<b>210</b>	12	15	126	<b>157</b>	9	11
1'-8"	228	<b>285</b>	12	15	171	<b>213</b>	9	11
2'-1"	288	<b>360</b>	12	15	216	<b>270</b>	9	11

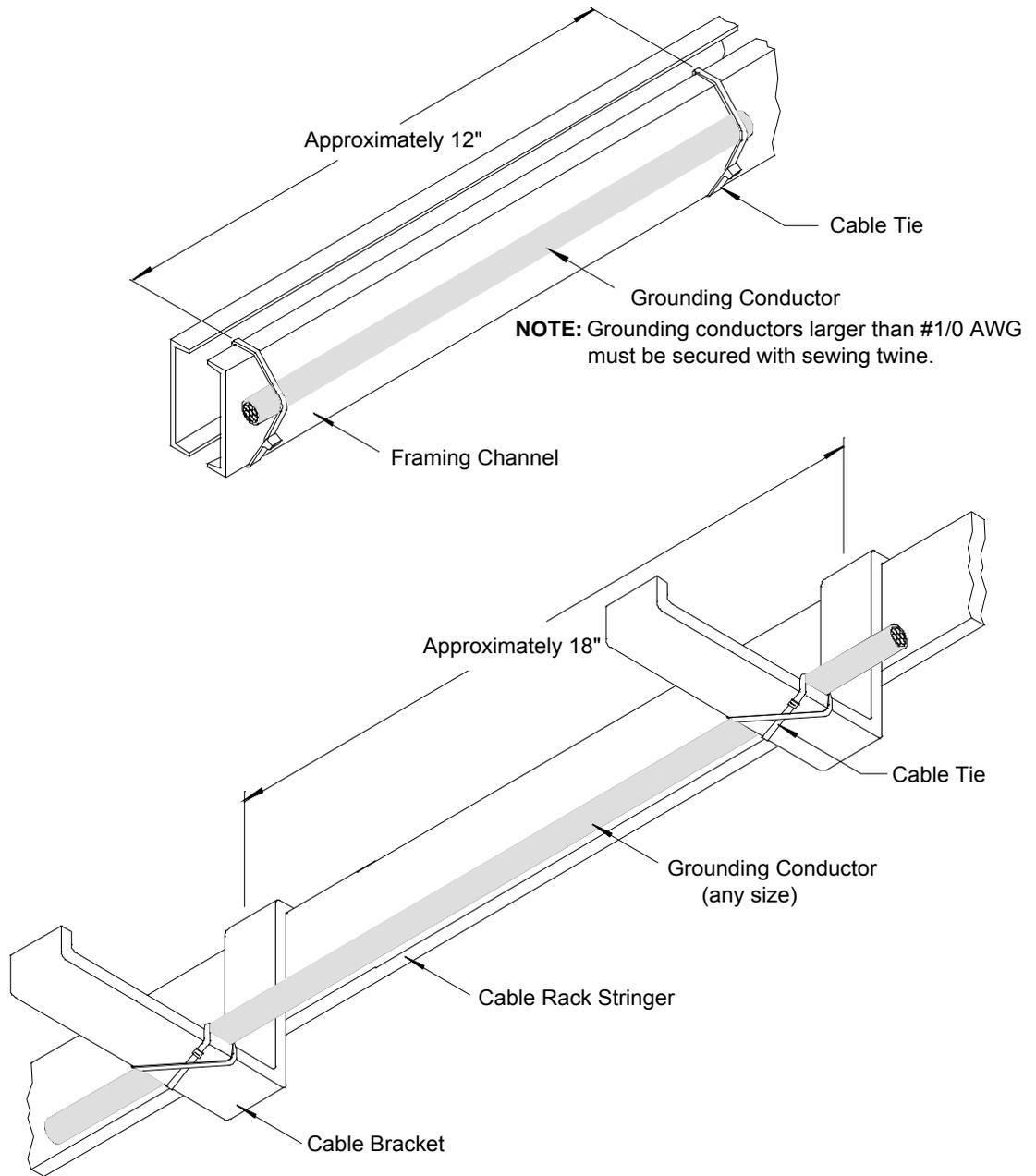
Note (1) In.<sup>2</sup> capacity is based on the rack width minus 1" for stringer attachment hardware.

Note (2) According to the above a new switch or other equipment entity having 500 In.<sup>2</sup> of **secured** interconnecting cable to other network elements requires a minimum of three 1'-8" via cable rack paths (500/171 = 2.9 racks @ 75% capacity).

**TABLE J-7 – MINIMUM BENDING RADIUS FOR GROUNDING CONDUCTORS**

<b>Grounding Conductor Size</b>	<b>Minimum Bending Radius (inches)</b>
<b>6 AWG</b>	<b>2</b>
<b>4 AWG</b>	<b>3</b>
<b>2 AWG</b>	<b>3</b>
<b>1/0 AWG</b>	<b>4</b>
<b>4/0 AWG</b>	<b>4</b>
<b>750 kcmil</b>	<b>7</b>

FIGURE J-1 - USE OF CABLE TIES TO SECURE GROUNDING CONDUCTORS



**Figure J-2 Bonding of Battery Return Conductors of Shared Power Plant to the MGB**

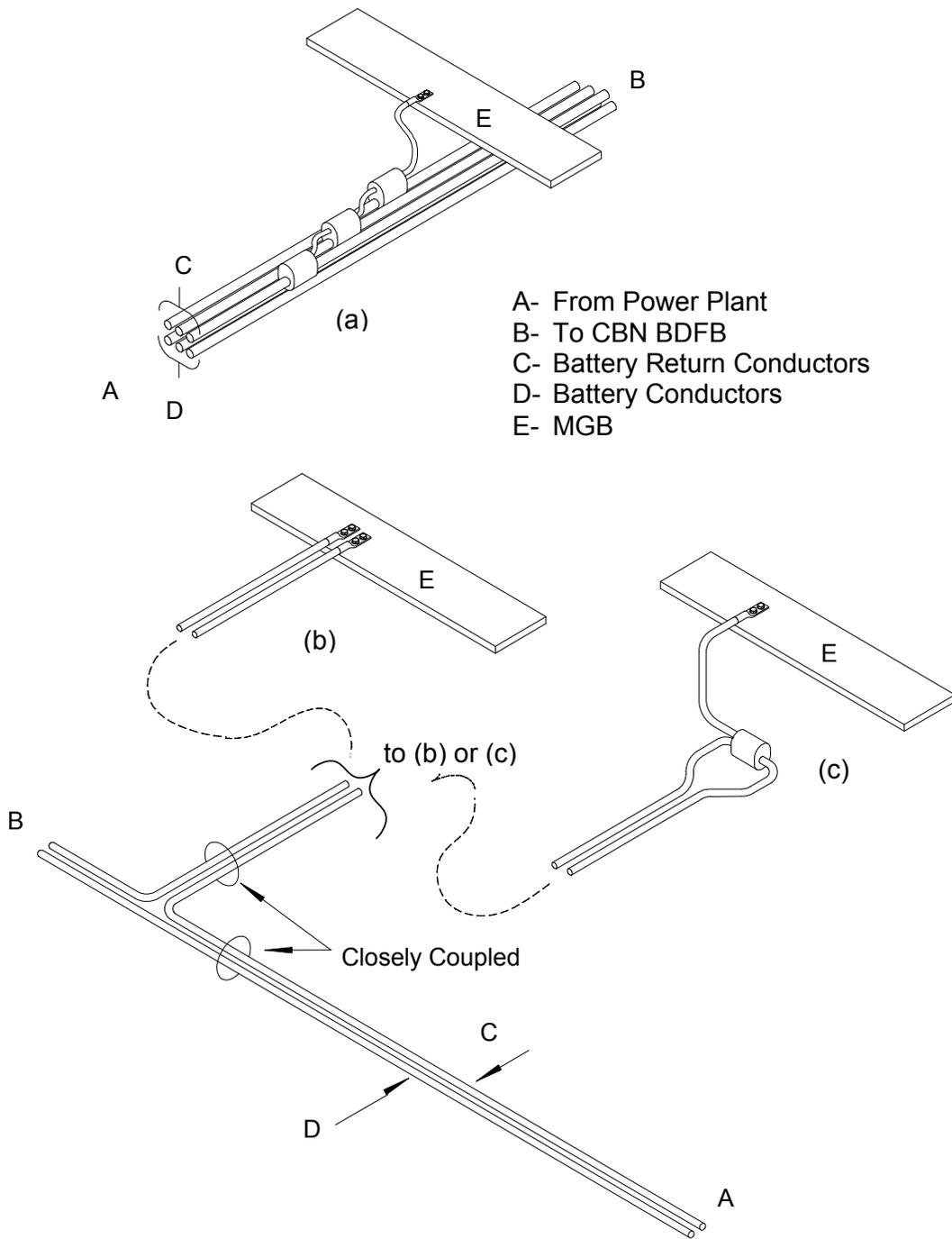


Figure J-3 Kansas City Stitch

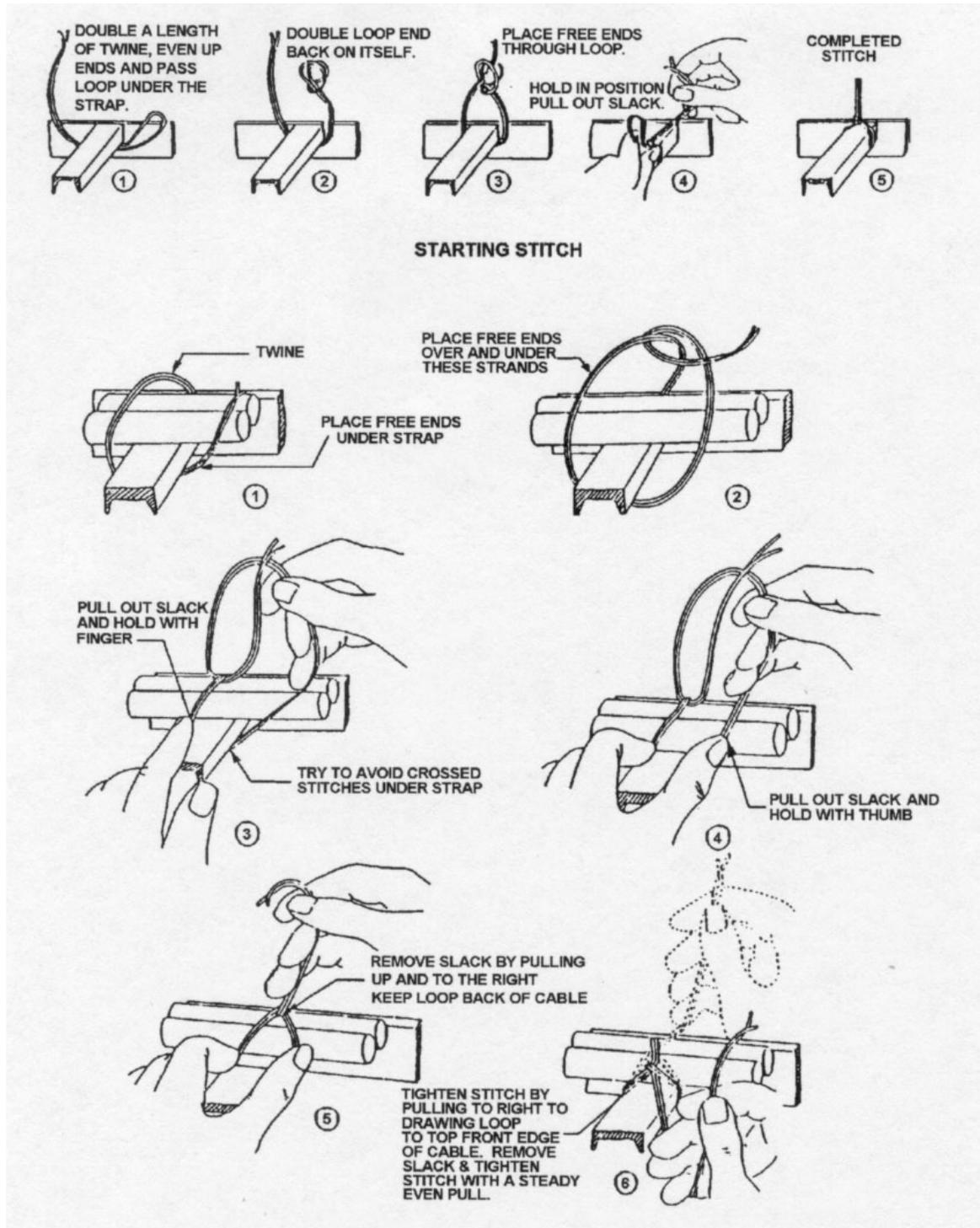


Figure J-4 Ending Stitches

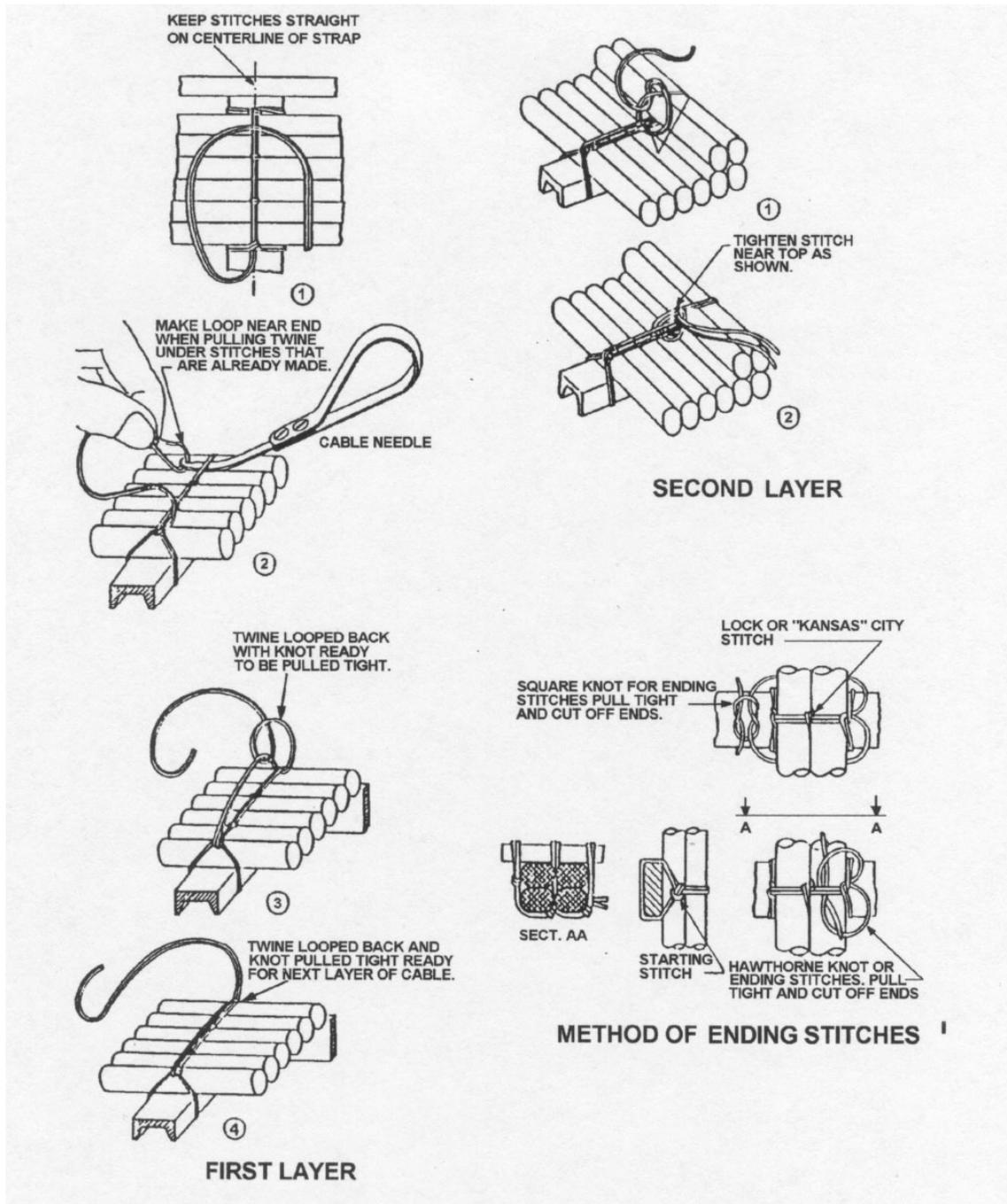


Figure J-5 Sewing Cable to Supports at Turns (Chicago Stitch)

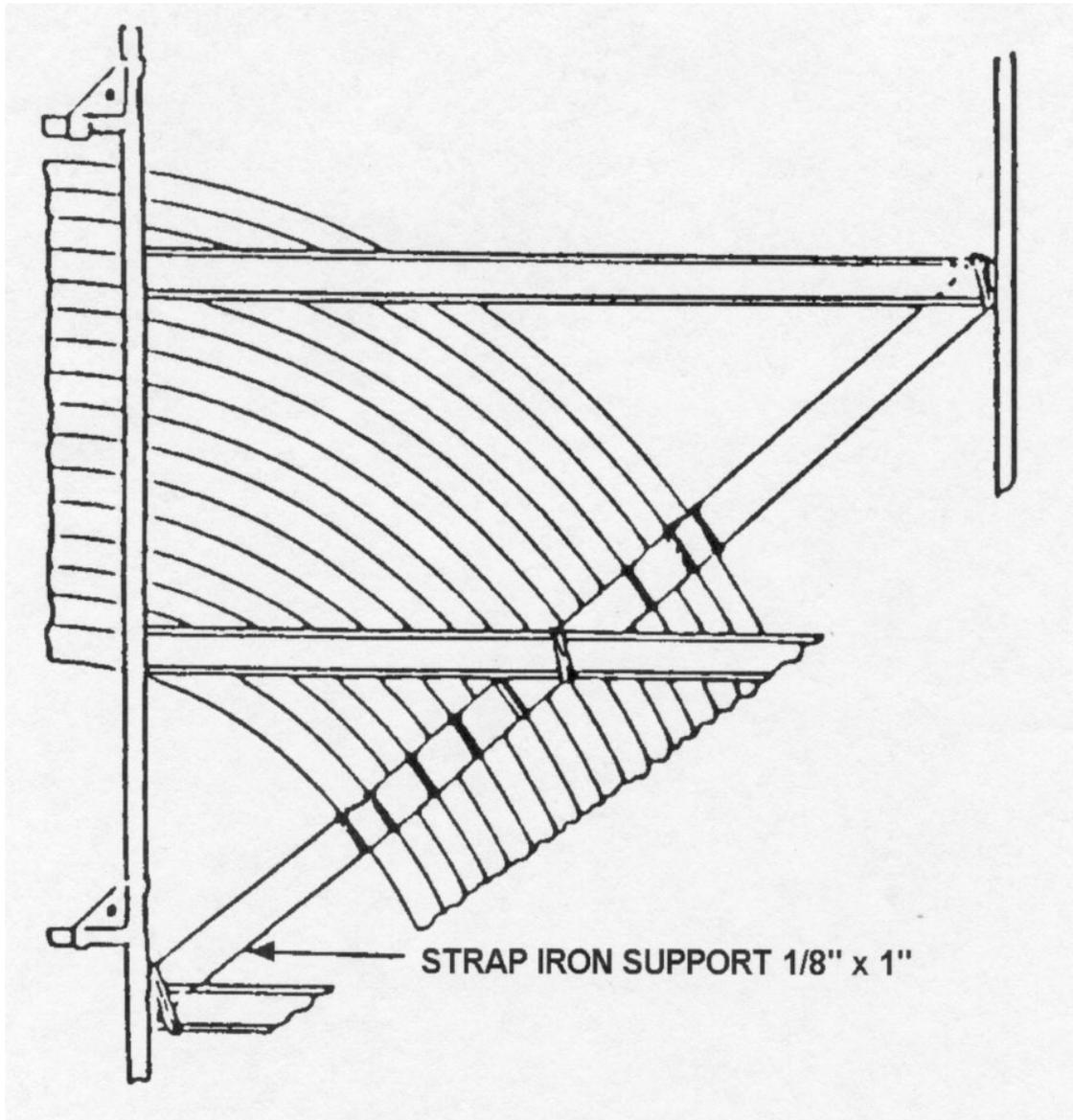


Figure J-6 Cables From Miscellaneous Run Secured Together Between Rack and First Support with a Modified Chicago Stitch

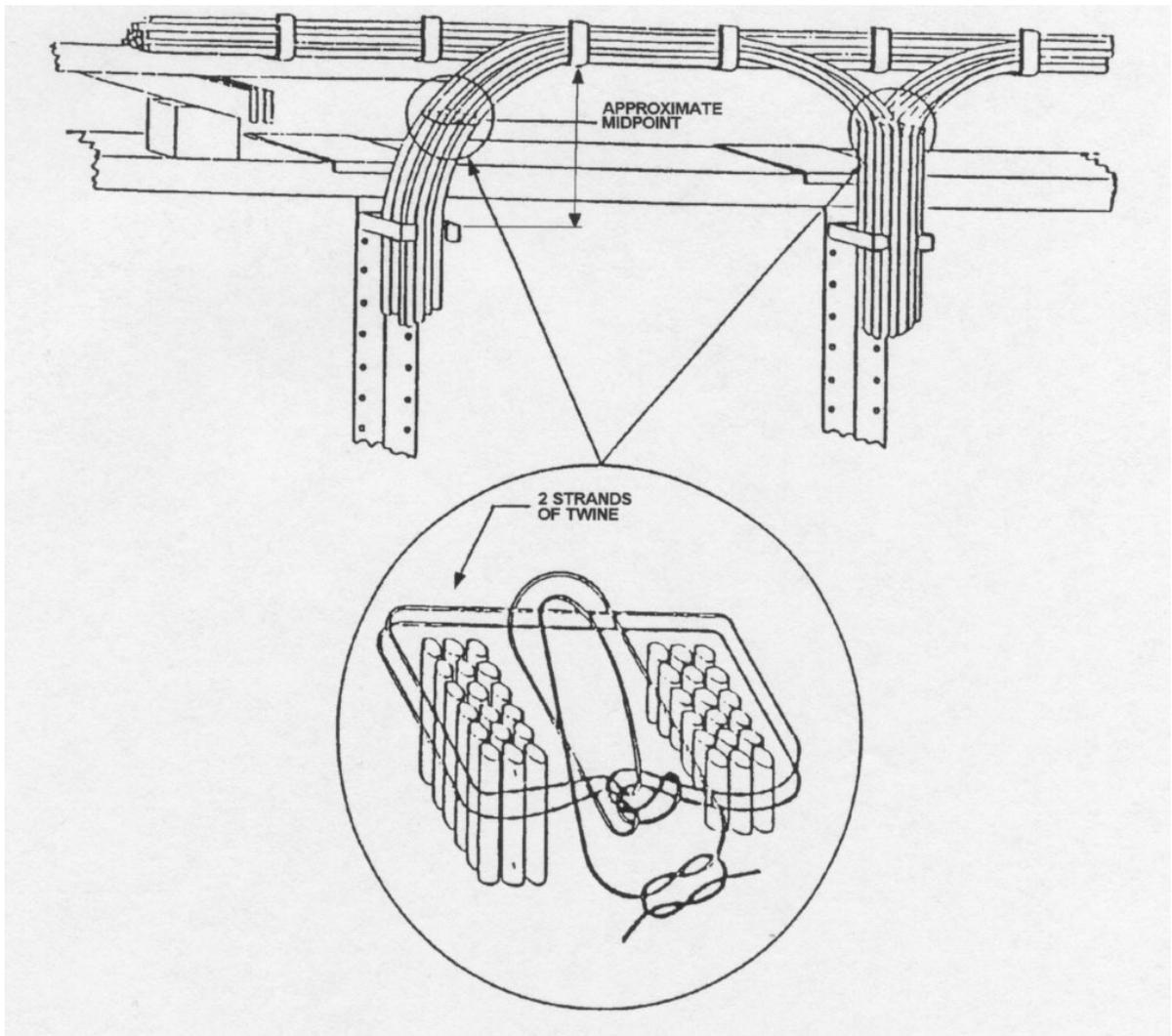
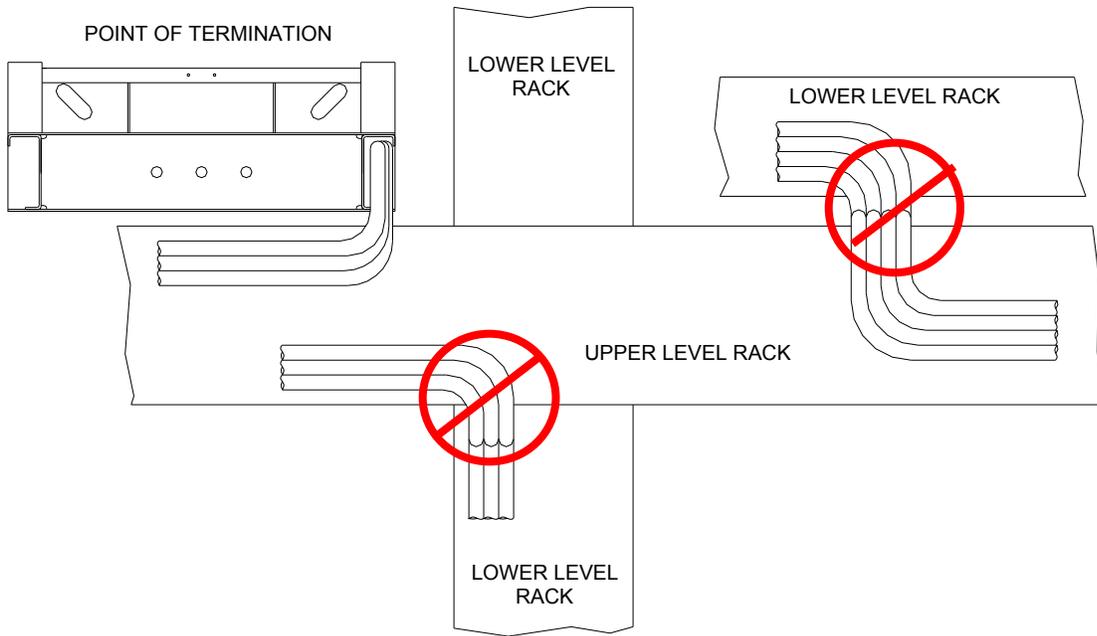


Figure J-7 Cable Routing Restrictions for Racks Installed At Different Levels



CABLE SHALL EXIT/WATERFALL OFF THE SIDES OF  
CABLE RACK AT POINTS OF TERMINATION ONLY.

EXCEPT FOR ATT-TP-76409 FIG. 6(F) ARRANGEMENT,  
CABLE SHALL NOT BE ROUTED BETWEEN VERTICALLY OFFSET  
RACKS AT CABLE RACK INTERSECTIONS OR ALONG THE LENGTHS  
OF PARALLEL CABLE RACKS THAT ARE AT DIFFERENT LEVELS.

**[END OF SECTION]**

**SECTION K -- WIRING AND CONNECTING**

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**TABLE K-1 – SUMMARY OF CHANGES IN SECTION K**

Change	Item in 09/08 Issue	Item in this Issue
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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&TIS 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, 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 Unterminated 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. The marking shall normally show on the bolt head, and carry through the washer and onto the connecting surface if visible for inspection; otherwise, the torque marking can be made on the nut, washer and onto the connecting surface, whichever is easiest for visible inspection.
- 2.2.5 Any connector drilled with two fastening holes shall be secured using both holes..

### **2.3. Reused Equipment**

- 2.3.1 Reused or relocated equipment that has wire wrap terminals which meet quality standards, but were soldered previously, shall be cleaned of solder so new solderless wire wrapped connections can be applied. 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&TIS 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. Coaxial Cable and Connectors**

- 3.2.1 Coaxial cable shall not be field spliced.
- 3.2.2 Only approved coaxial cable and connectors shall be used.
- 3.2.3 Only approved coaxial cable connector crimping tools with registered dies shall be used. Coax crimps shall be embossed with the vendor ID.
- 3.2.4 When stripping individual 734C and 735C coaxial cables for use with approved BNC type coaxial connectors, the Installation Supplier shall only use the connector's manufacturer-approved cable stripping device.
- 3.2.5 Pin height and continuity (for open and shorts) shall be verified on every installed coaxial connector.
- 3.2.6 There shall be no cracks or evidence of double crimps on the outer sleeve.

- 3.2.7 The crimped outer sleeve shall exhibit six flat surfaces with no fins or excessive rounding at the 60-degree corner bends.
- 3.2.8 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.
- 3.2.9 The ferrule shall be butted against the connector body.
- 3.2.10 The braided shield shall not be exposed at either end of the ferrule.
- 3.2.11 The Installation Supplier shall ensure that all coaxial connectors are locked.
- 3.2.12 All "F" type connectors shall be installed onto properly prepared non-rigid coax cables, such as RG-6 and RG-11, using manufacturer approved installation methods, instructions and tools unless superseded by specific ATT requirements.
- 3.2.13 All rigid Coax connectors shall be installed onto properly prepared rigid coax cables, such as .500 and .625, using manufacturer approved installation and cable preparation methods, instructions and tools unless superseded by specific ATT requirements.
- 3.2.14 The Installation Supplier shall provide the manufacture's documentation and a list of the approved tools used to connectorize both rigid and non-rigid coax cables along with the required end to end test records in the Job Folder.
- 3.2.15 The installer of coaxial connectors shall be manufacturer or in-house certified every 3 years.

**3.3. Shield Connection**

- 3.3.1 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.
- 3.3.2 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.
- 3.3.3 Exposed shields of shielded cable shall be protected with two half-lapped layers of electrical tape or heat shrinkable sleeve.
- 3.3.4 On shielded switchboard cable, the drain lead shall be protected by applying a sleeve material.

**3.4. Quick-Connect (Punch Type Terminals)**

- 3.4.1 Only one wire shall be engaged in each terminal.
- 3.4.2 Conductors shall not be placed on deformed terminals.
- 3.4.3 Previously terminated wire ends shall not be re-terminated. Cut them off and use new ends.
- 3.4.4 Wire ends shall protrude 1/16 inch beyond edge of clipped terminal.
- 3.4.5 Wire ends shall clear adjacent metallic parts by 1/32 of an inch minimum.
- 3.4.6 Textile-insulated wire shall not be terminated in slotted beam terminals.

**3.5. Solderless Wire Wrapped**

- 3.5.1 Solderless 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.
- 3.5.2 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.
- 3.5.3 Wire wraps shall be made using the tool sized to the wire gauge.
- 3.5.4 On terminals that are not square, 26-gauge wire shall have a minimum of 8 turns.
- 3.5.5 Overlapped turns shall not be counted in the number of turns of a connection.
- 3.5.6 Wire of gauges 28, 30 or 32 shall have one wrap of insulation in addition to the required number of wraps.
- 3.5.7 All connections not meeting the requirements of Figure K-2 shall be reskinned 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.
- 3.5.8 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.
- 3.5.9 The Installation Supplier shall not solder 26 through 32 gauge wire.
- 3.5.10 Exposed uninsulated wire (shiner) shall not exceed  $1/8$  inch.
- 3.5.11 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.
- 3.5.12 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.
- 3.5.13 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&TIS 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 ring-type terminal connector 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 DC power leads.

4.4.5 Mechanical "H" taps shall not be used on DC power leads.

4.4.6 The preferred method of interconnecting two cables is compression-type barrel or reducing splice using manufacturer recommended die. However, H-Taps may be used and shall be crimped with the manufacturer recommended circular die. H-taps with side taps may be used, and the side taps do not require a filler (a section of bare wire of the appropriate size); however, the branch requires a filler if not used.

4.4.7 All power cables shall be stitched in the following manner when power transition devices (H-taps, butt 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 installed on power cable shall be placed between cable rack straps, and shall not be adjacent to each other, but staggered, so the heat shrink or clear cover shall be against cable insulation.

4.4.9 Transitional devices shall not be placed inside power bays, BDFBs or other power distribution bays.

4.4.10 In-line reduction (barrel) taps shall be used in preference to H-taps where possible to reduce cable build-up on the cable racks

4.4.11 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-76301 for proper performance criteria.

- 4.4.12 All battery and battery return connections shall be torqued to battery manufacturer's specifications.
- 4.4.13 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.
- 4.4.14 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).
- 4.4.15 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.
- 4.4.16 All bus bar power connections shall be installed per ATT-P-05100-E.
- 4.4.17 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.
- 4.4.18 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 lead-acid 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.
- 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.):
- a) shall be installed to different load supplies on the BDFB/SPDU; if there is only a two-load BDFB/SPDU available in the area, the loads shall be split with at least one on each load supply keeping the BDFB/SPDU load balanced as close as possible
  - b) shall maintain separate primary protection device integrity throughout the circuit unless an AT&T technical drawing supersedes this requirement.
- 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&TIS 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 ( $\leq$ ) #2AWG. Power cabling to a 5/16-18 connection stud

on a TP158HC (TPL) or other type Fuse Disconnect shall be up to ( $\leq$ ) 2/0AWG. (Torque requirements for 1/4-20 connections = 72in.lb.; Torque requirements for 5/16-18 connections = 132in.lb.)

- 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

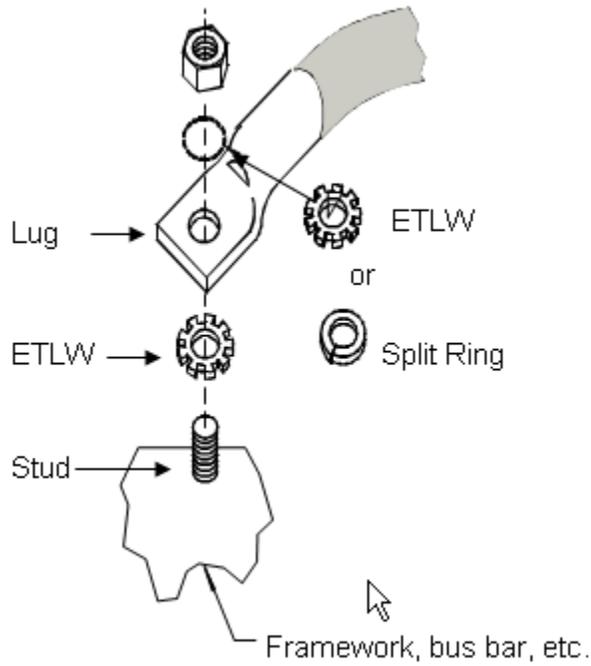
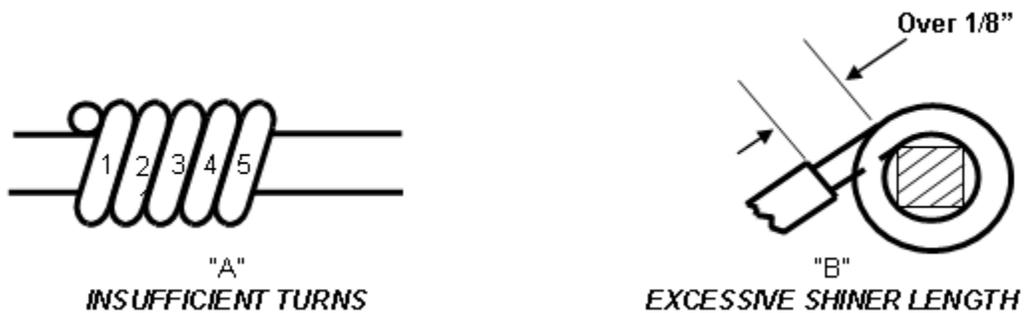


FIGURE K-2-- SOLDERLESS WIRE WRAPPED CONNECTIONS

FIGURE K-3 – SOLDERLESS WIRE-WRAPPED CONNECTIONS

FIGURE K-4--SOLDERLESS WIRE WRAPPED CONNECTIONS DEFECTS



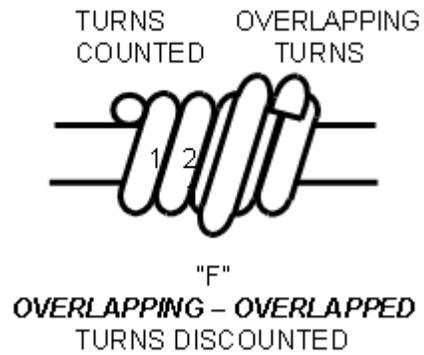
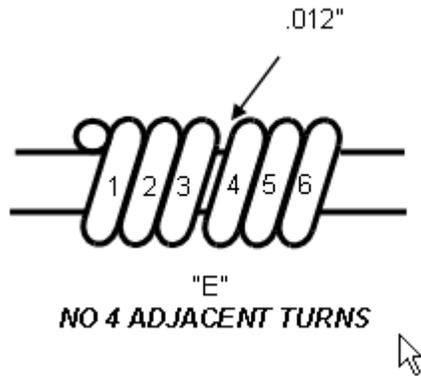
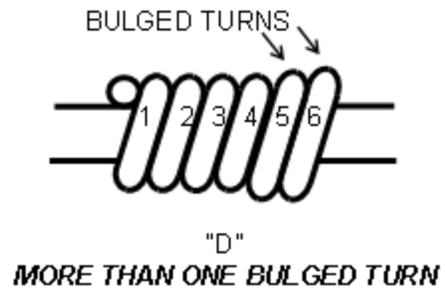
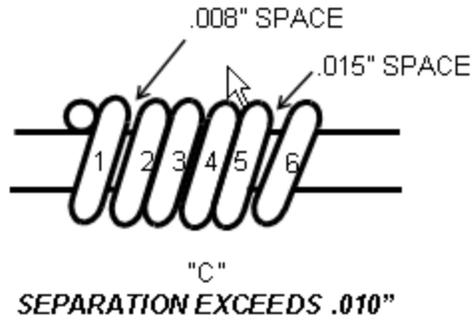
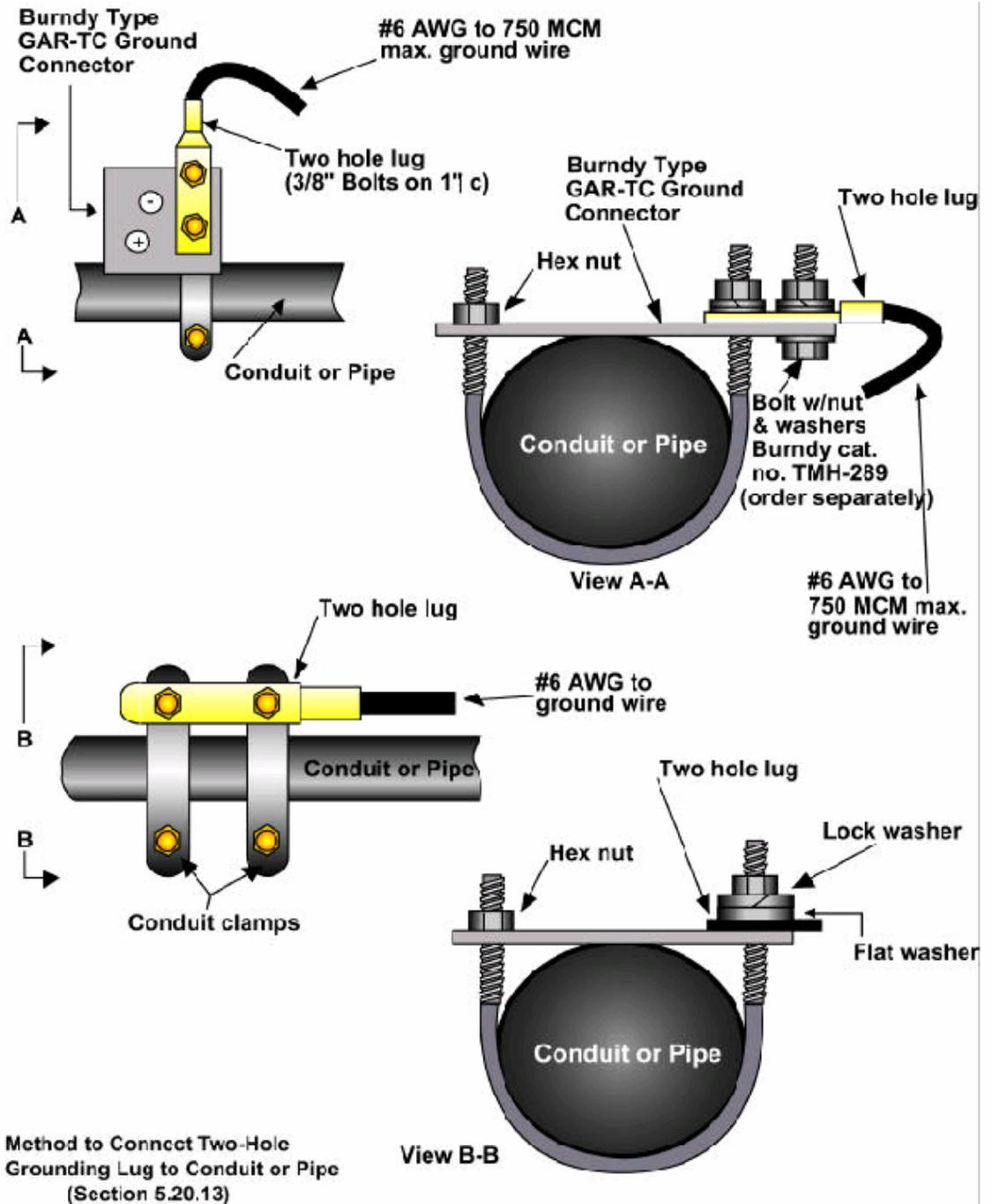


Figure K-5 - Pipe Ground Connector



**[END OF SECTION]**

**SECTION L -- DESIGNATION REQUIREMENTS**

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**TABLE L-1 – SUMMARY OF CHANGES IN SECTION L**

Change	Item in 09/08 Issue	Item in this Issue
Revised	1.2.9i, 2.3.15	1.2.9i, 2.3.15
Deleted		
Added	2.3.16	2.3.16

**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&TIS 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 contains requirements for and the description of the different classes of equipment designations.
- 1.1.4 It is required that all equipment, or groupings of equipment, frameworks or AT&T required assemblies, shall be stamped or labeled with a code or designation. If complete designation information is not provided, the Installation Supplier shall contact the AT&TIS representative to determine the required designation.
- 1.1.5 Changes in this issue of Section L are summarized in Table L-1.

**1.2. Requirements**

- 1.2.1 The Installation Supplier shall clean the surface to be designated. If necessary, wipe the surface using a clean rag and a non toxic cleaner, to remove any dust or oil that may be present, and touch up the painted surface with appropriate (type and color) paint.
- 1.2.2 All designations shall have the correct information, be at the proper location, legible from a normal distance and viewing position, the proper color, and conform to the existing office designation pattern.
- 1.2.3 All designations shall be sized per Table L-3.
- 1.2.4 When it is necessary to reduce the expected size of a designation due to insufficient space, the Installation Supplier shall use the largest size lettering that will fit in the designated area.
- 1.2.5 All designations shall be properly aligned and spaced.
- 1.2.6 Designations shall not be hand written.
- 1.2.7 Stamping or labeling is the only approved method for designating equipment.
- 1.2.8 DESIGNATION TAGS
  - a) Preformed stamped fiber material that measures  $\frac{3}{4}$ " to 1" wide, by  $1\frac{1}{4}$ " to  $1\frac{3}{4}$ " in length with rounded corners and a  $\frac{1}{4}$  inch hole at one end equipped with a ring. Ring shall be removed and tag shall be affixed with multi-strand waxed cord at a termination point to identify the far end termination. Typically referred to as a 145 type tag and/or 145 type number plate as listed on the Minor Material list.
  - b) Designation tags shall be installed so they are visible; not located under covers or heat shrink.

- c) Designations on tags shall be sized to allow for all information needed but shall be no smaller than 1/8 inch. Both sides of the tag can be utilized. (Refer to Table L-4 for Requirements)

**1.2.9 DESIGNATION MARKERS**

- a) Designation markers shall be 1/2 to 1 inch in width tape, not to exceed 3 inches in length
- b) Cable, wire or fiber patch cord < 1/4 inch diameter shall be designated using a flag style marker.
- c) A designation marker shall not overlap itself.
- d) Multi-strand waxed cord shall not be used to affix a marker.
- e) Designations on 3/4 to 1 inch markers shall be sized to allow for all information needed but shall be no smaller than 1/8 inch. (Refer to Table L-4 for Requirements)
- f) Designations on 1/2 inch markers shall be sized to allow for all information needed but shall be no smaller than 3/32 inch. (Refer to Table L-4 for Requirements)
- g) A designation marker on 1/2 inch tape shall have no more than 2 lines of information.
- h) Designation markers shall be installed so they are visible and legible.



- i) Longitudinal Markers
  - 1. Cables identified with longitudinal markers shall have two longitudinal markers at each end. The first marker with the near end information shall be placed closest to the connection point, followed by the second marker with the far end information.
  - 2. Longitudinal markers shall have the information printed three times and positioned so that the information can be read without having to twist the cable.
  - 3. Longitudinal markers shall be of a self laminating type to prevent the label from peeling. If the marker cannot be placed in a manner to keep it from peeling, the marker shall be protected with clear heat shrink.
- j) Flag Markers (Refer to Figure L-2)
  - 1. Flag markers shall not exceed 3 inches in length from the cable to the end of the flag.
  - 2. No adhesive surface shall be exposed once flag markers are affixed.
  - 3. Flag markers shall only have the designations stenciled on the non-adhesive side.
  - 4. Flag markers shall not be affixed to 900 micron fiber cable break outs.
  - 5. Flag markers shall be affixed to fiber cable break outs larger than 900 micron.
  - 6. Flag markers shall be affixed to fiber jumpers.

**1.3. Stamping**

1.3.1 Stamping shall be accomplished using a rubber stamp of the appropriate size.

1.3.2 The following color patterns for designations shall be used:

- a) Black characters on light colored surfaces
- b) White characters on dark colored surfaces
- c) Red characters for Caution notices

1.3.3 All lettering and numbering shall be neat, properly aligned and applied using the correct amount of ink without smudging.

1.3.4 Rub-on stencils are not acceptable on terminal strips or frame blocks.

1.3.5 All stamped lettering and numbering shall be coated with clear shellac.

#### **1.4. Labeling (Refer to Figure L-3)**

1.4.1 Label identification and designation for all batteries, battery racks, primary power equipment and associated 145 type tags located in the power room or power plant vicinity shall be done with manufacturer recommended labeling or stamping. The labeling shall be applied as to adhere for the life of the equipment and use color stable, high contrast lettering. Stamping is also an approved method as required by AT&TIS.

1.4.2 All labels shall be on clear, black or white backing, or as manufacturer provides. Lettering shall be black or white, in contrast to the backing.

1.4.3 Labeling shall not be placed where they are exposed to repeated physical contact.

1.4.4 When applying a label to a textured or smooth surface, a piece of plastic or rubber shall be used to press the label to conform to the textured surface. This can be visually verified when the label changes from a slight haze to a clear finish.

1.4.5 Labels shall be placed so that they do not peel or lift but remain permanently affixed.

1.4.6 Labels shall not be utilized to augment existing stamping. The Installation Supplier may either add the new information with a stamp or remove all of the existing designation and replace it with a new label. On equipment units including end guards, consistent labeling or stamping shall be done on a line-by-line basis.

1.4.7 If adhesive labels are provided by the manufacturer, the Installation Supplier shall verify that the information shown is correct.

1.4.8 The use of thermal transfer technology tape systems is limited to applications on smooth, nonporous surfaces. This tape shall not be used on ripple-finished surfaces or any other irregular surfaces.

1.4.9 All DC chassis shall be designated with a DC source power label. (See Figure L-10)

## **2. EQUIPMENT TYPES**

### **2.1. Common Items**

2.1.1 The front and rear of frames and bays shall be designated with the bay number.

- 2.1.2 The front and rear of equipment shelves and panels shall be designated with name and number.
- 2.1.3 When designation cards are furnished for the top of the bay, the bay name and number shall be placed on the designation cards.
- 2.1.4 When bay designation cards are not furnished, the bay designation shall be placed on the base cover if it is not blocked from view by equipment. If the bay designation cannot be placed on the base cover; it shall be placed on the left upright between 4½ and 5½ feet above floor.
- 2.1.5 The Installation Supplier shall verify that all plug-in units provided with the equipment being installed are equipped with bar code labels that provide for the automatic identification of the unit. The labels shall not be damaged and shall be located so that the bar code can be electronically scanned when the plug-in is in its in-service position. No markings shall be placed over the bar codes.
- 2.1.6 Except in power rooms, aisle end guards shall be designated to indicate all equipment bays in the line up in order of appearance whenever one or more bays are added or removed in the line up. Manufacturer's end guard designations shall be utilized when provided.
- 2.1.7 Dedicated cable racks reserved for specific purposes (power, unfused power cable, fiber optics, etc.), except switching equipment cable racks, shall be designated.
- a) Designations shall be placed on the outside of both stringers at the beginning, end and at intervals not to exceed 10 feet on horizontal cable rack.
  - b) These designations shall specify the purpose for which the cable rack is dedicated, followed by the word "ONLY" (e.g., Power cable only, unfused power cable only, fiber optic cable only, etc.).
  - c) Designations shall be made 4½ to 5½ feet from the floor on vertical cable rack. If the cable rack is dedicated to fiber optics and is yellow or orange, the cable rack need not be separately identified..
- 2.1.8 The year the job completed, the P/A Oracle Number and the Installation Supplier's name, in that order, shall be stamped or labeled on the front of all new equipment units on the left side. If space does not permit the placement of this information on the front of the unit, then the information may be placed on the frame upright adjacent to the equipment unit. The P/A Oracle Number may be placed only once on a fully equipped bay. If placed only once on a fully equipped bay this information shall be placed on the top left or bottom left upright of the bay. It shall be placed on each unit of a partially equipped bay. The designation format shall be as in this example: '03 1070598 ABC. Distribution frame blocks and other minor items do not require the placement of a "Year Installed" and "P/A Oracle Number."
- 2.1.9 Equipment mounted in cabinets, or cabinetized racks that have removable doors, covers, or finishing details, shall have the designation stamped on both the cabinet framework, and the doors, covers, and finishing details. The designation shall be placed on the doors, covers, or finishing details in approximately the same location as it would be on the framework.

2.1.10 Flag markers with far-end termination details shall be placed on the unterminated end of wire that is reserved for future use.

a) Does not apply to intra-bay wiring (i.e. switchboard cable and p-wire, etc.)

**2.2. Information Services Equipment**

2.2.1 When communication panels are to be added, which are to be multiplied to an existing panel, the multiple destinations shall be designated on the rear of both the new and existing panels.

2.2.2 145 type tag(s), with far-end termination details (e.g., shelf/bay/DF block, circuit number, TRMT/RCV, etc.), shall be placed on the unterminated end of cables reserved for future use. (Refer to Figure L-4)

2.2.3 The Installation Supplier shall designate, on panels, equipped with labels, the near end and far end terminations for all conductors. Panels equipped without adequate labeling space shall be designated with the far end termination. See Table L-2.

2.2.4 The Installation Supplier shall designate on each conductor of all equipment bays or shelves, with a label, showing the near end and far end termination.

TABLE L-2

Service Type	Term Type	Minimum Label Requirements
DS1	84 Term Panel	Relay Rack / Panel / Jack (e.g. 0201.01 / 3 / 1 - 84)
DS3	24 Term Panel	Relay Rack / Panel / Jack (e.g. 0201.01 / 3 / 1 - 24)
Fiber	72 Fiber Term Panel	Relay Rack / Panel / Jack (e.g. 0202.05 / 8 / 1 - 72)

**2.3. AC Power**

2.3.1 Power Service Cabinets (PSC's) shall be supplied from the House Service Panel and are used for building distribution loads.

2.3.2 Power Distribution Service Cabinets (PDSC's) shall be supplied from the House Service Panel and are dedicated to DC power plants.

2.3.3 Protected Power Service Cabinets (PPSC's) shall be supplied from the UPS or inverter systems and serve AC protected power network elements.

2.3.4 Foundation Distribution Cabinets (FDC's) shall be supplied from the UPS or inverter systems and serve AC protected power network elements.

2.3.5 AC building-type loads shall not be commingled with critical loads in PDSC's and PPSC's

2.3.6 Power Distribution Service Cabinets (PDSC's) and Power Service Cabinets (PSC's) shall be designated with name, number, voltage, phase and type of service, e.g., PWR DISTG

SERVICE CAB 101 200A 240/120V 1PH/ 3W FED BY PANEL "X - CB#," or PWR SERVICE CAB 101 200A 240/120V 1PH/ 3W FED BY PANEL "X - CB#," (Refer to Figure L-6)

- 2.3.7 Protected Power Service Cabinets shall be designated with the PPSC cabinet designation, UPS system number or inverter system, voltage and phase. The following shall also be designated in the same cabinet: CONTACT AT&TIS ENGINEER FOR ALL AC CIRCUIT ASSIGNMENTS IN THIS PANEL. #," (Refer to Figure L-7 and Figure L-8).
- 2.3.8 AC power service cabinet circuits shall be designated (labeled or stenciled, not handwritten) beside the circuit breaker or on the designation card with the location of the equipment being served and the circuit breaker amperage.
- 2.3.9 All hardwired AC powered equipment shall be designated with a 145 type tag (within six inches of the connection) with the location of power source and the circuit breaker number of the power source.
- 2.3.10 All AC outlets and light switches shall be designated with the location of the power source and circuit breaker number or inverter frame location. AC power strips with multiple outlets (such as those used with data mountings) shall be designated same as above once near the first outlet on the strip.
- 2.3.11 Voltage on all AC outlets shall be designated on or adjacent to the cover plate above the outlet for all voltages greater than 120 volts AC.
- 2.3.12 End guards for all aisle switches shall be designated adjacent to the switch with a direction arrow to indicate which aisle the switch controls.
- 2.3.13 All AC circuits originating in miscellaneous or building electrical panels (PSC's) shall be designated (labeled or stenciled, not handwritten) on the panel schedule card.
- 2.3.14 Inverter fed AC power service cabinets shall be designated with name, number, voltage and type of service, e.g., Protected Power Service Cabinets, PPSC CAB 001 208V AC 60 HZ 3PH 4W. The following shall also be designated in the same cabinet: CONTACT AT&TIS ENGINEER FOR ALL AC CIRCUIT ASSIGNMENTS IN THIS PANEL.. (Refer to Figure L-7 and Figure L-8)
- 2.3.15 All AC powered equipment shall have the power cords labeled at both ends with a 145 type tag. Designations shall include the near and far end information.
- 2.3.16 All 145 type tags shall be secured with multi-strand waxed cord, with a sufficient pigtail to allow the tag to be rotated for viewing. Tags equipped with metal rings shall have the ring removed. The tag size shall be between ¾" to 1" wide, by 1¼" to 1¾" in length.

## **2.4. DC Power**

### **2.4.1 Power Boards (PBDs)**

- a) All fuse and circuit breaker positions shall be designated with frame location, fuse/circuit breaker size, load, and, if applicable, fuse panel number or equipment unit.
- b) Fuse or circuit breaker numbers shall be designated on the front and back of the panel.

- c) The numbering scheme for existing PBDs shall be matched; new PBDs shall be numbered similar to BDFBs; bottom to top, left to right (viewed from the front of the PBD) starting with the first panel position as 1, fuse position 1, eg. 1.1. Panel positions shall be designated from bottom to top whether by inch or rack unit depending on the PBD manufacturer. On full panel distribution bays, if the panel occupies more than an inch or rack unit; the panel shall be designated with the number of the highest inch or rack unit, e.g., if a panel uses inches 1 thru 8 of the power distribution bay, it shall be designated panel number 8. If a split panel distribution bay, the panel positions shall be counted in odd increments on the left and even increments on the right. This numbering method shall keep PBD panels in sequence should a larger panel be replaced with smaller panels.

#### 2.4.2 Miscellaneous Fuse Bays and Panels

- a) The Installation Supplier shall designate fuse panels in a miscellaneous fuse bay with row designation in configurations with multiple fuse panels and voltage designation.

#### 2.4.3 Power Distribution Units (PDUs, i.e. Telect Fuse Panels)

- a) The Installation Supplier shall designate fuse panels in a single bay with row designation in configurations with multiple fuse panels and voltage designation.
- b) Fuse capacity pins shall be installed at all fuse positions that are designed to hold fuse capacity pins. The pins shall be color coded to match the fuse installed and located directly adjacent to the associated fuse. Where the fuse position is not designed for fuse designation pins, this information shall be designated on the fuse position of the fuse panel.
- c) The Installation Supplier shall ensure that miscellaneous bay mounted fuse panels have a fuse record book, fuse assignment card or plate mounted on the bay upright adjacent to the fuse panel.
- d) The Installation Supplier shall record equipment additions, amperages and fuse positions on the fuse designation card, record book, or bay mounted designation plate.
- e) Fuse record book covers shall be designated with "Fuse Record" and bay location.
- f) Fuse record card covers in PDUs shall be designated with the bay location and if applicable, the fuse panel number.
- g) The Installation Supplier shall stamp, label or type added circuits on fuse record book sheets with black ink, or use lettering guide with permanent black ink. A marking pen may be used.
- h) Correction fluid shall be used to remove circuit information from the fuse record book for circuits removed from fuse panels.
- i) The fuse record sheet shall be retyped after a maximum of 5 handwritten additions, removals or corrections. Replacing pages shall be of the same size as existing pages.

#### 2.4.4 BDFBs and Secondary Power Distribution Units (SPDUs)

- a) Alarm fuses in BDFBs/SPDUs not mounted adjacent to the discharge fuse shall be designated to associate them with discharge fuses.

- b) All fuse and circuit breaker positions shall be designated with frame location, fuse/circuit breaker size, load, and, if applicable, fuse panel number or equipment unit.
  - c) Fuse or circuit breaker numbers shall be designated on the front and back of the panel.
  - d) At the BDFB/SPDU, power load (e.g., A, B, C or D) shall be designated on the shelf (panel).
  - e) The Installation Supplier shall designate on the front of the BDFB/SPDU (under meter, if applicable) the size and location of the primary fuse or circuit breaker feeding the BDFB/SPDU. (See AT&T Drawing ATT-P-05410-E for an example of the labeling designation.)
  - f) The actual engineered voltage drop at the BDFB/SPDU (1-way, battery to BDFB/SPDU) shall be designated on the BDFB/SPDU near the power board designation.
  - g) BDFBs/SPDUs shall be numbered from bottom to top, starting with "1." On horizontal panels the count will start at the bottom left and go to right. Each fuse position shall be designated with its panel and fuse position number, e.g., 2.15 (fuse panel 2, fuse position 15). See AT&T Power Drawing – ATT-P-05400-E for specific BDFB/SPDU designation requirements
  - h) External BDFB/SPDU battery return bus shall be stamped with the BDFB designation and the hole position numbers (first, every fifth, and last, on each bar).
- 2.4.5 Bus bars outside the power plant area shall be designated with potential and group designation (such as "-48V Load A," "Battery Return," etc.) in 3/4-inch lettering.
- 2.4.6 Battery Racks
- a) The battery rack shall be designated with:
    - 1. Voltage and String ID
    - 2. Battery cell manufacturer, model and capacity
    - 3. Battery manufactured date
    - 4. Date installed
    - 5. P/A Oracle Number, and the Installation Supplier's name
    - 6. Battery rack manufacturer and model number
  - b) The designation shall be placed on the right side of the rack upright or shelf as to match existing applications where applicable; if the right side of the rack is against the wall, the front of the upright shall be used. (See Figure L-11)
  - c) All characters shall be 3/8 inch, with the exception of string identification which shall be 3/4 inch.
  - d) The battery stand shall be designated to indicate the selected pilot (P) cell and the position number of each cell.

**2.5. 145 Tag Requirements for DC Power** (Refer to Figure L-9)

- 2.5.1 All 145 type tags shall be secured with multi-strand waxed cord, with a sufficient pigtail to allow the tag to be rotated for viewing. Tags equipped with metal rings shall have the ring removed. The tag size shall be between  $\frac{3}{4}$ " to 1" wide, by  $1\frac{1}{4}$ " to  $1\frac{3}{4}$ " in length.
- 2.5.2 Except as noted below, the Installation Supplier shall place 145 type tags or equivalent, with the far end designation, on all battery and battery return leads. For leads connected to the battery return bus bar, the associated fuse number shall also be designated on the 145 type tag.
- a) When a network element is installed in a bay and the battery and battery return leads run to a fuse panel within the same bay, the Installation Supplier shall update the fuse designation card indicating designation of shelf. 145 type tags or equivalent are not required on battery and battery return leads at the network element or fuse panel.
  - b) When a network element is installed in a bay and the battery and battery return leads run outside the bay to a fuse panel in a different bay, the Installation Supplier shall place 145 type tags or equivalent on the battery and battery return leads at the rear of the network element showing far end designation. When battery and battery return leads utilizing 16 gauge or smaller wire, one 145 type tag can be used for both leads. 145 type tags or equivalent are not required at the fuse panel if the fuse panel is equipped with designation card. Update the designation card
- 2.5.3 Any un-terminated ends of power cable shall be equipped with a 145 type tag designating the far end termination.

**2.6. BITS Shelves**

- 2.6.1 Building Integrated Timing Supply (BITS) shelves shall be designated in accordance with AT&T Standard Equipment Drawings.
- 2.6.2 Shelf labels shall be placed on the front face panel of the BITS shelf in accordance with Table L-3.
- 2.6.3 Designation markers for "far-end identification" shall be placed on the cable 2 to 6 inches from the butted end of the cable at both the BITS end of the circuit and at the network element end of the circuit. (Refer to Figure L-2)
- 2.6.4 All cable markers shall be white with black letters.
- 2.6.5 The Installation Supplier shall type, stamp, or label (never handwritten) all designations on the designation markers and in the BITS record book.
- 2.6.6 "P" or "S" shall indicate Primary and Secondary designations. Primary is equal to Lead A, Secondary is equal to Lead B.
- 2.6.7 The designation marker at the network element shall contain the far end terminating location of the BITS shelf including the bay, shelf, slot, port, and primary or secondary. (Refer to Table L-4)

2.6.8 The designation marker at the BITS shall contain the far end terminating location. For a single timing lead to an entire bay (i.e. D4, SLC 96 bays etc.), the bay location designation is sufficient. If multiple leads are supplied for timing within a single bay (i.e. SONET ADMs, SLC SERIES 5 bays etc.), each termination shall be individually addressed. SONET ADM designations shall include the bay and shelf locations.

2.6.9 The Installation Supplier shall designate in the BITS record book the far end termination. If a database record is placed as the designation in the BITS record book, it shall be fastened in the book using the securing screws of the book. Plastic pouches and sleeves shall not be used. If a BITS record book is not available, the Installation Supplier shall request the record book from the DESP.

## **2.7. Grounding Designations**

2.7.1 The Installation Supplier shall place 145 type tags or equivalent on ground cable terminations; however, grounding conductors do not require identification of short runs when both ends are clearly visible from a point on the floor. The tag shall be designated to show the far end termination.

2.7.2 The Installation Supplier shall designate bars associated with the CO grounding system or isolated bonding network with the functional designation of the bar in 3/4-inch lettering. This includes the CO Ground Bar, Main Ground Bar (MGB), Office Principal Ground Point Bus (OPGPB), etc., and collection bars or splice plates such as Common Bonding Network (CBN) collection bar, Integrated Ground Splice Plate (INGSP), Frame Bonding Equalizer (FBE), etc. A sign at the bus bar may be used instead of stamping at the discretion of AT&TIS.

2.7.3 The MGB shall be identified with minimum 3/4" letters by way of stenciling or a designation plate. The designation shall be located so that it is easily visible from the floor. The designation may be directly on the bus bar or on the supporting cable rack or ironwork adjacent to the MGB.

2.7.4 The MGB portion of battery return bars shall be identified using stenciling or an identification plate. Lines and arrows shall also be used to identify the boundaries of the MGB.

2.7.5 The Installation Supplier shall designate the CBN side of the MGB with "Common" and the isolated side of the MGB with "Isolated". A separation line shall be designated on the MGB to delineate the two sides.

2.7.6 The terms used in designations for IS POP/VHO GRD bus bars shall be either "POP/VHO GRD", "POP GRD", "VHO GRD". For OPGP bus bars, the terms used in the designations shall be "OPGP", "O.P.G.P." or "Office Principal Ground Point". Terms such as "Telco Ground" or "Telephone Ground" shall not to be used.

2.7.7 Certain CO grounding system conductors shall be equipped with a brass or plastic laminate tag with the phrase "**DO NOT DISCONNECT**" designated on the tag. The letters shall be 3/16" minimum. The following conductors shall always be equipped with this tag:

- a) Conductors from earth electrodes
- b) Grounding conductors at a water pipe

- c) Grounding electrode conductors from a house service panel or other source of a separately derived system (transformer, UPS, etc.)
- d) Horizontal equalizer connections at a bus bar
- e) Vertical equalizer connections at a bus bar
- f) Both ends of a power plant's DC system grounding conductor
- g) Both ends of grounding conductors between a protector frame and an office bus bar.

### **3. FIBER OPTIC LASER WARNING LABELS**

#### **3.1. Requirements**

- 3.1.1 Manufacturer supplied fiber optic warning labels shall be applied to the equipment per manufacturer's specifications.

### **4. OTHER DESIGNATIONS**

#### **4.1. DSX**

- 4.1.1 Digital system cross connect (DSX) panels shall be designated on the front of the panel with network element connection information as leads are terminated on the panel (not required on rear). At a minimum, the following information shall be provided on designation strips of the DSX panel:
  - a) Frame/module name and number or relay rack number.
  - b) Circuit number
  - c) Jack positions shall be labeled with the first, last, and at least every fifth jack with its associated circuit number within the group.
  - d) On DSX-3 panels, one designation area shall be reserved for AT&TIS use.
  - e) Place a circuit limit designation (brackets) when designating frame terminal strips or DSX jacks. This designation shall indicate the beginning and end of circuit terminations. It shall also be used to separate group, sub-group, functional and numeric designations.

#### **4.2. FIBER**

- 4.2.1 Fiber distribution frame shelves shall be designated according to manufacturer's specifications.
- 4.2.2 If the manufacturer does not provide designations, the fiber terminations will be identified every 6 couplers top to bottom i.e. 1-6, 7-12 etc. left to right on the front and right to left on the rear of the shelf covering the full count of the shelf.

- 4.2.3 Fiber optic termination panels (FOT) and fiber Termination panels (FTP) shall have far end termination designations placed on the following.
- a) Manufacturer provided assignment card, or
  - b) Manufacturer provided assignment label on the front of the panel.
- 4.2.4 Underminated fiber optic conductors, either individual patch cords or 2mm cable breakouts at the network element shall have both near and far end termination information placed as a flag style marker on each individual conductor.
- 4.2.5 All terminated fiber conductors shall be marked with a flag style marker at both ends with near and far end designation information.

**4.3 Cable Hole Designations**

- 4.3.1 Through Penetrations shall be uniquely identified as follows;
- a) The cable hole designation shall be stamped on the top steel cover(s) and face of sheathing channel of floor openings.
  - b) The cable hole designation shall be stamped on the covers and walls on both sides of wall openings. Where multiple covers are involved all covers shall be stamped.
  - c) Cable hole designations shall be centered horizontally approximately 2 inches from front edge of cover (bottom edge of wall covers).
  - d) Designations on cable hole sheathings shall be centered horizontally just below the top of the sheathing assembly.

Note: Cable hole numbering conventions can be found in Section 4 of ATT-TP-76401

TABLE L-3-- SIZES OF CHARACTERS (inches) FOR COMMON APPLICATIONS ON FRAME AND RACK-MOUNTED EQUIPMENT

<b>CHARACTER SIZE REQUIREMENTS IN INCHES</b>			
Refer to paragraph L1.2.4 if requirement cannot be met.			
Designation Location	Size	Designation Location	Size
Aisle End Guards	3/4	H MDF	
RR/Bay Designations	3/4	Terminal Covers - Outer	3/8
Bay Name (OC 48, D4 CXR etc.)	3/8	Terminal Covers - Inner	1/8
Equipment Designations		Cable Racking (Power Cable Only, etc.)	3/4
Shelf/Panel/Unit Numbering/Lettering	3/8		
CLEI Codes	3/8	Fiber Protection System	3/4
Far End Cabling information	3/8		
Fuse Panel Assignments	3/16	AC Assignments	
		PSC, PDSC, PPSC	3/8
		Outlet / Switches	3/8
BDFB, PBD, PDB, PDF etc.		AC Panels	1/4
Fuse Position	3/8	Light Switch Aisle Arrow (length)	3/4
Fuse Assignments	3/8		
Panels	3/8	Battery Stands	
		String ID and Voltage Designation	3/4
145 type Tags (see Para 1.2.8c for more info)	1/4	Number of Cells	3/8
		Battery Manufacturer or Model	3/8
DSX Panels		Battery Manufacture Date	3/8
Shelf Designations	3/8	Date Installed	3/8
Slot Assignments	1/4	Battery Rack Manufacturer and Model Number	3/8
VMDF		Year Completed, P/A Oracle number, Supplier Name	3/8
Term Board	3/4		
Cable Heading	1/4	Cable Hole Cover, Sheathing, Wall	3/4
Terminal Covers - Outer	3/8		
Terminal Covers - Inner	1/8	Clock Assignments	3/16

**TABLE L-4 TAG & MARKER REQUIREMENTS**

	<b>Tag or Marker from Relay Racks (far end terminations)</b>	<b>Tag or Marker from Distributing Frame or Power Source</b>
Line 1 Front	Eq Type (i.e. LGX) – Floor Aisle and Bay	Frame Name (FR)
Line 2 Front	Shelf (SHLF) or Panel (PNL)	Block Location (BLK)
Line 3 Front	(If Required) – Slot (SLT), Card(CR)	Pair Count (PR)
Line 4 Front	Fuse (FS) or Return (RTN), Jacks (JK), Ports (PRT), Transmit (TX) or Receive (RX) (TX & RX are required)	Fuse (FS), Battery (Batt) or Return (RTN),
Line 1 Rear	CLEC ACNA	CLEC ACNA
Line 2 Rear	CLEC CLLI-11	CLEC CLLI-11

**Note:** A marker of ½" tape can only have 2 lines of information

FIGURE L-2

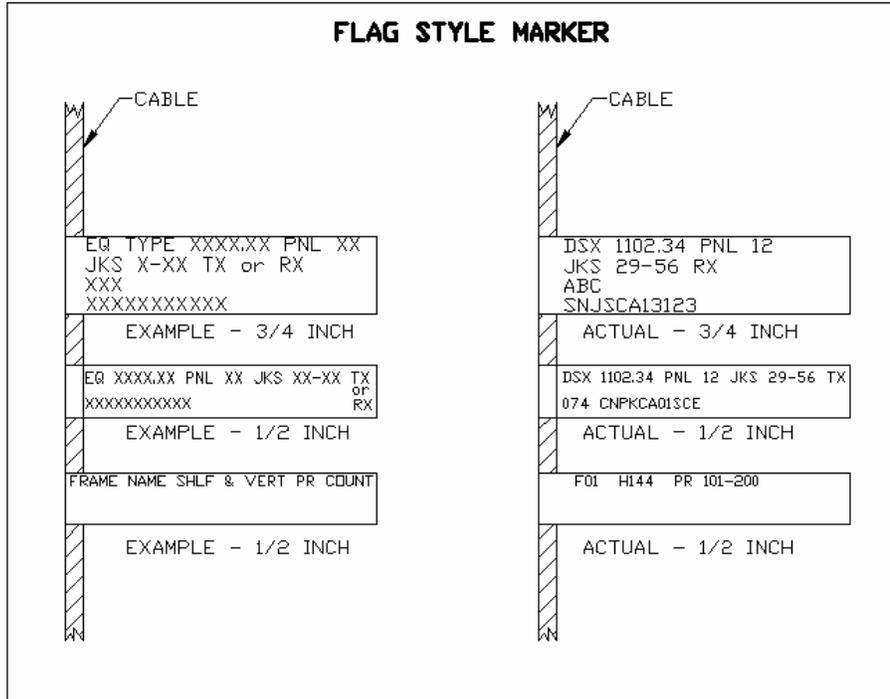


FIGURE L-3

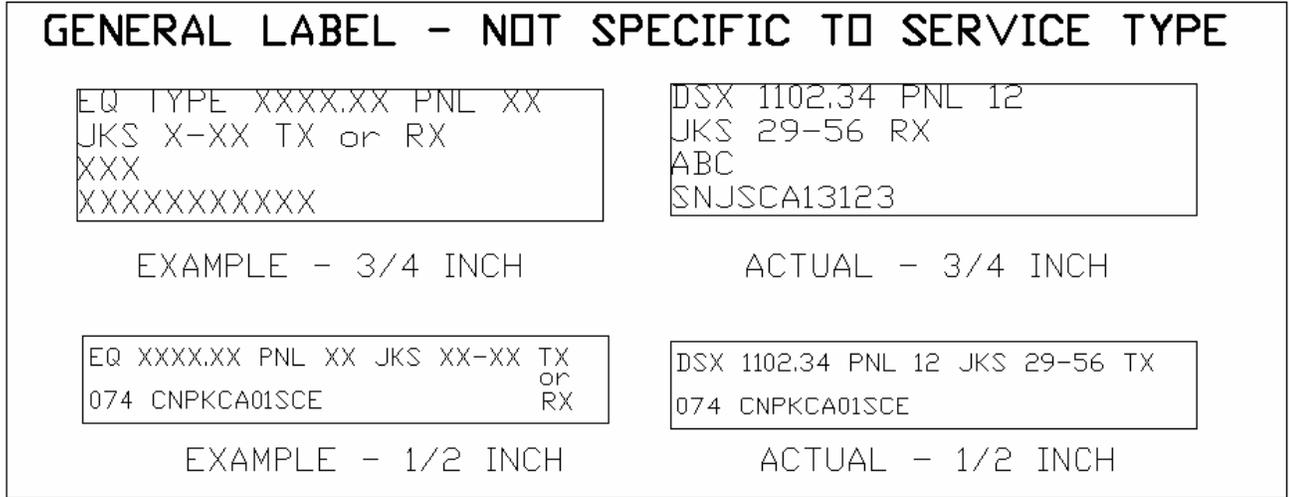


FIGURE L-4

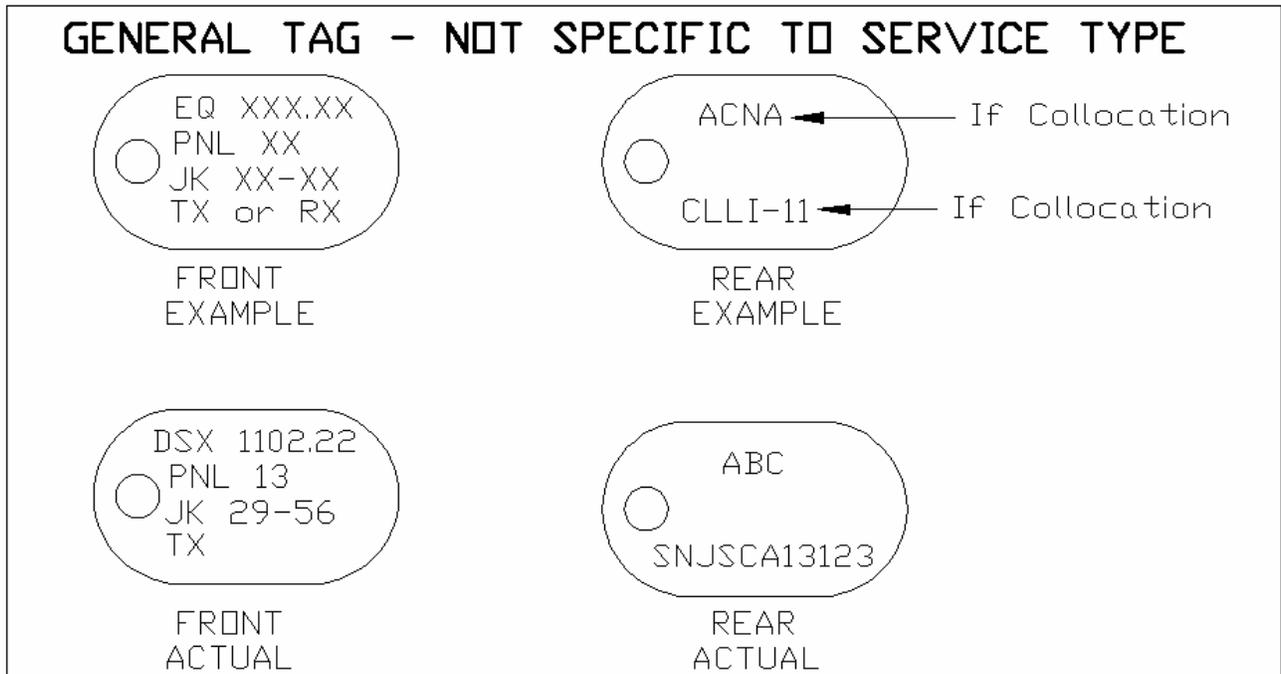


FIGURE L-5

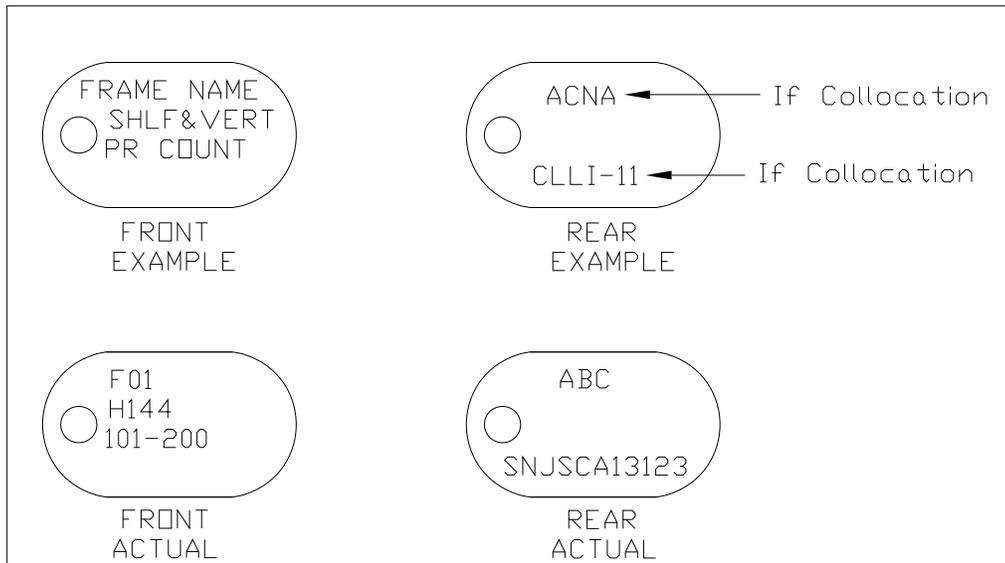


FIGURE L-6

POWER SERVICE CABINET LABEL EXAMPLE

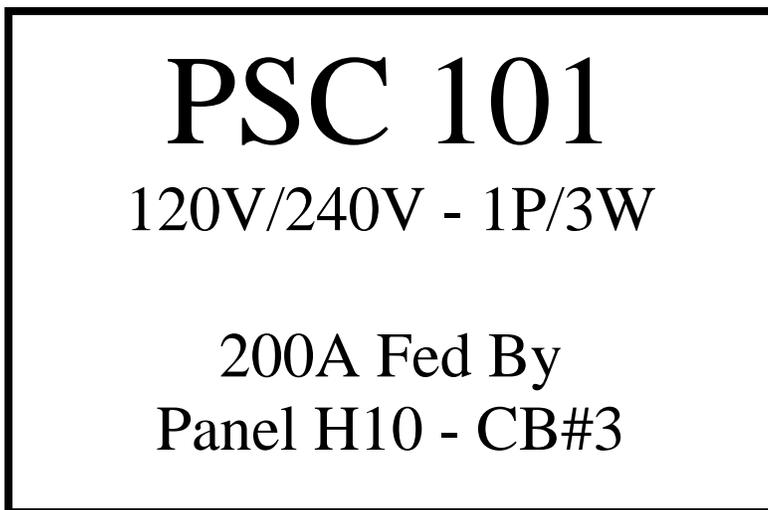


FIGURE L-7

PROTECTED POWER SERVICE CABINET LABEL EXAMPLE

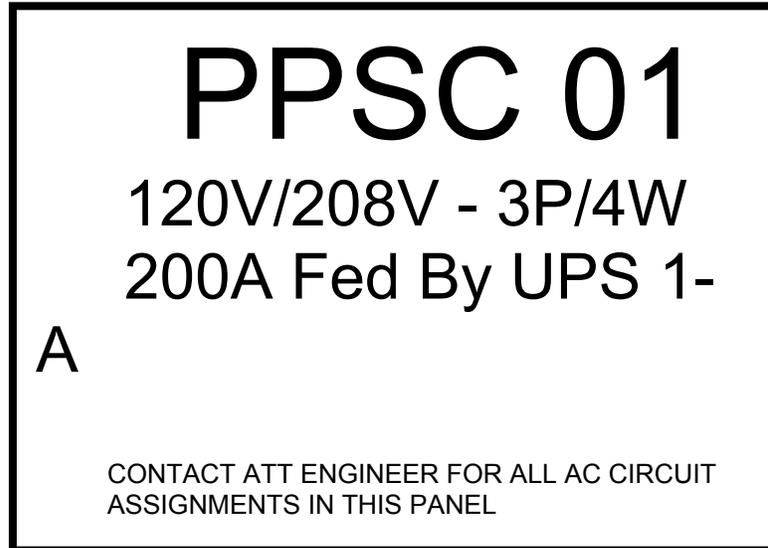


FIGURE L-8

PROTECTED POWER SERVICE CABINET LABEL EXAMPLE

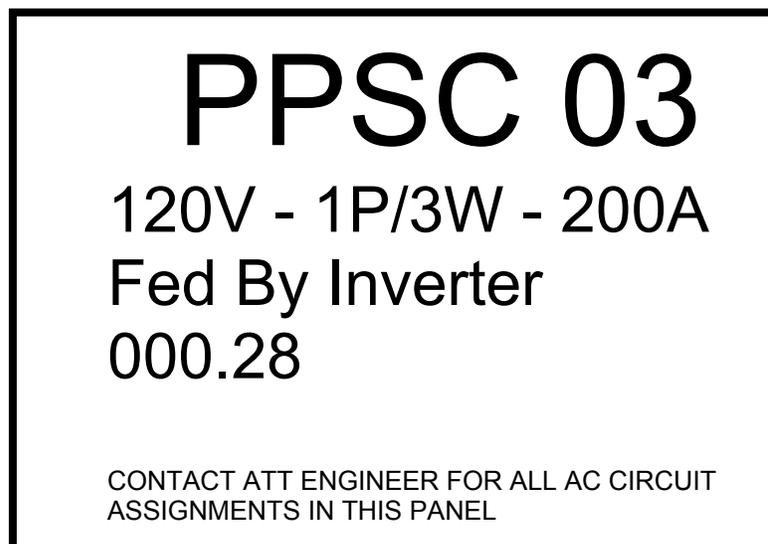


FIGURE L-9

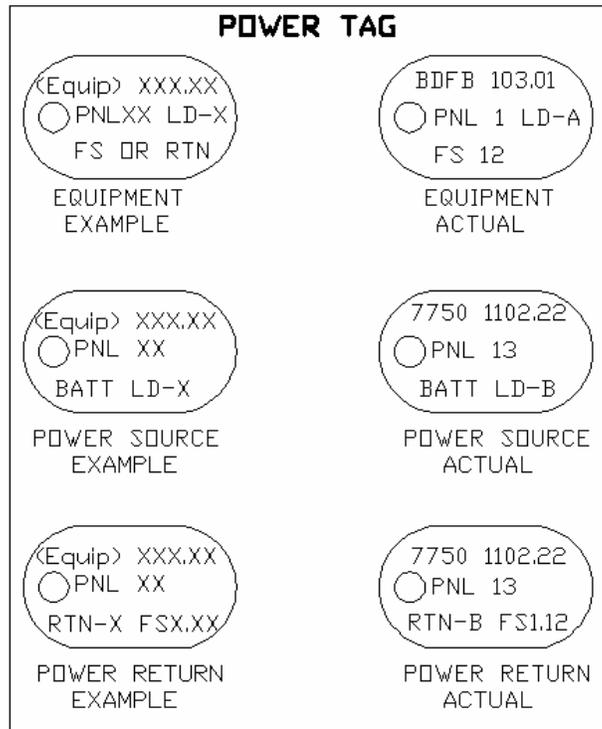


FIGURE L-10

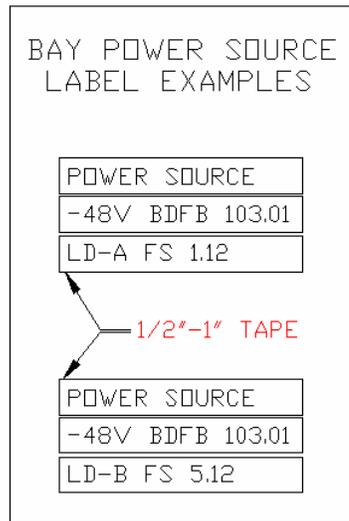
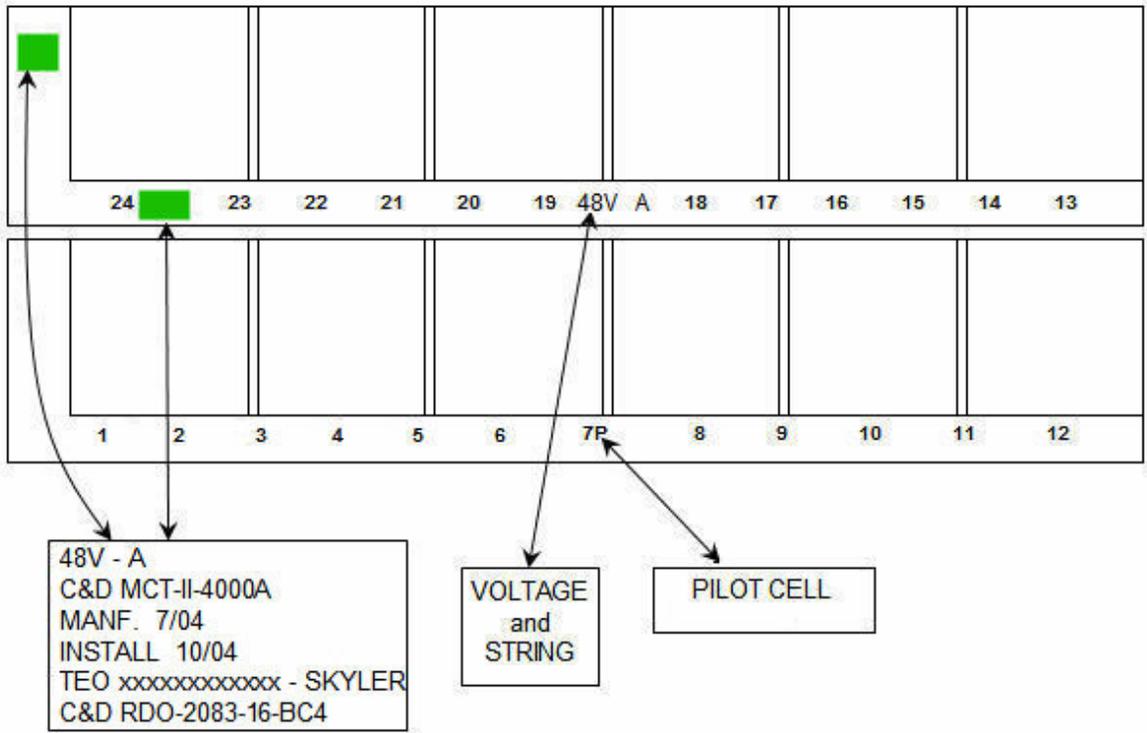


FIGURE L-11  
Battery Stand Installation Markings



**[END OF SECTION]**

**SECTION M -- POWER**

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**TABLE M-1 – SUMMARY OF CHANGES IN SECTION M**

<b>Change</b>	<b>Item in 09/08 Issue</b>	<b>Item in this Issue</b>
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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&TIS 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 general requirements for the installation of power equipment and associated systems.
- 1.1.4 Changes in this issue of Section M are summarized in Table M-1.

**1.2. General Requirements**

- 1.2.1 The Installation Supplier shall use copper bus bars and any deviations must be approved by the AT&TIS Equipment Engineer.
- 1.2.2 The Installation Supplier can reference the specific installation requirements for battery, return, and bus bar hardware connections that are listed in AT&T Power Drawing – ATT-P-05100-E.
- 1.2.3 The Installation Supplier shall verify (with a multi-meter) the absence of voltage on the battery and battery return leads before connecting the leads. That is, when two conducting parts are to be landed, there shall be less than or equal to 0.05V between them.
- 1.2.4 The Installation Supplier shall verify (with a clamp-on ammeter) the absence of current for each power lead to be removed.
- 1.2.5 Power equipment and bus bars shall be protected any time there is installation activity in the immediate vicinity. See Section B.
- 1.2.6 If electronic BDFB/SPDU load monitoring is not available at the site, the Power Assignment Log shall be used. See Section E of ATT-TP-76301.
- 1.2.7 The record of the installation for a new BDFB/SPDU shall be completed by the power installation vendor and sent to the AT&TIS Capacity Power Engineer within five working days of the Installation Complete Date.

**1.3. Removal Of DC Fuses Or Opening DC Circuit Breakers**

- 1.3.1 Unless stated otherwise in the MOP, the Supplier shall not remove a fuse or open a circuit breaker serving energized equipment. The AT&TIS Engineer is responsible to authorize the opening of the circuit on energized equipment.
- 1.3.2 The Installation Supplier shall ensure that all circuit breakers that are spare, unassigned, or reserved for future equipment are in the "Off" position.

**1.4. DC Circuit Protection Devices**

- 1.4.1 Fuses and circuit breakers shall be of the type and capacity as indicated in the job documentation. Under no circumstances shall circuit protection devices (fuses or circuit breakers) be placed in parallel in order to increase circuit capacity.
- 1.4.2 Only approved GMT style and Telpower® or Telcom® -type fuses shall be used on DC circuits unless another type of fuse is specified in the applicable manufacture's Equipment or Power Drawing.

- 1.4.3 The Installation Supplier shall install all circuit protection devices to make the equipment operational only at the direction of the AT&TIS Representative or as authorized in the MOP
  - 1.4.4 Dummy fuses shall be installed at all open faced and GMT type vacant fuse positions.
  - 1.4.5 Cartridge and knife type fuses shall be coated with a thin film of NO-OX-ID "A" anti-corrosive compound.
  - 1.4.6 Blade type fuse position contacts shall be coated with a thin film of NO-OX-ID "A" anti-corrosive compound prior to fuse installation (on contact surfaces only).
  - 1.4.7 The use of any fuse reducer shall require the authorization of the AT&TIS Capacity Power Equipment Engineer.
  - 1.4.8 Spare circuit protection devices shall be placed in a designated location or turned over to the AT&TIS Representative at job completion if a spare fuse holder is not provided.
  - 1.4.9 On BDFBs and power boards, all local alarm wiring for associated fuses/circuit breakers shall be tested in accordance with Section E of ATT-TP-76301.
  - 1.4.10 Connecting hardware shall be installed on all BDFB/SPDU fuse posts.
  - 1.4.11 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.
    - a) Secondary power distribution cabling to a 1/4-20 connection stud on a 15800 (TPS) or other type Fuse Disconnect shall be up to ( $\leq$ ) #2AWG.
    - b) Power cabling to a 5/16-18 connection stud on a TP158HC (TPL) or other type Fuse Disconnect shall be up to ( $\leq$ ) 2/0AWG.
  - 1.4.12 Circuit Protection devices shall not be installed or activated on unterminated leads (power wire/cable).
  - 1.4.13 The largest circuit protection device to be used in a BDFB/SPDU shall be no larger than 150 Amps.
  - 1.4.14 The Installation Supplier shall verify that all electrical contact surfaces are not damaged.
- 1.5. Battery Post**
- 1.5.1 The Installation Supplier shall refer to the job documentation and cell manufacturer's documentation for specific requirements and precautions for cleaning and treating cell posts. If the cell manufacturers recommended procedures for cell post cleaning and preparation differ from those specified in this section, then the Installation Supplier shall contact the AT&TIS Equipment Engineer for direction.
  - 1.5.2 All contact surfaces of flooded lead acid and VRLA battery posts and contact areas of intercell connectors shall be cleaned and coated with a thin film of NO-OX-ID "A" anti-corrosive compound.
  - 1.5.3 All cell post connections shall be made with the proper tools and shall be tightened to the manufacturer's torque requirements.

- 1.5.4 When lead-plated details and/or details with elongated holes are used, flat lead-plated or stainless steel washers shall be used under the nut and under the bolt head.
- 1.5.5 Requirements for connector terminations to the lead battery posts of lead acid-type batteries or battery plates are in Section K, ATT-TP-76301
- 1.5.6 Lead coated connectors shall be used when connecting to lead acid-type batteries or battery post terminal adapter plates.
- 1.5.7 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 1/4 inch, the space shall be covered with clear heat shrink tubing. Where the shiner exceeds 1/4 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.
- 1.5.8 On new battery string installations, all nuts, bolts and washers shall be stainless steel, unless specified otherwise by the manufacturer. Stainless steel (316 or better grade) is required, and the washer shall be 1/8 inch thick. Lock washers shall not be used on battery posts. The smooth (rounded) side of the washer shall be placed against the battery strap.
- 1.5.9 The threaded portion of bolts on intercell connectors shall not be installed to have exposed threads past the nut more than the equivalent diameter of the bolt.

## **2. DC BUS BARS**

### **2.1. Assembly**

- 2.1.1 The Installation Supplier shall use zinc-chromium plated SAE J429 ASTM B117 & B633 specifications or ASTM B99 silicon bronze finished bus bar joint, fastening and support bolts, nuts, washers, etc. as listed on the Minor Material List. The hardware shall be American National Coarse with a Class #2 Fit.
- 2.1.2 Bus bar runs shall be supported on a maximum of 6 feet 0 inch centers. Each length between joints shall be supported on both sides of a mechanical splice.
- 2.1.3 Bus bar runs supported by ceiling inserts, threaded rod and/or auxiliary framing channels shall be braced, both side and lengthwise, according to AT&T seismic requirements.
- 2.1.4 Except for the auxiliary framing bar supporting the red insulator, bus bar runs shall be installed at least one foot from metal pipes, cable racks, and auxiliary framing channels, etc., unless approved by the AT&TIS Equipment Power Engineer. In no case shall this distance be less than three inches.
- 2.1.5 Bus bars shall be a minimum of 7'3" above finished floor.
- 2.1.6 The bus bar shall be insulated from all supporting ironwork with approved insulators.
- 2.1.7 Exposed bus bar splice plates with plant voltage potential, located outside the power plant environment, (e.g. above or below secondary power distribution frames, cable rack, auxiliary framing, etc.,) shall be protected, in order of preference:

- a) With non-combustible covers (V-1 or better rating) , or
- b) Have each bus bar and its associated cable connectors wrapped with two half-lapped layers of plastic insulating tape.

## **2.2. Connecting Bus Bars Together**

- 2.2.1 Existing aluminum bus bars or details shall not be connected directly to heat producing devices. Examples are:
- a) Circuit breakers
  - b) Fuse terminals
  - c) Switch terminals
  - d) End cells
- 2.2.2 Aluminum bus bars shall not be tapped for fastening terminal lugs or for fastening bar to bar. Use through-bolts or clamp joints.
- 2.2.3 Only American Standard Unified Course (UNC) Grade 5 threads and hardware shall be used on all external power plant and bus bar connections (internal manufacturer power plant connections may be metric as long as there are no requirements for field installation interaction).
- 2.2.4 High spots, sharp edges and burrs shall be removed from all electrical contact areas, before assembly, to maximize continuity. Contact surfaces shall be flat.
- 2.2.5 Plated contact surfaces shall be cleaned without using abrasives coated with a thin film of NO-OX-ID "A" anti-corrosive compound and then assembled in a timely manner.
- 2.2.6 All non-plated contact surfaces shall be cleaned with a fine abrasive material coated with a thin film of NO-OX-ID "A" anti-corrosive compound and then assembled in a timely manner.
- 2.2.7 The overlap at a bus bar joint shall be no less than the width of the bus bar.
- 2.2.8 For through-bolt connections on bus bars, flat washers shall be used under the nut and under the bolt head. In addition, a lock-washer shall be used under the nut. (See AT&T Drawing ATT-P-05100-E for assembly details.)

## **2.3. Bus Bar Clamps**

- 2.3.1 Clamps that have a bus bar contact surface concave in shape are defective and shall not be used.
- 2.3.2 Bus bar clamp bolts shall be equipped with self-locking pal nuts. Non-self-locking nuts shall be torqued per the manufacturer's specifications before applying a pal nut. The pal nut shall be applied with the smooth (flat) side in, open side out, run up to the regular nut, tightened and taken up only one quarter turn with an insulated wrench. On larger clamps, lock nuts may be provided instead of pal nuts. The lock nuts shall be tightened until tension is snug against the regular nut.

## **2.4. Taping**

- 2.4.1 Two overlapping wraps of plastic electrical insulating tape, (e.g., Scotch 33 or Scotch 88) (when required) shall be applied when taping bus bars with battery potential.
- 2.4.2 The Installation Supplier shall tape the portion of the battery return bar in close proximity to live exposed terminals, studs, etc. In power rooms or in power board lineups containing power exclusively, taping is not required.
- 2.4.3 Bus bars, studs, nuts and details having 150 volts or more to ground shall be taped with two layers of friction tape, unless protected by enclosures or barriers.
- 2.4.4 Power panels and power boards having 150 volts or less shall have exposed details taped when located in open type frames, racks, boards and bays. In power rooms or in power board lineups containing power exclusively, taping is not required.

### **3. FLOODED LEAD-ACID STORAGE BATTERIES**

#### **3.1. General**

- 3.1.1 Batteries shall not be unpacked until the battery stand installation is complete and the Installation Supplier is ready to install the batteries.
- 3.1.2 The Installation Supplier shall not place cells of different manufacturers in the same string. Unlike strings, however, may be placed in parallel. KS20472 List 1 round cells can be replaced by KS20472 List 1S cells.
- 3.1.3 When cells in a string are replaced, the replacing cells shall have the same ampere-hour capacity, the same number of plates and shall have the same manufacturer. KS20472 List 1 round cells can be replaced by KS20472 List 1S cells.
- 3.1.4 Battery cells shall not be lifted or moved using the inter-cell connectors, cell posts or covers; with the exception of the KS20472 round cell battery which is designed to be lifted by the jar cover lip.
- 3.1.5 The battery marked as the pilot cell shall have a thermometer installed.

#### **3.2. Cautions**

- 3.2.1 While batteries are being charged, the Installation Supplier shall post temporary warning signs in conspicuous locations near the batteries as follows:

**WARNING: BATTERY GASES ARE FLAMMABLE. NO SPARKS OR OPEN FLAME NEAR CELLS.**

- 3.2.2 While batteries are being charged , the following precautions shall be observed :
  - a) Provide maximum ventilation (at least 2 air changes per hour).
  - b) Before charging, allow the cell to stand at least 1/2 hour on open circuit or on float voltage.
  - c) Install explosion vent caps before charging

#### **3.3. Shipping Batteries for Removal or Reuse**

- 3.3.1 When batteries are removed for non-reuse, procedures described in Section V shall be followed.
- 3.3.2 Batteries staged for reuse shall be prepared for shipment by packing in original-type shipping material. Cells shall be marked and reinstalled in the same order as placed in the original installation. Miscellaneous battery items such as spark arrestors and thermometers shall be packed and stay with the cell in which they were originally installed.
- 3.3.3 Vents shall be covered with a shipping cap.
- 3.3.4 Filling tubes shall be plugged and terminals shall be protected against short circuits with tape, caps or protective packaging.
- 3.3.5 Each container or unit shall be marked with proper identification and address of the assignee and consignor. Also a 4 inch by 4 inch label with the word "Corrosive" shall be applied to each container or unit.

**3.4. Cell Unpacking, Cleaning And Inspection**

- 3.4.1 Flooded battery cells shall remain in their protective packaging or be protected from damage until commencement of battery installation.
- 3.4.2 All cells shall be cleaned and neutralized thoroughly as soon as practical after they arrive on the job. Use a wet cloth in a 5% - 10% baking soda or soda ash solution, squeeze out sufficiently, and wipe thoroughly to neutralize cell top and sides. Ensure that posts, post holes and post seals are thoroughly cleaned.
- 3.4.3 After neutralization has been completed, the Installation Supplier shall remove salts and residue with water, wet cloth and frequent rinsing. Batteries and/or jars shall be wiped clean until dry to be sure all soda residues have been removed.
- 3.4.4 Solvents, mineral spirits, commercial detergents, ammonia, or other cleaning compounds or oils, waxes or polishes shall never be applied to the cell jar or lid. When such information is not provided in the job documentation (e.g., cell manufacturer's documentation) only water and baking soda or soda ash may be used.
- 3.4.5 The Installation Supplier shall make a visual inspection of all batteries shipped to the job site (prior to installation) to identify any physical damage, defects or problems that may prevent their proper installation, maintenance and/or operation.

The Installation Supplier shall inspect for the following defects:

- Breaks in the jar to cover seal.
- Crooked posts.
- Plates improperly supported on the bottom bridge.
- Loose paste material between the jar wall and interior.
- Bent or broken internal parts.
- Cracked jar or cover.

- Scratched, gouged, or chipped jar or cover. Indentations of more than 1/64 of an inch should be reported.
  - Hairline cracks around the cell and post.
  - Small dots on the post or early signs of post porosity.
  - Uneven gaps or flaws in the cover.
  - Crystals on plates.
  - Low (touching plates) or high (at or above upper level mark) electrolyte level.
  - Presence of sprues (raised areas) on the jar
- 3.4.6 When uncrating cells, the Installation Supplier shall check for stains or discoloration in the packing material to locate damaged or defective cells.
- 3.4.7 The Installation Supplier shall install explosion proof vents when cells are first unpacked.
- 3.4.8 In all geographic areas, batteries awaiting installation shall be secured (strapped together in groups of four or more with non-metallic straps).
- 3.4.9 Unpacked batteries awaiting installation shall not be covered with a tarp.
- 3.4.10 Upon installation of a new battery string, the Installation Supplier shall inspect and verify that all voltage-matching stickers are of like color prior to their initial charge. The only exception being round cell technology, which does not supply the stickers. In the event that the entire string does not have like colored voltage-matching stickers the Installation Supplier shall notify the AT&TIS Power Equipment Engineer for direction before proceeding.

### **3.5. Pressure Testing**

- 3.5.1 The following testing requirements apply only when ordered by the AT&TIS Power Equipment Engineer, or if any battery leakage is found in any of the cells during unpacking:
- a) The Installation Supplier shall pressure test all cells. The cells shall be pressure tested after placement onto the stand to assure that they were not damaged during placement. The Installation Supplier may choose to perform an additional pressure test prior to placing cells on the rack (to avoid placing a "leaker"). This, however, does not replace the "on the rack" test.
  - b) Cells, posts and cover seals shall withstand a pressure of 1/2 pound per square inch for one minute without any noticeable loss in pressure. Do not over pressurize the cells.
  - c) Document the results of the pressure test on the Pressure Test Record (Figure M-1).
- 3.5.2 Pressure Test Records shall be turned over to the AT&TIS Equipment Engineer at the completion of the job.
- 3.5.3 The Installation Supplier shall notify the AT&TIS Equipment Engineer, as soon as practical, if a cell does not pass pressure tests.
- 3.5.4 Cells that do not pass the pressure test shall not be connected until the cell has been fixed and passed a retest, or is replaced.

**3.6. Electrolyte Spills**

3.6.1 All spills shall be contained and reported to:

AT&T Environmental Health & Safety at 1-800 KNOW EHS or for Legacy-B locations, 1- 888-330-CRES. Refer to Section V, ATT-TP-76301 for additional requirements concerning Electrolyte spills.

**3.7. Battery Water**

3.7.1 Prior to initial charging, if the electrolyte level is below the bottom fill line, the Installation Supplier shall adjust the electrolyte level to the bottom fill line. No adjustment shall be made if the electrolyte level is above the bottom fill line.

**3.8. Battery Preparation**

3.8.1 The Installation Supplier shall notify the AT&TIS Equipment Engineer if the electrolyte is above the upper level line when the cells are received at the job site. The Installation Supplier shall NOT remove excess electrolyte for any reason.

3.8.2 A Storage Battery Charge Report (see Figure M-2) shall be maintained on each battery throughout the installing and charging phases of battery installation. A completed copy of the Storage Battery Charge Report shall be provided to the AT&TIS Representative at job completion.

3.8.3 The Installation Supplier shall check the installed batteries for the presence of crystals. If crystals or other defects are detected, notify the AT&TIS Equipment Engineer. The Installation Supplier shall note the presence or absence of crystals on the Storage Battery Charge Report.

**4. BATTERY RACKS**

**4.1. General**

4.1.1 Battery racks shall be positioned, assembled, aligned, grounded, designated and installed as specified in the job documentation, ATT-TP-76301, and the rack manufacturer's documentation.

4.1.2 For personnel protection, creating sparks while working with batteries shall be avoided. To avoid Electrostatic Discharge (ESD), the Installation Supplier shall perform one of the following steps prior to beginning each work operation involving battery work:

- a) Firmly touch a grounded metal rack/object or battery termination plate near the return (grounded) end of the battery for the removal of static electricity.

- b) If the battery stand is equipped with an ESD ground termination, an ESD wrist/ankle strap may be used for self-discharge. However, it is not the intent to require the technician to wear the device while working on the batteries, except during charging.
- 4.1.3 The following are minimum clearances between a battery rack and other battery racks, equipment, rigid spill containment and non-movable obstructions. The Installation Supplier shall notify the AT&TIS Equipment Engineer if the minimum requirements cannot be met to determine resolution.
- a) Adjacent or parallel racks - 36 inches.
  - b) Double row rack and a wall - 36 inches.
  - c) Equipment or bays - 36 inches.
  - d) Walls - 36 inches. This applies to the end of a rack where the length of the rack exceeds 72 inches. A single row rack parallel to a wall shall be a minimum of 8 inches from the wall. The clearance of a rack shall be a minimum of 8 inches from another structure at one end of the rack (the other end requires 36 inches). At no time shall fire aisles be blocked.
- 4.1.4 On a two-tier, two-row, two-string, rectangular, flooded lead-acid battery rack each of the battery strings shall have cells 1 through 12 on the bottom tier and 13 through 24 on the top tier.
- 4.1.5 In seismic zones 3 and above, cell separators shall be installed between battery cells. Manufacturer supplied battery container support cradles may be used instead of cell separators if they minimize battery movement.
- 4.1.6 In seismic zones 2 and below, cell separators or container support cradles shall be installed between battery cells if shipped by the battery manufacturer.
- 4.1.7 Only material that meets an oxygen index of 28 or better shall be used as cell separators. (Styrofoam packing material shall not be used as separators.)
- 4.1.8 When tie rods are required for seismic protection on a battery stand installation, it is permissible to double nut the battery stand tie rod on both ends.
- 4.1.9 Battery cells shall not touch each other or adjacent framework.
- a) The spacing between the cells in a row shall be 3/8" to 5/8".
  - b) The spacing between the rows of cells shall be greater than 3/4"
  - c) Side and end-rail clearance to the battery jar shall be 1/32" to 1/8". On installation, PVC jars should be set up with the maximum clearance to allow for jar growth.
- 4.2. Battery Cabling (Unfused)**
- 4.2.1 Size 4/0 flexible type power cable shall be the standard size and type to be used on all cells through 1900 AH. A cable size of 350 kcmil, flexible type power wire shall be used on all cells over 1900 AH.

- 4.2.2 Cables between the battery posts and battery bus bar shall be installed as shown in Table M-3.
- 4.2.3 Cable runs, from bus bar drop plates to cell posts shall have sufficient slack to allow 6 inches of movement.
- 4.2.4 The Installation Supplier shall install the same quantity of equal length inter-tier and equal length inter-shelf conductors.

## **5. CHARGING STORAGE BATTERIES**

### **5.1. Charging**

- 5.1.1 Before charging is started, the Installation Supplier shall designate the cell with the lowest specific gravity as the Pilot Cell (a.k.a Temperature Reference Cell). The Pilot Cell shall be located on the lower shelf of the stand. Do not place the Pilot Cell on the end of a stand, near a window, or near a heating/cooling vent.
- 5.1.2 When more than one string is charged in parallel, the Installation Supplier shall select a separate Pilot Cell for each string.
- 5.1.3 The Installation Supplier shall record the Pilot Cell number in the appropriate box on the Storage Battery Charge Report (Figure M-2). Indicate number of strings charged in parallel and voltage regulation employed.
- 5.1.4 The Installation Supplier shall insert a thermometer in the Pilot Cell so the temperature reading can be taken without touching the thermometer. The Pilot Cell is used for the purpose of temperature measurement for the hours of charge.
- 5.1.5 The Installation Supplier shall provide its own portable battery charger with a protective fuse device.
- 5.1.6 Before installation, batteries shall be charged in accordance with manufacturer's recommendations.
- 5.1.7 When using a voltage regulated charger delivering at least 12 amps, the Installation Supplier shall monitor the initial charge.
- 5.1.8 Just before the start of initial charge, the Installation Supplier shall measure the cell temperature of the Pilot cell and determine the total length of initial charge requirement by referring to corresponding Cell Temperature column and Time on Open Circuit column of Table M-2. The required time on charge begins at the time that the voltage and current have reached steady state operation.
- 5.1.9 The Installation Supplier shall ensure that adequate ventilation is present to prevent the hydrogen concentration from reaching the 1 percent level at any time during the charging

process. Warning signs shall be placed near the charge area. For information regarding ventilation requirements, refer to Section 6 of ATT-TP-76401.

- 5.1.10 Explosion proof vent caps and shipping plugs (for the electrolyte draw-off tubes) shall be firmly in place on each cell during cell charging activities.
- 5.1.11 Before performing any work functions, the Installation Supplier shall touch any bare metal grounded part of the battery rack to avoid ESD to the batteries.

**5.2. Charging Records**

- 5.2.1 The Installation Supplier shall complete the Storage Battery Charge Report (Figure M-2) for each battery string. Document the voltage, specific gravity and temperature of each cell at the following intervals.
  - a) Prior to start of initial charge (indicated in Initial Charge section of Figure M-2)
  - b) At end of charge, prior to turn-down to float
  - c) 72 hours after end of initial charge
- 5.2.2 The Installation Supplier shall document (on the Pilot Cell Charge Report, Figure M-3) the time, charge current, voltage and temperature of the pilot cell, at the following intervals:
  - a) At the start of charge.
  - b) Once each hour for the first eight hours of charge.
  - c) Three times a day after the first eight hours of charge.
  - d) Just before charging is stopped or temporarily discontinued. Reference the manufacturer's documentation to establish the recommended procedure to determine and record full charge.
  - e) When charging is restarted (if initial charge is interrupted) and the charge current is stable.
- 5.2.3 All Storage Battery Charge Reports shall be turned over to the AT&TIS Representative. A copy shall be placed in the job folder.

**5.3. Electrolyte Level**

- 5.3.1 While batteries are on initial charge, the electrolyte level may rise above the maximum level line. If it should become necessary to remove electrolyte to prevent overflow, the Installation Supplier shall make note of removals on the battery initial charge records. Retain electrolyte for possible reuse at the cell level.
- 5.3.2 Electrolyte not reused shall be disposed of in accordance with Section V, Hazardous Material and Waste Management of the ATT-TP-76301.
- 5.3.3 After the initial charge, distilled water shall be added to bring the electrolyte midway between the lower and upper level lines. If the electrolyte level exceeds the high mark, the Installation

Supplier shall note the high level on the initial Storage Battery Charge Report in the comment section, but shall not make any adjustment in the electrolyte.

**5.4. End Of Initial Charge Crystal Identification**

5.4.1 Before stopping the initial charge, the Installation Supplier shall record the following for each cell on the Storage Battery Charge Report:

- a) Voltage
- b) Specific gravity
- c) Electrolyte temperature

5.4.2 After a satisfactory initial charge, there shall be no crystals or discoloration present on the plates when examined with a flashlight.

5.4.3 Cells that is not free of crystals after the initial charge may contain an internal short. If some cells still have crystals after the initial charge, it is recommended that the battery string be continued on boost charge at 2.5 to 2.55 volts for a total charge time not to exceed 250 hours for both charges. If charging fails to clear the crystals within 250 hours, the cells shall be referred to the AT&TIS Equipment Engineer for investigation and/or replacement.

**5.5. Turnover**

5.5.1 The Installation Supplier shall ensure that the full-charge specific gravity of each cell meets the manufacturer's documentation and does not vary by more than 0.015 (15 points) per cell.

5.5.2 On the installation of new battery strings, the power plant float voltage shall be upgraded to 52.80 volts if not already at that float setting

5.5.3 Cell voltage shall have a measurement between 2.15 and 2.25 volts for the recommended 52.80 Power Plant Voltage; or between 2.12 and 2.22 volts for a 52.08 Power Plant Voltage.

5.5.4 All charged strings shall remain on continuous uninterrupted float voltage of 2.20 (52.80 Power Plant Voltage) or 2.17 (52.08 Power Plant Voltage) volts per cell until placed in service.

**5.6. Valve Regulated Cells**

5.6.1 The manufacturer's installation instructions and forms shall be utilized for installation of valve regulated cells.

5.6.2 The Installation Supplier shall record individual battery jar and strap conductance values before battery charge.

5.6.3 For initial charge, temperature compensated chargers or current limited chargers shall be used to insure that thermal runaway does not occur.

5.6.4 For float operation, temperature compensated controllers shall be used to insure that thermal runaway does not occur.

- 5.6.5 Valve regulated lead-acid (VRLA) cells shall have a float voltage measured at 2.25 volts, plus or minus 0.05 volt, provided this value is within manufacturer's specifications.
- 5.6.6 A VRLA Battery String shall contain 24 cells with a nominal 54.00 VDC Float Voltage.
- 5.6.7 For CO or Type 1, 2, and 3 Nodes applications, a Battery Monitor or Float Current Monitor shall be provided for all VRLA battery Strings.
- 5.6.8 Before any VRLA battery string can be accepted, the resistance or conductance of all cells and inter-cell connectors shall be read and recorded by the supplier's installer. This record becomes part of the battery records turned over to the AT&T Representative and must remain with the battery string. These records are used as a baseline for future readings. The test shall meet the following requirement.
- Supplier shall use a test set approved by AT&T Maintenance Engineering
  - Each cell and intercell connector shall be measured.
  - No reading (conductance or intercell connector resistance) shall be more than 20% above or below the average for the string. Individual intercell connector measurements above 35 micro-ohms shall be investigated to assure proper torque, cleanliness, etc.
  - The test set manufacturer's form shall be used as a paper record.
  - A paper copy and disk or CD of the test results will be left on site.
  - The CD or computer diskette shall also have a spreadsheet and a graph of the cell conductance and intercell connector measurements.
- 5.6.9 After string has settled at proper float voltage, the Float Current shall be recorded and preserved as a baseline.
- 5.6.10 VRLA battery strings shall be equipped with individual string disconnects for Type 1, 2, and 3 Nodes, or customer premises applications.

**5.7. Flooded Nickel Cadmium**

- 5.7.1 The manufacturer recommendations and forms shall be utilized for the installation of NiCad cells.
- 5.7.2 The Installation Supplier shall perform and record an Open Circuit Voltage (OCV) for each cell before installation. Any cell with less than 1.10 volts shall be replaced.
- 5.7.3 The NiCad battery strings for Central Office applications contain 38 (1.43V) cells that shall have a string float voltage measured at 54.4V for optimum performance. The float voltage can be reduced to 1.42 volts per cell (54.0 string float) if there is an adjustment issue with high voltage alarms.

- 5.7.4 The higher than normal 54.4V float voltage requires that a power plant be entirely supported by NiCad batteries. Strings of flooded lead acid batteries or VRLA batteries shall not be mixed with NiCad battery strings.
- 5.7.5 Recommended alarm points for the 54.4 float are: Very High Voltage – 56.0V; High Voltage – 55.5V; Low Voltage – 52.0V; Very Low Voltage – 48.0v.
- 5.7.6 Saft® NiCad NCX-125 Battery Drain Table end voltage is 1.10V per cell; 42V for a 38 cell string after delivering up to a constant 16A current discharge for 4 hours when new. Load bank testing shall be performed at 35.2A for a Saft NCX-125 battery string.
- 5.7.7 Battery racks that house the NiCad batteries shall have sliding shelves allowing adequate working space, and shall meet the seismic rating for the geographic area.
- 5.7.8 Battery cabling between the battery strings and the bay collection bars shall be continuous; the use of Anderson or Anderson-style quick-connectors is prohibited.
- 5.7.9 Size 2AWG flex cable shall be used to connect up to 125AH NiCad battery strings shelves to the rack battery and return bus bars (collection bars). The use of the 2AWG flex cable allows easy movement of the shelves for battery servicing. For this application, gray cotton braid flex-cable is preferred over rubber insulation.
- 5.7.10 Battery collection bars shall be installed at the top of the NiCad bay(s).
- 5.7.11 Tin plated copper lugs without inspection holes and nickel plated steel hardware shall be used for NiCad battery connections.
- 5.7.12 NiCad battery hardware shall be Saft® supplied as standard metric threads are not compatible with the Saft® NiCad battery connections.
- 5.7.13 NiCad battery connections shall be torqued to 50 inch-pounds.
- 5.7.14 Saft® NOX-Rust corrosion inhibitor shall be used on all external battery connections.
- 5.7.15 NiCad batteries contain a corrosive alkaline electrolyte solution that shall be neutralized with a special NiCad spill kit (which is labeled in bright orange). Spill kits for flooded lead acid batteries do not contain the correct neutralizing absorbent for NiCad batteries, and the lead acid battery safety equipment shall not be used when cleaning up a NiCad electrolyte spill due to the potential of a dangerous chemical reaction.
- 5.7.16 NiCad batteries can release hydrogen gas, and the same safety precautions regarding gassing and explosion hazard apply to NiCad as flooded lead acid battery installations.
- 5.7.17 NiCad batteries shall use constant voltage charging to maintain float voltage. Temperature compensated voltage control used with VRLA application is not recommended.
- 5.7.18 High float current on a NiCad battery string is an indication there is a maintenance issue or the battery is reaching end-of-life.
- 5.7.19 NiCad batteries shall only be recycled through the manufacturer.
- 5.7.20 Additional details regarding NiCad batteries can be found in AT&T Power Drawing – ATT-P-05330-E.

**5.8. Alternative Battery Technologies**

- 5.8.1 All new battery technology shall be installed with charge records, maintained and serviced per the manufacturer's documentation.

**6. FLOODED LEAD-ACID STRING TRANSITIONS**

**6.1. General**

- 6.1.1 Prior to and during battery transition work, air flow in the battery area shall be at least two air changes per hour to eliminate the buildup of hydrogen gas.
- 6.1.2 The Installation Supplier shall ensure that temporary wiring for transition batteries is never less than two 4/0 or one 500 kcmil for 1680 AH and smaller or two 500 kcmil for strings larger than 1680 AH.
- 6.1.3 The Installation Supplier shall ensure that the battery string to be transitioned has been on a stable float charge for at least 48 - 72 hours so that hydrogen gas release is minimal. Only one string shall be taken off line at a time. When opening a string, the installation supplier shall cover cable ends by taping on a heat shrink cap after removing bolt assemblies.
- 6.1.4 When necessary, the transition string voltage shall be raised to adjust voltage differences to 0.05 volts or less. The AT&TIS Representative must approve any decision to lower the plant voltage for a battery transition. The plant voltage shall never be lowered more than 2.0 volts from the normal float voltage for a -48 volt plant.
- 6.1.5** In all cases, the plant voltage shall be kept within the operating limits of the equipment served by the battery plant.

**7. UPS SYSTEMS**

**7.1. Flooded Lead-Acid Storage Batteries**

- 7.1.1 Batteries shall not be unpacked until the battery stand installation is complete and the Installation Supplier is ready to install the batteries.
- 7.1.2 The Installation Supplier shall not place cells of different manufacturers in the same string. However, unlike strings from different manufacturers may be placed in parallel.
- 7.1.3 When cells in a string are replaced, the replacing cells shall have the same ampere-hour capacity, the same number of plates and shall have the same manufacturer.
- 7.1.4 Battery cells shall not be lifted or moved using the intercell connectors, cell posts or covers.
- 7.1.5 The battery marked as the pilot cell shall have a thermometer installed.

**7.2. Cautions**

- 7.2.1 While batteries are being charged, the Installation Supplier shall post temporary warning signs in conspicuous locations near the batteries as follows:

**WARNING: BATTERY GASES ARE FLAMMABLE. NO SPARKS OR OPEN FLAME NEAR CELLS.**

- 7.2.2 While batteries are being charged , the following precautions shall be observed :
- a) Provide maximum ventilation (at least 2 air changes per hour).
  - b) Before charging, allow the cell to stand at least 1/2 hour on open circuit or on float voltage.
  - c) Install explosion vent caps before charging.

**7.3. Shipping Batteries for Removal or Reuse**

- 7.3.1 When batteries are removed for non-reuse, procedures described in Section V shall be followed.
- 7.3.2 Batteries staged for reuse shall be prepared for shipment by packing in original-type shipping material. Cells shall be marked and reinstalled in the same order as placed in the original installation. Miscellaneous battery items such as spark arrestors and thermometers shall be packed and stay with the cell in which they were originally installed.
- 7.3.3 Vents shall be covered with a shipping cap.
- 7.3.4 Filling tubes shall be plugged and terminals shall be protected against short circuits with tape, caps or protective packaging.

NOTE: Each container or unit shall be marked with proper identification and address of the assignee and consignor. Also a 4 inch by 4 inch label with the word "Corrosive" shall be applied to each container or unit.

**7.4. Cell Unpacking, Cleaning And Inspection**

- 7.4.1 Flooded battery cells shall remain in their protective packaging or be protected from damage until commencement of battery installation.
- 7.4.2 All cells shall be cleaned and neutralized thoroughly as soon as practical after they arrive on the job. Use a wet cloth in a 5% - 10% baking soda or soda ash solution, squeeze out sufficiently, and wipe thoroughly to neutralize cell top and sides. Ensure that posts, post holes and post seals are thoroughly cleaned.
- 7.4.3 After neutralization has been completed, the Installation Supplier shall remove salts and residue with water, wet cloth and frequent rinsing. Batteries and/or jars shall be wiped clean until dry to be sure all soda residue has been removed.
- 7.4.4 Solvents, mineral spirits, commercial detergents, ammonia, or other cleaning compounds or oils, waxes or polishes shall never be applied to the cell jar or lid. When such information is not provided in the job documentation (e.g., cell manufacturer's documentation) only water and baking soda or soda ash may be used.
- 7.4.5 The Installation Supplier shall make a visual inspection of all batteries shipped to the job site (prior to installation) to identify any physical damage, defects or problems that may prevent their proper installation, maintenance and/or operation.

The Installation Supplier shall visually inspect for the following defects:

- Breaks in the jar to cover seal.
- Crooked posts.
- Plates improperly supported on the bottom bridge.
- Loose paste material between the jar wall and interior.
- Bent or broken internal parts.
- Cracked jar or cover.
- Scratched, gouged, or chipped jar or cover. Indentations of more than 1/64 of an inch should be reported.
- Hairline cracks around the cell and post.
- Small dots on the post or early signs of post porosity.
- Uneven gaps or flaws in the cover.
- Crystals on plates.
- Low (touching plates) or high (at or above upper level mark) electrolyte level.
- Presence of sprues (raised areas) on the jar

7.4.6 When uncrating cells, the Installation Supplier shall check for stains or discoloration in the packing material to locate damaged or defective cells.

7.4.7 The Installation Supplier shall install explosion proof vents when cells are first unpacked.

7.4.8 In all geographic areas, batteries awaiting installation shall be secured (strapped together in groups of four or more with non-metallic straps).

7.4.9 Unpacked batteries awaiting installation shall not be covered with a tarp.

7.4.10 When installing the batteries in the racks, the use of petroleum products to aid in sliding the batteries on the racks is strictly prohibited. A light coating of water or unscented talcum powder on the stand rails to aid in sliding the batteries on the racks is approved. Enersys also approves the use of Enersys Proslide or Dow Corning Compound #111S for this purpose.

## **7.5. Electrolyte Spills**

7.5.1 All spills shall be contained and reported to:

AT&T Environmental Health & Safety at 1-800 KNOW EHS or for Legacy-B locations, 1- 888-330-CRES. Refer to Section V, ATT-TP-76300 for additional requirements concerning Electrolyte spills.

**7.6. Battery Water**

7.6.1 Prior to initial charging, if the electrolyte level is below the bottom fill line, the Installation Supplier shall adjust the electrolyte level to the bottom fill line. No adjustment shall be made if the electrolyte level is above the bottom fill line.

**7.7. Battery Preparation**

7.7.1 The Installation Supplier shall notify the AT&TIS Equipment Engineer if the electrolyte is above the upper level line when the cells are received at the job site. The Installation Supplier shall NOT remove excess electrolyte for any reason.

7.7.2 A Storage Battery Charge Report shall be maintained on each battery throughout the installing and charging phases of battery installation. A completed copy of the Storage Battery Charge Report shall be provided to the AT&TIS Representative at job completion.

7.7.3 The Installation Supplier shall check the installed batteries for the presence of crystals. If crystals or other defects are detected, notify the AT&TIS Equipment Engineer. The Installation Supplier shall note the presence or absence of crystals on the Storage Battery Charge Report.

**7.8. Battery Racks**

7.8.1 The battery and stand/cabinet selection shall be coordinated to insure the correct battery is matched with the stand/cabinet designed for that specific battery. All battery stand/cabinets shall meet NEBS Level 1 and the prevailing seismic zone (or better). To minimize the battery stand/cabinet selection process Zone 2 stand/cabinets shall be engineered for all Zone 2 and below applications. Zone 4 battery stand/cabinets shall be engineered for all Zone 3 and above applications. Appropriate battery choices may be found on the AT&T Battery Technology Comparison Table found at; <http://mechteam.sbc.com:8080/Power/infotech.html>

7.8.2 Battery racks shall be positioned, assembled, aligned, grounded, designated and installed as specified in the job documentation, ATT-TP-76301, and the rack manufacturer's documentation.

7.8.3 For personnel protection, creating sparks while working with batteries shall be avoided. To avoid Electrostatic Discharge (ESD), the Installation Supplier shall firmly touch a grounded metal rack or object prior to beginning each work operation involving battery work:

7.8.4 The following are minimum clearances between a battery rack and other battery racks, equipment, rigid spill containment and non-movable obstructions. The Installation Supplier shall notify the AT&TIS Equipment Engineer if the minimum requirements cannot be met to determine resolution.

(A) Adjacent or parallel racks - 36 inches.

(B) Double row rack and a wall - 36 inches.

(C) Equipment or bays - 36 inches.

(D) Walls - 36 inches. This applies to the end of a rack where the length of the rack exceeds 72 inches. A single row rack parallel to a wall shall be a minimum of 8 inches from the wall. The clearance of a rack shall be a minimum of 8 inches from another structure at one end of the rack (the other end requires 36 inches). At no time shall fire aisles be blocked.

7.8.5 In seismic zones 3 and above, cell separators shall be installed between battery cells. Manufacturer supplied battery container support cradles may be used instead of cell separators if they minimize battery movement.

7.8.6 In seismic zones 2 and below, cell separators or container support cradles shall be installed between battery cells if shipped by the battery manufacturer.

7.8.7 Only material that meets an oxygen index of 28 or better shall be used as cell separators. (Styrofoam packing material shall not be used as separators.)

7.8.8 When tie rods are required for seismic protection on a battery stand installation, it is permissible to double nut the battery stand tie rod on both ends.

7.8.9 Battery cells shall not touch each other or adjacent framework.

(A) The spacing between the cells in a row shall be 3/8" to 5/8".

(B) The spacing between the rows of cells shall be greater than 3/4"

(C) Side and end-rail clearance to the battery jar shall be 1/32" to 1/8". On installation, PVC jars should be set up with the maximum clearance to allow for jar growth.

**7.9. UPS Battery DC Cabling and Post Connections.**

7.9.1 The Installation Supplier shall install the same quantity of inter-tier and inter-shelf conductors.

7.9.2 Battery cabling within the string shall be black non-braided or gray braided insulated Class I flex power cable. Stranded RHH/RHW Rated, Tinned Copper Conductor; Non-Halogen, ((KS-24194 L2, L4) (Telcoflex II, IV)) Manufactured by American Insulated Wire (AIW) or other AT&T approved power cable manufacturer as listed on the AT&T MML.

NOTE: No Equivalents or Substitutions from the Cable and Manufacturers Listed Above

7.9.3 Lead coated connectors shall be used when connecting to lead-acid flooded type batteries at the post or terminal plate. A thin coat of NO-OX-ID "A" anti-corrosive compound is required.

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

7.9.5 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, the space shall be covered with clear heat shrink tubing. The heat shrink tubing shall cover the entire barrel portion of the lug and shall extend a minimum of 2 inches up the cable. Cables with shiners greater than 1/4 inch shall be re-terminated.

7.9.6 On new battery string installations, all nuts, bolts and washers shall be stainless steel, unless specified otherwise by the manufacturer. Stainless steel (316 or higher alloy) is required,

- 7.9.7 The threaded portion of bolts on inter-cell connectors shall not be installed to have exposed threads past the nut more than the equivalent diameter of the bolt.
- 7.9.8 For flooded lead acid batteries, cell post hardware shall be stainless steel, grade 316 and marked 316 accordingly. Washer thickness shall be 1/8 inch and the washer must rest completely on the tongue face of the post/terminal plate connector. Use the battery manufacturer's recommended bolt size for post connections.
- 7.9.9 Inter-cell straps shall meet manufacturer requirements and shall be attached with stainless steel hardware as specified by the battery manufacturer.
- 7.9.10 UPS battery posts and the ends of the connectors where they contact the posts shall have a thin coat of NO OX-ID-A applied.

**7.10. Charging Storage Batteries**

- 7.10.1 Before charging is started, the Installation Supplier shall designate the cell with the lowest specific gravity as the Pilot Cell (a.k.a Temperature Reference Cell). Do not place the Pilot Cell on the end of a stand, near a window, or near a heating/cooling vent.
- 7.10.2 When more than one string is charged in parallel, the Installation Supplier shall select a separate Pilot Cell for each string.
- 7.10.3 The Installation Supplier shall record the Pilot Cell number in the appropriate box on the Storage Battery Charge Report (Figure M-2). Indicate number of strings charged in parallel and voltage regulation employed.
- 7.10.4 The Installation Supplier shall insert a thermometer in the Pilot Cell so the temperature reading can be taken without touching the thermometer. The Pilot Cell is used for the purpose of temperature measurement for the hours of charge.
- 7.10.5 Explosion proof vent caps and shipping plugs (for the electrolyte draw-off tubes) shall be firmly in place on each cell during cell charging activities.

**7.11. Charging Records**

- 7.11.1 The Installation Supplier shall complete a vendor supplied Storage Battery Charge Report for each battery string. Document the voltage, specific gravity and temperature of each cell at the following intervals.
  - (A) Prior to start of initial charge
  - (B) 72 hours after end of initial charge
- 7.11.2 The Installation Supplier shall document the time, charge current, voltage and temperature of the pilot cell, at the following intervals:
- 7.11.2 The Installation Supplier shall document the time, charge current, voltage and temperature of the pilot cell, at the following intervals:
  - (A) At the start of charge.
  - (B) Just before charging is stopped or temporarily discontinued. Reference the manufacturer's documentation to establish the recommended procedure to determine and record full charge.

(C) When charging is restarted (if initial charge is interrupted) and the charge current is stable.

7.11.3 Storage Battery Charge Reports shall be turned over to the AT&TIS Representative.

**7.12. Electrolyte Level**

7.12.1 While batteries are on initial charge, the electrolyte level may rise above the maximum line level. If it should become necessary to remove electrolyte to prevent overflow, the Installation Supplier shall make note of removals on the battery initial charge records. Retain electrolyte for possible reuse at the cell level.

7.12.2 Electrolyte not reused shall be disposed of in accordance with Section V, Hazardous Material and Waste Management of the ATT-TP-76301.

7.12.3 After the initial charge, distilled water shall be added to bring the electrolyte midway between the lower and upper level lines. If the electrolyte level exceeds the high mark, the Installation Supplier shall note the high level on the initial Storage Battery Charge Report in the comment section, but shall not make any adjustment in the electrolyte.

**7.13. End of Initial Charge Crystal Identification**

7.13.1 After a satisfactory initial charge, there shall be no crystals or discoloration present on the plates when examined with a flashlight.

7.13.2 Cells that are not free of crystals after the initial charge may contain an internal short. If some cells still have crystals after the initial charge, it is recommended that the battery manufacturer be consulted for further guidance.

**7.14. Turnover**

7.14.1 On the installation of new battery strings, the rectifier voltage shall be adjusted to the appropriate float setting as specified in the manufacturer's guidelines.

**7.15. Valve Regulated Cells**

7.15.1 The manufacturer recommendations shall be utilized for installation and maintenance of valve regulated cells.

7.15.2 The Installation Supplier shall record individual battery jar and strap resistance or conductance values before battery charge.

7.15.3 For initial charge, temperature compensated chargers or current limited chargers shall be used to insure that thermal runaway does not occur.

7.15.4 For float operation, temperature compensated controllers shall be used to insure that thermal runaway does not occur.

7.15.5 Valve regulated lead-acid (VRLA) cells shall have a float voltage measured at 2.25 volts, plus or minus 0.05 volt, provided this value is within manufacturer's specifications.

- 7.15.6 For initial charge, temperature should be monitored and if at any time the battery temperature approached 110F, the battery should be disconnected from the rectifier and allowed to cool. The manufacturer should be consulted for specific directions.
- 7.15.7 Before any VRLA battery string can be accepted, the resistance or conductance of all cells and inter-cell connectors shall be read and recorded by the supplier's installer. This record becomes part of the battery records turned over to the AT&T Representative and must remain with the battery string. These records are used as a baseline for future readings. The test shall meet the following requirement.
- Supplier shall use a test set approved by AT&T Maintenance Engineering
  - Each cell and inter-cell connector shall be measured.
  - No reading (conductance or inter-cell connector resistance) shall be more than 20% above or below the average for the string. Individual inter-cell connector measurements above 35 micro-ohms shall be investigated to assure proper torque, cleanliness, etc.
  - The test set manufacturer's form shall be used as a paper record.
  - A paper copy, disk, CD or electronic copy of the test results will be left on site.
  - The CD computer diskette or electronic copy shall also have a spreadsheet and a graph of the cell resistance or conductance and inter-cell connector measurements.
- 7.15.8 After string has settled at proper float voltage, the Float Current shall be recorded and preserved as a baseline.

**7.16. Alternative Battery Technologies**

- 7.16.1 All new battery technology shall be installed with charge records, maintained and serviced per the manufacturer's documentation.

**7.17. UPS Battery Disconnect Switch.**

- 7.17.1 The UPS battery disconnect switch cabling to the UPS shall be either supplied by the Manufacturer or the electrical contractor, and shall be either black non-braided or gray braided insulated, Tinned Copper Conductor, Non-Halogen, RHH/RHW, ((KS-24194 L2, L4) (Telcoflex II, IV)) Class I flex power cable manufactured by American Insulated Wire (AIW) or other AT&T approved power cable manufacturer as listed on the AT&T MML.
- 7.17.2 UPS battery disconnect switches (one per string) shall be located within the battery area. The local AHJ may dictate the specific location.

**7.18. UPS EPO Switches**

- 7.18.1 Where required, UPS EPO switches may be placed at the exits of the equipment rooms and at the exit or entrance of the UPS equipment rooms. Switches shall be adequately labeled, covered and protected from accidental activation. The EPO switches must lock in place to identify activation when depressed.

**8 AC POWER**

**8.1 AC Panels**

- 8.1.1 Work clearance for newly placed AC panels serving equipment with AC input voltages 150V AC or less to ground shall be a minimum of 36 inches per the NEC Article 110-26. This does not include the rear or side(s) when the equipment is built for no access.
- 8.1.2 Work clearance for newly placed AC panels serving equipment with AC input voltages greater than 150V AC to ground shall comply with NEC Article 110-26, "Spaces About Electrical Equipment".
- 8.1.3 Circuit Breaker additions to existing AC Panels (PSC/PDSC) shall be validated for the existence of available capacity. Additional distribution circuit breakers shall not be added to the (PSC/PDSC) AC Panels where measured demand exceeds 80% of the primary supply circuit breaker. Installation Suppliers shall notify the responsible AT&T representative where the 80% levels have been met or exceeded.

**8.2 AC Cabling**

- 8.2.1 All AC conductors shall be enclosed in a metal conduit, metal raceway or metal trough.
- 8.2.2 AC equipment connections, or conduit transitions from walls or columns in Seismic Zones 3 & 4, with Jacketed Metallic Clad (JMC) flex (Seal-Tite® SA, or Liquidtight® LA rated UL 94 V-0) shall not exceed 3 feet.
- 8.2.3 In High Seismic areas where JMC is used between the wall or column and conduit supported by auxiliary framing, the Installation Supplier shall install the JMC with a minimum of six inches of play.
- 8.2.4 Final AC lighting fixture connections with Jacketed Metallic Clad (JMC) flex (Seal-Tite® SA or Liquidtight® LA rated UL 94 V-0) shall not exceed six feet.
- 8.2.5 Jacketed Metallic Clad (JMC) flex (Seal-Tite® UA or Liquidtight® LA rated UL 94 V-0) may be run a distance greater than three feet only within bay end -guards and bases to connect light switches and bay test receptacles. The JMC shall not have excessive slack or be coiled within the bay end -guard or base.
- 8.2.6 Jacketed Metallic Clad (JMC) flex (Seal-Tite® or Liquidtight® rated UL 94 V-0) may be run a distance greater than three feet when utilized as whips in a raised floor environment

**8.3 Multi-outlet Power Strip**

- 8.3.1 Power strips serve as the final point of AC distribution typically found in the Information Services cabinet/bay.
- 8.3.2 The installation supplier shall install power strips that are approved for use by AT&T.
- 8.3.3 Power strips shall be connected to the branch circuit by either hard-wiring or a listed cord-plug assembly. If the connection is hard wired, the whip shall be comprised of a ZHFL rated Liquidtite flexible conduit using standard electrical connection hardware at each end. If power

strips with cord-plug assembly are utilized, the approved unit shall be provided from the manufacturer with the power cord as part of the listed assembly.

- 8.3.4 The power strip shall be bolted and permanently affixed to the cabinet/bay structure.
- 8.3.5 Depending on the configuration the power strip may be specified as horizontal or vertical mounting.
- 8.3.6 The power strip shall not include local fusing or a cut off switch.
- 8.3.7 Surge protection is not required and shall not be included in the power strip.
- 8.3.8 The power strip shall be listed.

#### 8.4 Convenience Outlets

- 8.4.1 All work on AC circuits shall be done in compliance with the technical requirements of the NEC and applicable local electrical codes. Note: AC work in IS POP/VHO in central offices refer to *AT&T Inc. Policy NON-272 Affiliate Request for Space in AT&T Inc ILEC Central Office*.
- 8.4.2 While work is being done on AC circuits, fuses shall be removed or switches opened whenever it is practical to do so without causing a service interruption.
- 8.4.3 When work is being performed that requires removing the electrical potential from an operating circuit, the circuit shall be identified with a **“Warning - Working on Circuit”** tag at the AC source. The tag shall only be removed by the person performing the work. (a.k.a. “Lock-out, Tag-out”).
- 8.4.4 An Alternating Current Equipment Ground (ACEG) lead shall be provided with each AC circuit. When a conduit contains more than one AC circuit, one ACEG lead may be used if properly sized per the NEC.
- 8.4.5 The spacing of Convenience Outlets shall be every third bay, not to exceed 10 feet in equipment frames. A single or stand-alone frame shall have a test receptacle provided or placed in the base.
- 8.4.6 Convenience outlets may be located on the aux framing supporting the aisle lighting fixtures with the face of the outlet facing down for ease of connectivity. One duplex outlet shall be installed every other aux bar at a minimum not to exceed 10 feet. Convenience outlet and lighting circuits may run in the same raceway. Raceway shall be supported every 5 to 6 feet minimum.
- 8.4.7 Convenience outlets mounted in equipment bays shall be mounted flush and equipped with a metal cover plate.
- 8.4.8 The Installation Supplier shall ensure that the grounding and polarity of convenience outlets are correct, verified and recorded on the test record (refer to Section E, Document 4)
- 8.4.9 The entire length of the metallic raceway, conduit or trough shall provide a continuous conductive path for grounding.

- 8.4.10 The Installation Supplier shall install bushings, nipples or connectors to protect wiring. Exposed AC conductors shall not be in contact with edges of metal frameworks, boxes or raceways (e.g. running through a knockout).
- 8.4.11 Isolated ground AC receptacles (orange) shall not be installed.
- 8.4.12 Dedicated AC receptacles shall be installed in the same bay/frame as the equipment load the receptacle serves.
- 8.4.13 The Installation Supplier shall install a green ACEG lead for all AC lighting fixtures.
- 8.4.14 Wire and cable utilized to distribute AC power shall be exclusively copper conductors.
- 8.4.15 A wire nut shall be used to cover the exposed ends of all AC conductors.
- 8.4.16 Wire nuts shall meet the V-1 oxygen index rating or better.
- 8.4.17 The maximum number of duplex appliance outlets allowed on a branch circuit shall not exceed 10 for a 15 Ampere circuit breaker or 13 for a 20 Ampere circuit breaker.
- 8.4.18 Branch circuit conductors serving convenience outlets shall be, at a minimum of, #12 AWG copper. All conductors shall be insulated to 600 volts and meet the requirements of the National Electrical Code.

#### **8.5 Conduit**

- 8.5.1 Refer to Section I of TP76301 for information regarding conduit.

#### **8.6 Branch Circuits**

- 8.6.1 When adding new branch circuits, fluorescent lighting or extending existing circuits, the Installation Supplier shall verify that no additional connection is made between the added neutral (white wire) and the required green wire ground (ACEG).
- 8.6.2 When extending an existing circuit, the Installation Supplier shall insure that the rating of the circuit protection device is not exceeded.

#### **8.7 Lighting**

- 8.7.1 Airey-Thompson and H.E.Williams lighting fixtures shall be installed per manufacturer's instructions.
- 8.7.2 LumiCool lighting fixtures shall be installed per manufacturer's instruction and ATT-TP-76202.

TABLE M-2--TOTAL HOURS OF CHARGE AT 2.50 - 2.55 VOLTS PER CELL

(NOTE A)

Time (T) on Open Circuit (Note C)	Cell Temperature - Measured at Open Circuit Voltage (Note B)		
	81 Degrees (F) and above	65 - 80 Degrees (F)	64 Degrees (F) and Less
T ≤ 4 months	100 hours	150 hours	200 hours
4 months < T ≤ 6 months (lead calcium)	150 hours	200 hours	250 hours

NOTES: A. Total charging time shall not exceed 250 hours.

B. Cell temperature will be determined by selecting a Pilot Cell ("Temperature Reference Cell")

C. Time on open circuit is determined from the "charge by" date on the shipping container. The "Charge By" date is that date when the open circuit time will be 6 months.

**FIGURES M-1, M-2 AND M-3**

A reproducible copy of a Pressure Test Record (Figure M-1), Storage Battery Charge Report (Figure M-2) and Pilot Cell Charge Report (Figure M-3) are provided on the following pages.





**Use a separate form for multiple strings**

PILOT CELL CHARGE REPORT – PAGE 1						
Office CLLI				Power Plant ID:		
P/A Oracle No.:						
Installation Supplier Name						
Installation Supplier Contact Telephone No.:						
Name or Person making measurements:						
String ID:						
Pilot Cell #		Reading Date and time		Pilot Cell Readings		
Reading Number	Reading Reqmt.	Date:	Time:	Charge Current	Charge Voltage	Temperature
1	Initial					
2	1 hour					
3	2 hours					
4	3 hours					
5	4 hours					
6	5 hours					
7	6 hours					
8	7 hours					
9	8 hours					
10	Day 1 #1					
11	Day 1 #2					
12	Day 1 #3					
13	Day 2 #1					
14	Day 2 #2					
15	Day 2 #3					
16	Day 3 #1					
17	Day 3 #2					
18	Day 3 #3					
19	Day 4 #1					
20	Day 4 #2					
21	100 hours					
22	Day 4 #3					
23	Day 5 #1					
24	Day 5 #2					
25	Day 5 #3					
26	Day 6 #1					
26	Day 6 #2					
27	150 hours					
28	Day 6 #3					
29	Day 7 #1					
30	Day 7 #2					
31	Day 7 #3					

PILOT CELL CHARGE REPORT – PAGE 2						
String ID:						
Pilot Cell #		Reading Date and time		Pilot Cell Readings		
Reading Number	Reading Reqmt.	Date:	Time:	Charge Current	Charge Voltage	Temperature
32	Day 8 #1					
33	Day 8 #2					
34	200 hours					
35	Day 9 #1					
36	Day 9 #2					
37	Day 9 #3					
38	Day 10 #1					
39	Day 10 #2					
40	Day 10 #3					
41	250 hours					
42						
43						
44						
45						
46						
47						
48						
49						
50						
51	Final - Before stopping charge					

**TABLE M-3--CONDUCTORS FOR BUS DROP TO CELL POSTS**

<b>Cells AMP HR Capacity</b> <b>8 HR Rate</b>	<b>Conductors</b>	
	<b>Number</b>	<b>Size</b>
<420	1	4/0
>420	2	4/0
<840	2	4/0
>840	4	4/0
1680	4	4/0
>3500	4	350 kcmil

**[END OF SECTION]**

**SECTION N -- ELECTROSTATIC DISCHARGE (ESD)**

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**TABLE N-1 – SUMMARY OF CHANGES IN SECTION N**

Change	Item in 09/08 Issue	Item in this Issue
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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&TIS installation specifications. Refer to ATT-TP-76306 (Electrostatic Discharge Control)
- 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 requirements to protect equipment from Electrostatic Discharge (ESD).
- 1.1.4 Changes in this issue of Section N are summarized in Table N-1.

1.1.5 The term circuit pack is equivalent to terms such as plugs, plug-ins, plug-in units, printed wiring boards, circuit boards, packs, cards, etc.

1.1.6 All equipment containing solid state electronic components is considered ESD-sensitive.

## **1.2. General Requirements**

1.2.1 The Installation Supplier shall provide the necessary anti-static devices to prevent Electrostatic Discharge (ESD) damage to sensitive devices.

1.2.2 Static generating material shall be kept out of work areas where circuit packs are handled.

## **2. ESD CONTROL HARDWARE - PLACEMENT AND USE**

### **2.1. Wrist Straps**

2.1.1 A grounded wrist strap shall be worn at all times when handling a circuit pack that is not inserted in equipment or its protective storage/shipping container. A wrist strap may also be required by an equipment vendor's documentation when performing installation and/or maintenance operations.

2.1.2 To maintain continuity between the wearer's skin and the wrist strap ground point, the band of the wrist strap shall be properly adjusted.

### **2.2. Wrist Strap Testing and Testers**

2.2.1 At minimum, the wrist strap assembly shall be tested each day it is used to assure proper operation. It shall be replaced or repaired when found defective.

2.2.2 The Installation Supplier shall test the integrity of the wrist strap assembly. A Go/No-Go type wrist strap tester using both audible and visual indicators shall be used for testing the wrist strap assembly. In the absence of a wrist strap tester, the wrist strap assembly shall be tested with a volt-ohm meter (VOM). The reading shall be greater than 750 kilo-ohms and less than 1.2 meg-ohms.

2.2.3 When a wrist strap assembly is tested, the band shall be properly adjusted to the wrist, and then the cord shall be stressed from side to side and subjected to a pulling stress to discover intermittent conditions. This dynamic test helps detect open cords or improperly adjusted or dirty bands.

### **2.3. Wrist Strap Grounding Points**

2.3.1 The wrist strap shall be connected to the bay mounted grounding jack, if the bay is so equipped. An alligator clip shall be used to connect a wrist strap to an effective grounding point in equipment not equipped with a grounding jack. Any unpainted screw, nut, bolt, equipment mounting plate, etc., is considered an effectively grounded point

2.3.2 An ESD jack and label shall be provided on the front of all new equipment racks (right upright at a height of 45" from the floor line, plus or minus 1"). This requirement does not apply to Power Distribution Racks/Bays. Refer to Note 7 of ATT-E-00174-E. Exceptions to this requirement apply to equipment racks that have no accessible space on which to install an

ESD jack. The ESD jack shall be electrically continuous with the rack. An ESD jack and label shall be provided on the front of an existing equipment rack upright when specified by AT&T Engineering.

- 2.3.3 The Installation Supplier shall test for continuity between the ESD jack and the bay ground lead and record this test on the test record.

**2.4. Static-safe Work Station and Field Service Kit**

- 2.4.1 An ESD Field Service Kit provides a portable static-safe workstation well suited for use at all sites and in CEVs and SLC huts not equipped with ESD protective material. An acceptable kit shall include a wrist strap and cord, a grounding cord, and a static dissipative mat that folds out to create a work surface mat. The mat shall include pouches that can be used as a temporary means to transport circuit packs while not in their protective shipping/storage containers.

- 2.4.2 A static-safe workstation shall be created and used at any location where personnel will handle bare circuit packs. At minimum, the workstation shall be equipped with a wrist strap assembly, a wrist strap grounding point, and a static dissipative surface on which a circuit pack can be placed. A circuit pack's static-safe shipping/storage container meets the requirement for a static dissipative surface.

- 2.4.3 Items not allowed at static-safe work stations include:

- a) a highly conductive work surface, unless it is covered with a static dissipative material
- b) any static-generating material not absolutely required at the work station

**3. CIRCUIT PACK STORAGE AND HANDLING**

**3.1. Circuit Pack Storage**

- 3.1.1 When a circuit pack is removed from an equipment shelf, bank, module, etc., the circuit pack shall immediately be placed in a static-safe container. A circuit pack shall not be removed from its container *except* for installation into equipment or for maintenance at a static-safe workstation (setting option switches, etc.).

- 3.1.2 A circuit pack storage container shall be one of the following:

- a) The circuit pack's original static-safe shipping container
- b) An approved third party static-safe container
- c) An approved static-safe wrapping

Note 1: While static-safe containers are the preferred method of storage, it is acceptable to store bare circuit packs in an existing circuit pack storage frame or cabinet that is a component of an approved equipment system, such as DMS-100F switches.

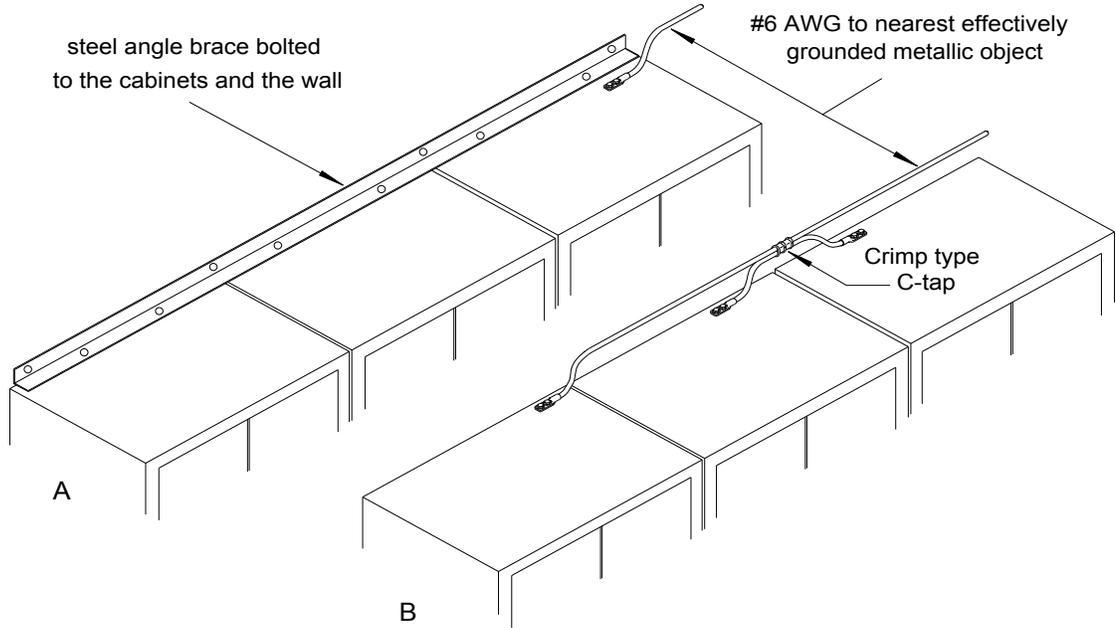
Note 2: A number of static-safe transport cases for circuit packs have been approved for use in AT&TIS sites.T facilities. The purpose of these cases is to transport circuit packs; they shall not be used in place of storage cabinets.

- 3.1.3 Metal circuit pack storage cabinets shall be grounded. The requirements below are based on the storage cabinets being one or a combination of the following:
- a) Any general purpose type metal storage cabinet (wall locker, etc.) that has been braced per applicable storage unit bracing requirements using a metallic angle secured to the wall and/or floor and the top and/or bottom of the cabinet(s), an enclosure that is a component of an approved for use equipment system, or
  - b) A storage cabinet that has been approved as a stand-alone type (floor support only)
- 3.1.4 A single circuit pack storage cabinet or a group of cabinets shall be grounded using minimum #6 AWG conductor. This connection shall be made to the common bonding network or the isolated bonding network as applicable.

**3.2. Handling and Transportation Guidelines.**

- 3.2.1 While ESD events can affect working equipment, a circuit pack is most vulnerable while not installed in equipment or in a static-safe shipping/storage container. The following guidelines shall be followed to avoid ESD damage:
- a) Wear a properly grounded wrist strap assembly before working on or handling circuit packs.
  - b) Handle a circuit pack by its edge only; avoid touching contacts of the edge connector.
  - c) Avoid touching the individual components of a circuit pack.
  - d) Keep the circuit pack in its original shipping container or static-safe protective container until ready for use.
  - e) When transporting a circuit pack, place it in static-safe cardboard and/or a static-safe plastic bag or use a protective circuit pack container. The container shall be fire retardant if left in an open area or placed on open shelving to meet local fire codes.
  - f) Never place static generating material, like documents, inside a static-safe container.
  - g) Store circuit packs on approved suitable shelving. Avoid storing them in equipment bays not specifically designed as a storage area. Circuit packs stored in non-approved shelving and/or bay shall be kept in a static-safe fire retardant container.
  - h) Unprotected circuit packs shall only be placed on a static-safe work surface in a single layer; circuit packs shall not be placed on top of each other.
  - i) A circuit pack shall be accepted only when it is in an approved ESD protective container.
  - j) Containers are not to be opened unless wearing appropriate wrist strap assembly.

FIGURE N-1 – TWO METHODS FOR GROUNDING CIRCUIT PACK STORAGE CABINETS



[END OF SECTION]

**SECTION O -- FIBER OPTICS**

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**TABLE O-1 – SUMMARY OF CHANGES IN SECTION O**

Change	Item in Previous 3/31/07 Issue	Item in this Issue
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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 Internet Services 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 AT&TIS requirements for running and terminating fiber optic cables and jumpers.

## 1.2. Definitions

### 1.2.1 Premise Fiber Optic Cable

Premise Fiber Optic Cable is intended for indoor use within an environmental structure (i.e. home, commercial, or industrial building) to carry optical signals from place to place within the structure. There are two types of Premise cable and they are as follows:

#### 1. Distribution Cable:

Distribution Cable is cable consisting of two or more fibers, assembled individually or as members of multi-fiber units, normally intended for installation in relatively long lengths, and in installations normally requiring each entire cable end to be terminated at a single location.

**Distribution cable is what we commonly refer to as OFNR (Optical Non-conductive Riser) cable.**

The minimum requirements for Distribution cable are as follows:

- A. Shall consist of two or more fibers.
- B. Shall be for indoor use only.
- C. Shall be riser rated i.e. rated for use between floors or in a riser shaft.
- D. Shall be tight buffered.
- E. Shall be Type 1 construction.
- F. Shall have an independent strength member that is not part of the fiber construction.

#### 2. Interconnect Cable:

Interconnect Cable consists of one, two or four fibers, reinforced and jacketed, intended for short distance applications. One-fiber cable is often called Simplex Cable, while two-fiber cable is known as Duplex Cable. Duplex Cable consists of two single-fiber (simplex) cables or two individual fibers assembled with an overall jacket, or two simplex cables bonded together or may be referred to as "Zip Cord". In bulk, these cables are referred to as Simplex Cordage or Duplex Cordage. Quad cables consist of four single fibers reinforced and jacketed or four simplex cables assembled and jacketed or bonded as a unit. **Interconnect cable is what we commonly refer to as either a jumper or a patch cord.**

**Note:** The difference between a jumper and a patch cord is defined as follows:

**Patch Cord** – Defined as a connection between the rear of an FOT panel and a Network Element.

**Jumper** – Defined as a connection within the FDF complex between panels i.e. FOT to FOT, FOT to OSP etc.

The minimum requirements for Interconnect cable or jumpers/patch cords are as follows:

- A. Shall consist of only one, two or four fibers.
- B. Shall be for indoor use only.
- C. Shall be tight buffered.
- D. Shall be Type 1 construction
- E. Shall **not** have an independent strength member that is not part of the fiber construction.

## 1.3. Requirements

- 1.3.1 The entire length of a polyethylene sheathed fiber optic cable run shall be placed on ladder type cable rack.
- 1.3.2 The Installation Supplier shall not install innerduct for use with polyethylene sheathed fiber optic cable in the AT&TIS environment unless needed for diversity requirements.
- 1.3.3 The AT&T approved Fiber optic cable troughs, also commonly referred to as fiber optic raceway, Protection System (FPS) shall not be run through floor penetrations or fire rated walls.
- 1.3.4 Refer to section L, ATT-TP-76301 for Fiber Optic Warning Label requirements.

## **2. RUNNING, SECURING AND FIRESTOPPING FIBER OPTIC CABLE**

### **2.1. Running Fiber Optic Cable**

- 2.1.1 When the fiber optic cable enters the building in conduit, any slack shall be stored in the cable vault or cable entrance facility area, so that the cable can be pulled back and reterminated or spliced.
- 2.1.2 Whenever the building has no cable vault, any fiber optic cable slack shall be stored at the entrance facility. The stored length shall not exceed 50 feet. If the fiber optic cable has metallic strength members or a metallic shield, no more than fifty (50) feet of cable shall be pulled into the AT&TIS site.
- 2.1.3 When the fiber optic cable is direct buried and does not enter the AT&TIS site in conduit and, it cannot be pulled back into the first manhole, slack shall not be stored in the cable vault.
- 2.1.4 Fiber optic cable shall be run on dedicated fiber cable rack or dedicated metallic/terra cotta conduit, from the cable vault and/or cable entrance facility (CEF) to the fiber optic terminating bay.
- 2.1.5 Fiber Optic Cables (not to be confused with fiber optic patch cords or jumpers) shall not be placed in any fiber raceway/duct work of the fiber protection system. Fiber Optic Cable placements within the AT&TIS site shall be placed on/in dedicated cable rack, L-Brackets, U-shaped cable rack horns or metallic conduit and shall adhere to the standards as outlined in ATT-TP-76305, *Cable Installation, Removal and Mining Requirements - Cable Racks and Raceways*.
- 2.1.6 All OSP cable entering a building, for more than 50 feet, that is not riser rated shall transition to an approved riser rated cable at the CEF or be placed in a fire Stopped metallic raceway or approved fire rated innerduct prior to leaving the CEF.
- 2.1.7 Fiber cable shall not be run on dedicated power cable racks.
- 2.1.8 The cable shall be run straight on the cable rack and shall not hang off the side or run across an open area.
- 2.1.9 To avoid the premature exhaustion of available cable space, excess cable of individual fiber optic cable runs shall not be stored on/in the overhead cable rack.

- 2.1.10 Fiber optic cable connectors shall be covered and protected with the manufacturer's dust caps during installation.
- 2.1.11 Fiber optic cables shall be installed and/or secured in a manner that protects them from damage.
- 2.1.12 The Installation Supplier shall utilize cable clamps and grommets to secure all fiber optic cables terminating between Fiber Distributing Frames (FDF) or between FDFs and Network Elements. Clamps and grommets shall be attached to the terminating shelf if there is a designated place on the shelf itself to do so. If there is no designated place on the terminating shelf, then the clamp and grommet shall be placed on the bay upright. Multiple clamps and grommets may be used if necessary to facilitate proper cable slack management. Nine cord may be used as an additional cable securing instrument on the bay upright once the primary clamp and grommet have been placed.
- 2.1.13 Optical Fiber Non-conductive Riser (OFNR) cable leaving cable racks and entering frames, racks or other equipment shall be supported at least every 3 feet.
- 2.1.14 When OFNR cable transitions downward from a horizontal cable rack to a vertical plane, a preformed turndown shall be utilized. If using L-brackets in this scenario, no preformed turndown is required.
- 2.1.15 When placing OFNR cable rack relative to the bay lineup, consideration to the type and size of the required cable rack preformed turndown needs to be taken into account.
- 2.1.16 On vertical runs, the cable shall be secured at every strap.
- 2.1.17 Horizontal runs of cable on cable racks shall be secured at every 4<sup>th</sup> strap to maintain a straight run, and flow of the bends.
- 2.1.18 The cable shall be secured at points of break off from the cable rack.
- 2.1.19 Fiber optic cable shall be secured with two (2) strands of 9 ply polyester twine.
- 2.1.20 The maximum amount of fiber cables allowed to be secured under one stitch are as follows:
  - \* Fiber counts of 2 to 6 per cable are allowed to have up to 10 cables under one stitch.
  - \* Fiber counts of 8 to 36 per cable are allowed to have up to 5 cables under one stitch.
  - \* Fiber counts above 36 fibers per cable are allowed to have no more than 2 cables under one stitch.
- 2.1.21 Plastic tie wraps shall not be used to secure fiber optic cable inside the building.
- 2.1.22 The use of Fusion Splices is rated as Standard in AT&T.
- 2.1.23 No more than 10ft of slack shall be permitted for fiber cable runs over 100ft. For runs under 100ft, no more than 10% of the cable length shall be permitted as slack.
- 2.1.24 When securing OFNR cable, a minimum of two wraps of sheet fiber shall be placed around the fiber cable at each tie down point.

### **3. FIBER OPTIC CABLING From VAULT TO FDF**

3.1. Fiber cabling between the vault and the FDF is fiber cable type dependent. Given the appropriate fiber cable type, the following procedures shall be followed:

- a) **Traditional OSP Cable** - This cable shall be required to be run in an inner-duct, which is a semi-rigid, plastic, fire retardant tubing, unless local fire or building codes dictates differently. This tubing can be corrugated or smoothed walled. The composition of the OSP cable requires that it be installed in such tubing due to the fact that it gives off unsafe gases when burned. It is an NEC code requirement to install OSP cable in fire retardant inner duct when the cable enters a building and runs 50 feet or more. **Note: when inner duct is used, it shall be properly fire stopped at the open ends and where it penetrates any fire rated wall, floor or cable penetration.**
- b) **OFNR Cable** – When this type of cable is run on horizontal rack, it shall be secured at every 4<sup>th</sup> strap. For vertical runs it will be secured on every strap. OFNR cable shall not be run in an inner duct since it does not have an adequate strength member to support itself in a tube type installation. If OFNR cable is installed in such a manner which causes the cable to free fall three or more floors, then a Kellum grip type of strain relief shall be used to support the cable. OFNR cable shall carry markings showing compliance to the UL-1666 standard and marked as TYPE OFNR.
- c) **The Indoor/outdoor cable** (i.e. FREEDM cable, a Corning brand name) can be run as traditional OSP cable or as OFNR cable. It has strength members, which are the same as that used in non-metallic OSP cable, so it can be run in an inner duct. This type of cable shall only be run in inner duct when fiber management (space for future installations, etc.) is an issue or when local fire/building codes require it. Once Indoor/Outdoor cable reaches the Cable Vault it shall be secured at 4 foot intervals. When Indoor/Outdoor cable goes from the vault to the FDF, horizontal runs shall be secured every 4<sup>th</sup> strap and vertical runs shall be secured at every strap. When inner duct is used it shall be properly fire stopped at the open ends and where it penetrates any fire rated wall, floor or cable penetration.

**NOTE:** For OFNR & Indoor/Outdoor type cables coming from the vault, the cables shall carry flag type markers at the points where it enters and exits the inner-duct, conduit or at the point where it passes through and exits a floor, wall or ceiling. The label will show the originating Frame Identification Code (FIC) or relay rack and the terminating Field Identification Code (FIC) or relay rack locations as well as the installation vendor name and date installed.

- d) **USING INNERDUCT WITHIN A SMALL COMPLEX i.e. Rt, Hut, CEV, Node** - When installing Indoor/Outdoor type cable within a small complex, where the splice box is within the complex there is no need to install the cable in an inner duct. The cable shall be installed like traditional riser cable either on cable rack or horns.
- e) **FDF PANEL DIVERSITY** - When OSP cable is brought into a location and the cables are routed diversely to the FDF (LGX), it is an acceptable practice to terminate these cables within the same bay as long as these cables are terminated in separate FDF (LGX) shelves. These cables shall be routed on opposite sides of the bay. In the event a pre-terminated shelf is being used then there could be a situation where both cables will be running on the same side of bay. This is ok as long as the cables take diverse routes after leaving the bay.

#### 4. FIBER OPTIC PATCHCORDS AND JUMPERS

##### 4.1. Requirements

- 4.1.1 Fiber optic patch cords and jumpers shall be limited to simplex and duplex type only. The use of multiple count fiber jumpers and patch cords beyond a duplex is prohibited unless otherwise specified by individual equipment drawing or equivalent requirements.
- 4.1.2 Fiber optic patch cords shall not be run on cable racks.
- 4.1.3 Fiber optic patch cords shall be run in dedicated troughs of fiber protection systems. New fiber raceways shall be installed using the AT&TIS approved fiber protection system. The following requirements apply to the installation of fiber protection systems:
- a) Solid-walled raceway shall be used for horizontal runs. The raceway shall be installed with covers where room permits. Covers shall face the ceiling and no side ways mounting of raceway is allowed. Auxiliary framing, conduit, cable racks, etc. shall not obstruct the opening of the raceway covers.
  - b) Slotted-walled vertical raceway with covers and appropriate elbow sections shall be used on the framework upright between the overhead fiber trough and the equipment break off points. Framework mounted vertical raceway shall be mounted with covers facing the aisle.
  - c) When connectivity from an overhead Fiber Protection System (FPS) to the top of the network element bay is required (i.e. providing a drop option for fiber patch cords), the fibers shall be protected via the use of a rigid arrangement or a corrugated split tube arrangement. Spiral wrap shall **not** be used. The only methods acceptable for drop options to a Fiber Protection System (FPS) are either a rigid arrangement or a corrugated split tube arrangement. Examples and details of the rigid and split tube drop option arrangements can be found in ATT-TP-76401, Section 8.
  - d) Spiral wrap or yellow corrugated split tubing may be used to protect small bundles of individual fibers and to assist in maintaining proper bend radius control when fiber patch cords exit the vertical rigid FPS at the front or rear of a bay as the fibers are extended to their connection point within the bay footprint. When using yellow corrugated split tubing, it shall not be overloaded with individual fibers in such a manner that fibers become pinched or the tubing separates.
  - e) Spiral wrap, yellow corrugated split tubing or fiber sheeting shall not be used to store excess slack in the bay footprint.
  - f) Spiral wrap or yellow corrugated split tubing may be secured to the network element using hook and loop tape.
  - g) Yellow corrugated split tubing may be secured to the network element using 9 ply polyester twine.
  - h) When using spiral wrap for fiber management, hook and loop tape shall only be used to secure the spiral wrap. 9 ply polyester twine shall not be used.

- i) Fiber jumpers entering and exiting spiral wrap and yellow corrugated split tubing shall do so only from the ends.
  - j) Fiber sheeting shall not be used for protecting fiber jumpers.
  - k) Fiber patch cords transitioning from the vertical FPS at the side of a bay to the bay equipment shall be secured, protected or supported in one of the following methods:
    - Split Tube
    - Spiral wrap
    - Fiber Sheeting
    - Velcro
    1. When using any of the above mediums, the appropriate size shall be used. "Appropriate" size shall be defined as, as small as possible while at the same time leaving enough space between jumpers and side wall as to allow movement and not cause restriction.
    2. When using any of the above mediums, the fiber jumpers shall exit only the ends of the medium i.e. no jumpers shall protrude from the middle.
- 4.1.4 Other than in raised floor environments, at the FDF, the Fiber Protection System (FPS) shall be mounted above the bay towards the rear, in the air space between 7'-3" and 8'-5" where possible.
- 4.1.5 Other than in raised floor environments, at the Network Element, the Fiber Protection System (FPS) shall be mounted above the bay, in the air space between 7'-3" and 8'-5" where possible. Front or rear location will be dependent upon the terminating parameters of the equipment.
- 4.1.6 If equipment is installed that does not have the connections on the same side as existing fiber protection system, the use of a bay mounted tray shall be used to run the fibers from the existing fiber trough to the connection side of the equipment.
- 4.1.7 Fiber optic jumpers and patch cords shall be ordered in the near correct lengths in order to interconnect between FDF panels or FDF panels and network elements. These fiber jumpers/patch cords shall not be less than 6 feet in length and shall be ordered from an approved manufacturer. **Fiber jumper slack shall be conditional as follows:**
- A) No more than 10ft of slack is permitted for fiber runs over 100ft.
  - B) Fiber runs less than 100ft shall have no more than 10% of the jumper length as slack.
  - C) Excess patch cord slack shall be stored at either the network element cable management system or the FDF cable management system, depending on space availability, while maintaining the minimum fiber bending radius.
  - D) Excess fiber patch cord slack shall **NOT** be stored in the FPS.
- 4.1.8 Protective caps shall be placed on the ends of fiber optic jumpers and patch cords during installation, and on the ends of un-terminated fiber optic jumpers or patch cords. The

protective caps are used to prevent scratching the end of the jumper, which would increase loss and/or cause errors and accidental exposure to laser light.

- 4.1.9 Vertical portions of the fiber protection system on frame upright shall have support brackets at the top and bottom and every 18 inches between the top and bottom.
- 4.1.10 In the event a previously installed Fiber Protection System (FPS) that contains fibers must be cut, the section or sections involved shall be removed from their previously installed position and ALL fibers shall be supported and protected before any cutting can be done.
- 4.1.11 The cutting of installed Fiber Protection System (FPS) is to be considered a "Volatile Work Activity." and shall be performed during the Maintenance Window.
- 4.1.12 The cutting of installed Fiber Protection System (FPS) shall be outlined in the detailed steps of an approved MOP.
- 4.1.13 The length of split tube shall not exceed 24 inches from the horizontal FPS to the top of the bay. If the distance from the horizontal FPS to the bay is greater than 24 inches, the installation supplier shall install rigid vertical FPS from the horizontal FPS to within 24 inches of the top of the bay where possible. Where the split-corrugated tubing meets the FPS duct, the tubing shall be secured to the duct with either pop rivets, with nuts and bolts or waxed twine. Bolts shall be installed with the head of the bolt on the inside of the tubing and the nut on the outside of the FPS duct. Enough of the tubing must penetrate the FPS system to eliminate any sharp bends; however, the tubing shall never be allowed to block any of the cable runs.
- 4.1.14 Split flex tube shall not extend more than 3 inches into any fiber management system.
- 4.1.15 There are no drop length requirements for unsupported patch cords transitioning from the FPS to the network element.
- 4.1.16 When it is necessary to remove fiber jumpers/patch cords i.e. for provisioning purposes or where ducts have become or are on the verge of becoming overloaded, then removals shall be performed by a minimum of two individuals. The utmost care and discretion shall be observed as any Fiber Protection System will always be carrying live service.

**4.2. Fiber Optic Warning Labels**

- 4.2.1 Fiber Optic Warning Labels shall be installed per Section L, ATT-TP-76301.

[ END OF SECTION ]

**SECTION P -- CABLE VAULT AND CABLE ENTRANCE FACILITY**

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**TABLE P-1 – SUMMARY OF CHANGES IN SECTION P**

Change	Item in 09/08 Issue	Item in this Issue
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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&TIS 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 grounding requirements in the cable vault and Cable Entrance Facility (CEF).
- 1.1.4 Changes in this issue of Section P are summarized in Table P-1.

**1.2. Cable Vault**

- 1.2.1 Each lineup of cable rack in the cable vault shall be equipped with an insulated ground bar near each cable entrance facility (CEF). Refer to Figure P-1.
- 1.2.2 The insulated ground bar shall normally be mounted above the top horizontal support arms between verticals 2 and 3. As an alternate location, in cable vaults with a single line-up, the insulated ground bar may be mounted on the wall.

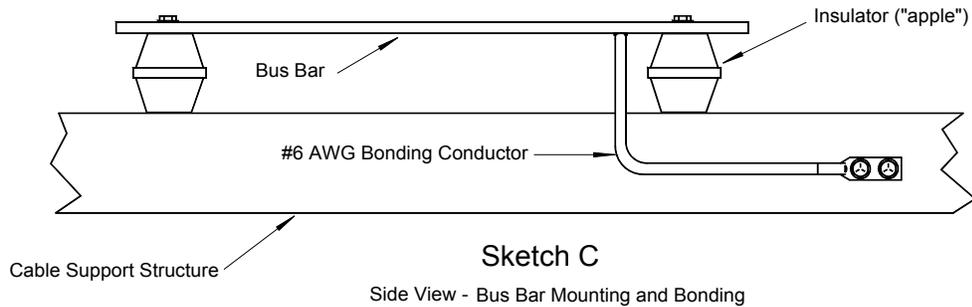
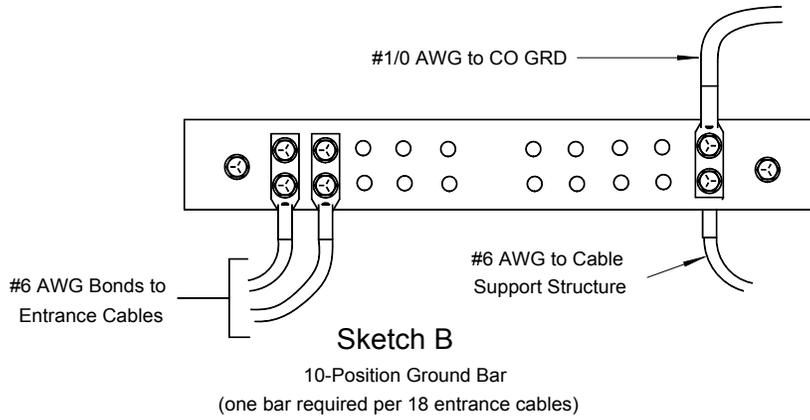
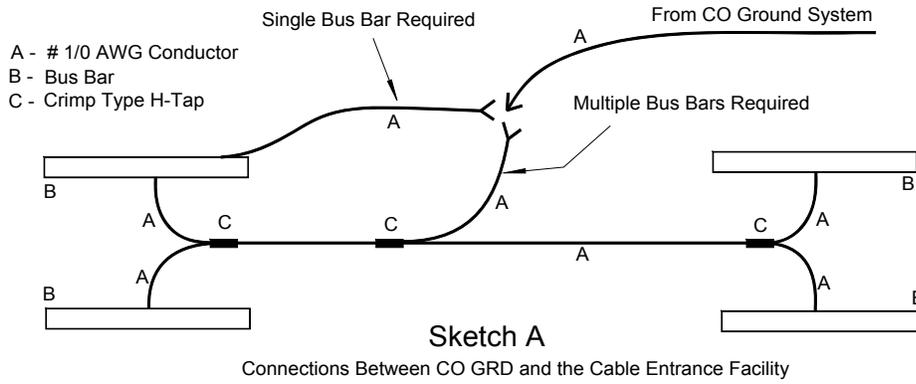
- 1.2.3 All of the ground bars located in the cable vault shall be bonded to each other with a minimum 1/0 AWG conductor to form a grounding system.
  - 1.2.4 The bonding conductor shall be run on the top horizontal and secured every 18 inches with cord.
  - 1.2.5 A 1/0 AWG grounding conductor shall be installed from the AT&TIS sites ground system to the associated cable vault grounding system.
  - 1.2.6 Each lineup of cable rack in the cable vault shall be bonded to the cable vault ground bar with a #6 AWG bonding conductor. Use a two (2) hole crimp type connector, drill the upright, remove the paint and coat contact surface with a thin coat of NO-OX-ID "A".
  - 1.2.7 Each ST 21 Peth (polyethylene) sheath entrance cable shall be bonded to the ground bar nearest its CEF (maximum 18 cables per bar). The bonding conductor shall be a #6 AWG conductor equipped with a single hole crimp type lug for connection to the cable splicing case. Lockwashers are required to ensure a secure connection.
  - 1.2.8 Each new or rearranged cable with lead sheath shall be bonded to the ground bar nearest its CEF. The #6 AWG bonding conductor shall be attached to the lead sheath using a B or D bond clip. The bonding clip is normally located between the 2nd and 4th verticals. Connecting a grounding conductor to a lead sheath by soldering on existing cable is not acceptable.
  - 1.2.9 The metallic shield of all cables, including fiber optic, entering a structure shall be bonded to the structure's ground system. In AT&TIS sites cable vaults, this bond is usually made at the point designated as the protection bay.
  - 1.2.10 Foil-lined air pipes shall also be bonded to the nearest CEF ground bar. Airpipe fittings are available for this purpose. #6 AWG bonding conductors shall be used. Several air pipes may be connected together.
  - 1.2.11 Connections to the cable vault ground bar shall be made using two (2) hole crimp type connectors.
  - 1.2.12 All #6 AWG and 1/0 AWG bonding conductors shall be tinned, stranded and insulated.
- 1.3. Cable Entrance Facility (CEF)**
- 1.3.1 The CEF is considered as the immediate area where the cables enter the building.
  - 1.3.2 The metallic shield of a cable entering a structure shall be bonded to the structure's ground system.
  - 1.3.3 In a CO, remote hut, CEV or customer premise location without a cable vault, an insulated ground bar shall be mounted near the CEF.
  - 1.3.4 A 1/0 AWG conductor shall be installed from the AT&TIS sites ground system to the CEF ground bar.
  - 1.3.5 Bond all cables to the CEF ground bar.

**INSTALLATION REQUIREMENTS**  
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**September, 2008**

- 1.3.6 Multiple CEFs may be provided in a single building. When this condition occurs, a #1/0 AWG conductor shall be installed to bond all bars together.

figure p-1 – cable vault grounding



[END OF SECTION]

**SECTION Q -- EQUIPMENT REMOVAL AND CABLE MINING**

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**TABLE Q-1 – SUMMARY OF CHANGES IN SECTION Q**

Change	Item in 3/31/07	Item in this Issue
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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&TIS 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 equipment removal activities.
- 1.1.4 Changes in this issue of Section Q are summarized in Table Q-1.

**1.2. General Requirements**

- 1.2.1 The Installation Supplier shall not remove equipment from service unless authorized by the AT&TIS Representative. A detailed MOP shall be prepared and approved by an AT&T Equipment Engineer prior to any removal activities.
- 1.2.2 Removal work shall include an analysis of the AT&TIS site ground paths. Connectivity to the AT&TIS site ground shall be maintained for frames and bays not being removed. It is the responsibility of the Installation Supplier to maintain the integrity of the AT&TIS site ground system.
- 1.2.3 Before removing frames or bays from a lineup, the AT&TIS site ground shall be temporarily bridged to insure the ground path is not interrupted. The minimum size used for the bridge shall be a #6 AWG stranded conductor.
- 1.2.4 When the MGB is removed, the Installation Supplier shall maintain ground reference continuity between the battery return of the power plant and the AT&TIS site Ground (IS POP/VHO GRD).
- 1.2.5 Frame and aisle lighting, switches and appliance outlet circuits that are modified or removed will have the AC power removed and the circuit breaker or fuse tagged with an installer created "Warning Tag", before work begins. A positive lockout device and tag at AC source shall be used to prevent any possibility of energizing circuit.
- 1.2.6 After removing fluorescent lighting or outlet circuits, verify that the remaining circuits have the correct polarity and the ACEG is continuous.
- 1.2.7 Ensure that all junction box holes produced by the removal of conduit etc. are plugged. All remaining, open-ended conduit shall be capped. All junction box cover plates shall be in place.
- 1.2.8 All through penetrations in fire rated walls and all floors created by removal activities shall be filled with approved fire stoppage products as listed in AT&T- 812-000-032.
- 1.2.9 All record books and designations shall be updated to reflect any revised circuit and fuse assignments, per requirements in Section L.

- 1.2.10 All designations on equipment remaining in an office associated with removed equipment shall be removed. This includes, but is not limited to, distributing frames, end guards, fuse and power board assignments, and DSX panels.
- 1.2.11 The Installation Supplier shall coordinate with the trucking, hauling or scrap company, specified in job documentation, or, as instructed by the AT&TIS Equipment Engineer, to ensure that all scrap materials are properly removed from the job site.
- 1.2.12 The Installation Supplier shall have at the job site a cable splicing kit capable of splicing 25 pairs of #22, #24 or #26 gauge conductors at one time.
- 1.2.13 The Installation Supplier shall have personnel experienced in cable tracing and splicing on the job site at all times during cable cutting operations in the vicinity of working equipment.
- 1.2.14 The Installation Supplier shall have an acid spill kit on site for all battery removal activities.
- 1.2.15 The Installation Supplier shall ensure that all battery vents and filling tubes are plugged with a shipping plug prior to shipment of batteries containing acid. Also, terminals shall be protected from short circuit with tape, caps, or protective packaging.
- 1.2.16 The Installation Supplier shall verify (with a clamp-on ammeter) the absence of current for each power lead to be removed. When multiple leads are being removed, the Installation Supplier shall verify the absence of current immediately before removing each lead.
- 1.2.17 Before the fuse at the power source end of the cable is removed, a clamp-on ammeter shall be utilized to verify the absence of current.

**1.3. Alarm Circuits**

- 1.3.1 Verification of all visual and audible AT&TIS site and building alarms shall be conducted by the AT&TIS Representative and the Installation Supplier before job start.
- 1.3.2 Alarm circuits shall be kept operational at all times, unless the current work activity dictates temporary disabling of the alarm circuit.
- 1.3.3 Any alarms disconnected shall be restored and verified for visual and audible accuracy at the completion of each work shift and when removal operations are completed. Alarm verification shall be confirmed for both the AT&TIS site and building alarms by the remote monitoring location.

**1.4. Disconnecting Live Circuits From Service**

- 1.4.1 The Installation Supplier shall verify that the AT&TIS Representative has had the equipment shutdown and removed all associated fuses, patch cords, cross-connections, etc., before any removal operation is started.

**1.5. Clearing Trouble**

- 1.5.1 If trouble is encountered during removal activity, the Installation Supplier shall notify the AT&TIS Representative immediately.
- 1.5.2 It is the joint responsibility of the Installation Supplier and the AT&TIS Representative to promptly locate and clear service interruptions and circuit troubles.

**1.6. Protection Of Working Equipment**

- 1.6.1 The Installation Supplier shall protect working equipment during removal operations.
- 1.6.2 All materials used for protection shall be anti-static, fire retardant and approved by the AT&TIS representative.
- 1.6.3 When extensive equipment removal activities are required, an anti-static, fire retardant sheeting or canvas partition wall shall be constructed and placed between working AT&TIS information services equipment and the equipment removal area to protect working AT&TIS information services equipment from airborne contaminants resulting from removal activity.
- 1.6.4 All applicable safety precautions shall be adhered to during cable removal and mining operations. Sharp objects shall not be used to separate cable bundles. Wedges, lifting, or separating tools shall be non-metallic and non-conductive.
- 1.6.5 During the mining operation, if it is observed that the ironwork, auxiliary framing or cable rack is becoming distorted, coming loose from its connecting hardware or displays unanticipated movement, the installation supplier shall immediately stop the work activity and notify the AT&T Engineer.
- 1.6.6 Cable cutting tools shall be equipped with a protective ring during the cable removal or mining operations in the vicinity of working equipment.
- 1.6.7 During cable removal or mining operations, cable ends shall be passed through the protective ring of cable cutting tools when they are to be cut.
- 1.6.8 Under no circumstances, shall a loop of cable or wire be inserted through the protective ring of cable cutting tool to be cut.
- 1.6.9 Under no circumstances shall a cable or wire be cut while on a cable rack.
- 1.6.10 If there is a possibility of the cut portion of cable striking working equipment when it is cut, the cable cutting activity shall be performed on the floor, or appropriate equipment protection shall be installed to ensure that the cut cable ends do not strike working equipment.
- 1.6.11 To avoid the possibility of cutting loops of live cables hanging off cable racks, the potentially live cables shall be temporarily separated away from the cables to be cut. When possible, the cables shall be separated on the cable rack. If due to the amount of cable on the cable rack the cables cannot be separated on the cable rack, then the cables shall be temporarily supported with trunk straps (or equivalent) to the side of the cable rack away from the cable cutting activity.

**1.7. Disposition Of Removed Equipment**

- 1.7.1 All removed equipment shall be disposed of at the direction of the AT&TIS Equipment Engineer.
- 1.7.2 The Installation Supplier shall contact the AT&TIS Equipment Engineer to obtain shipping containers if containers are not specified in the detail specification.

**1.8. Use Of Cable Markers**

- 1.8.1 The Installation Supplier shall place a green cable marker on each cable being removed from a bay, unless all the cables associated with the bay are being removed.

**2. HAZARDOUS MATERIAL**

**2.1. General Requirements**

- 2.1.1 Before the removal or shipment of any equipment, the Installation Supplier shall contact the AT&TIS Equipment Engineer for instructions for the identification and handling of hazardous material.
- 2.1.2 If the installation supplier uncovers hazardous materials during the removal and/or cable mining operation (e.g. lead cable, arsenic cable, PCB's, etc.) the work in that area shall be stopped immediately. The AT&T Representative shall be contacted for disposition and no work in that area shall continue until AT&T has a resolution for the hazardous material identified.

**3. RETIRED IN PLACE**

**3.1. Requirements**

- 3.1.1 Hazardous material shall not be removed.
- 3.1.2 All equipment retired in place (RIP) shall be identified by attaching a "RIP" tag or label. (Refer to ATT-TELCO-002-217-042) Place the RIP labels on the equipment so they do not cover the identifying designations. Stamping or labeling shall be used for marking the following information on the RIP label or tag:
- a) Project Number or PAO Number (Leave blank if unknown and retirement occurred prior to 4/1/06.).
  - b) Date retired in place (Indicate "Prior to 4/1/06" if unknown and retirement occurred prior to 4/1/06.).
  - c) If the equipment is determined to be reusable and not removed from the office, indicate 'Reusable Inventory'.
  - d) If the equipment is determined not to be reusable and not removed from the office, indicate 'Unusable Equipment'.
- 3.1.3 The Installation Supplier shall not remove power supply fuses unless authorized by the AT&TIS Representative in the MOP. The Installation Supplier shall disconnect and remove from the bay all cables associated with the removed fuses and insure disposition is in accordance with the AEO and/or spec.
- 3.1.4 The Installation Supplier shall install dummy fuses in each vacated open face; GMT and Type 70 fuse position(s).

- 3.1.5 Switchboard cable and wire terminating on the frame, bay, unit or position shall not be disconnected.
- 3.1.6 Switchboard cable and wire associated with the far end (i.e., distributing frame, fuse boards, other frames, bays, units or positions, etc.) shall be disconnected.
- 3.1.7 Designations associated with retired equipment shall be removed from partially vacated terminal strips, end guards and DSX panels.

#### **4. REMOVALS**

##### **4.1. Removing Frame, Bays And Units**

- 4.1.1 The Installation Supplier shall not remove power supply fuses unless authorized by the AT&TIS Representative in the MOP. The Installation Supplier shall disconnect and remove from the bay all cables associated with the removed fuses and insure disposition is in accordance with the AEO and/or spec.
- 4.1.2 The Installation Supplier shall install dummy fuses in each vacated fuse position.
- 4.1.3 When frames or bays are removed from under auxiliary framing, the auxiliary framing shall be permanently supported at intervals, not to exceed 6'0". Support shall be provided using 5/8" threaded rods from the ceiling inserts or from the floor using 2" pipe stanchions if ceiling inserts are not available. The auxiliary framing shall be level and at the height specified on the cable rack drawing if provided.
- 4.1.4 The Installation Supplier shall remove all far end wiring terminations associated with equipment being removed.
- 4.1.5 Opened alarm multiples shall be reconnected.
- 4.1.6 When distributing frame terminal strips are partially cleared, all wiring and designations associated with the removed circuits shall be removed.
- 4.1.7 When a frame or bay is removed, the floor fastener (e.g., Loxin, Hilti, etc.) shall not extend above the floor lines. If the floor fastener extends above the floor line, it shall be removed.
- 4.1.8 If the floor fastener is removed, the hole shall be filled.
- 4.1.9 The Installation Supplier shall remove the switchboard cable and wire back to the cable rack. If the cable rack is open ladder type, re-secure the cable with cord; if the cable rack is pan type, place the cable on the cable rack. Protecting the ends of dead switchboard cable is not required if the cable is on the cable rack. If the cable ends cannot be stored on the cable rack, the ends shall be covered with heat shrink.
- 4.1.10 If equipment is to be reused, the Installation Supplier shall:
  - a) Remove wire wrapped connections from rectangular terminals. Remove wire ends and clear wire holes.
  - b) Remove the unit and protect the equipment in a shipping container as specified by the AT&TIS Equipment Engineer.

- c) Not remove the hazardous material from the frame or bay.
  - d) Remove the frame or bay and protect the equipment in a shipping container as specified by the AT&TIS Equipment Engineer.
- 4.1.11 When equipment frame or bay removal activities take place near open cable holes, the installation supplier shall provide adequate protection to protect personnel and equipment from the danger of material or personnel falling through the cable hole to the floor(s) below.
- 4.1.12 Equipment frames and bays shall be removed systematically and shall be raised or lowered with hoisting equipment of an adequate size and type to safely perform the hoisting activity. Under no circumstances shall the equipment frame or bay removal process involve dropping frames or bays to the floor.

## **5. CABLE MINING**

### **5.1. Introduction**

- 5.1.1 Cable mining is defined as the removal of non-working cable (power, switchboard, armored, etc.) from cable racks (vertical or horizontal) that may be mixed with working cables on the same rack.
- 5.1.2 Cable mining is an operation with a potentially high risk of service problems, equipment damage, personnel injury and fire hazards.
- 5.1.3 A bulk cable mining operation involves the removal of a significant number of dead cables from a cable route. A bulk cable mining operation does not imply that all the cables on a cable rack are dead and will be removed.
- 5.1.4 A dead cable is a cable that has been disconnected at both ends and cut back to a point on the cable rack, as a result of equipment removals, relocations, modifications, etc.
- 5.1.5 Refer to ATT-TP-76305 and ATT-TP-76305-001 for additional cable mining requirements.

### **5.2. Requirements**

- 5.2.1 The Installation Supplier shall immediately stop work and notify the AT&TIS Representative if any of the following job conditions are observed.
- a) Sparks, ashes, or other signs of arcing
  - b) Cables that are warm to the touch
  - c) Worn, frayed, or damaged insulation on working cables
  - d) Armored cable.
- 5.2.2 The Installation Supplier shall exercise care when mining cable not to disturb H-tap covers. If an H-tap cover is opened, it shall be secured at each end with waxed cord.
- 5.2.3 Cable mining on vertical cable racks between floors where large cables or large amounts of cables are being removed shall be unsecured and removed no more than one floor at a time to prevent excessive unsecured cable hanging weight.

- 5.2.4 The Installation Supplier shall ensure that remaining cables are placed and secured in accordance with Section J of ATT-TP-76301.
- 5.2.5 The ends of dead power cables remaining after mining shall be protected with heat shrink caps or two layers of electrical tape.
- 5.2.6 If required, only a nonmetallic cable mining wedge shall be used to separate cables. The wedge shall not be driven between cables; it shall be inserted by hand.
- 5.2.7 Protection shall be provided for live equipment in the vicinity of cable mining and cutting operations.
- 5.2.8 Switchboard-type cable shall be cut initially as close to the termination of the cable at the equipment or frame as possible and mined toward its source.
- 5.2.9 Power cable shall be removed initially between the source protection device and the cable rack before power cable mining starts.
- 5.2.10 After the initial cut, the Installation Supplier shall cut cable as follows:
  - a) Pull the dead cable off the cable rack until the cut end is in hand (do not, under any circumstances, cut cable loops).
  - b) Pass the end of the dead cable through a cable ring cutter and cut. The cable shall be cut not less than 15 inches from the cable rack, with the hanging loose end visible.
  - c) Make sure the cable does not fall into live equipment.
- 5.2.11 The Installation Supplier shall remove cables off of the cable rack by hand. Excessive force shall not be used

**[END OF SECTION]**

**SECTION R -- PRODUCT CHANGE NOTICES AND MISCELLANEOUS  
INSTALLATIONS**

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**TABLE R-1 – SUMMARY OF CHANGES IN SECTION R**

Change	Item in 3/31/07 Issue	Item in this Issue
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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&TIS 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 installation suppliers performing Product Change Notice (PCN) and miscellaneous work operations not covered by a specific Automated Equipment Order (AEO).

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

## **2. CLASS A/AC PRODUCT CHANGE NOTICES (PCNs)**

### **2.1. Requirements**

2.1.1 The Installation Supplier shall ensure, as part of the evaluation of the installation that all work has been done in accordance with the product change documentation.

2.1.2 All applicable sections of ATT-TP-76301 shall be observed when applying PCNs, except that use of the Job Start Agreement and MOP shall be negotiated locally.

2.1.3 The Installation Supplier shall coordinate all hardwired class A/AC PCNs that are to be applied to AT&TIS equipment with the AT&TIS Representative, to provide the necessary coverage for removing affected equipment from service, testing and restoral of equipment to service. All spare plug-ins shall be modified.

2.1.4 The Installation Supplier shall be responsible for applying any apparatus to the plug-in. After the modification has been completed the Installation Supplier shall apply the new HECI/CLEI barcode label.

2.1.5 The Job Completion Report is not required to report PCN activity only. Instead, the Installation Supplier shall provide the location and quantity of all CLEI changes (old and new), using the Report of PCN Activity form in Figure R-1, to the address provided at the bottom of the form.

## **3. MISCELLANEOUS WORK OPERATIONS**

### **3.1. Introduction**

3.1.1 Miscellaneous work operations include any supplier installation activity performed at an AT&TIS location that is not covered by a AEO or Product Change Notice (PCN). An example of such work would be when an Installation Supplier had to return to a job site to correct errors discovered during an audit and the AEO had already been closed.

### **3.2. Requirements**

3.2.1 Miscellaneous work operations (e.g., warranty work, engineering complaint orders, defects correction) shall be performed according to all applicable sections of the ATT-TP-76301.

**FIGURE R-1 -- REPORT OF PCN ACTIVITY FORM**

A reproducible copy of the Report of PCN Activity form is provided on the next page.



**[END OF SECTION]**

**SECTION S -- MARKED DRAWING REQUIREMENTS**

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**TABLE S-1 – SUMMARY OF CHANGES IN SECTION S**

Change	Item in 09/08 Issue	Item in this Issue
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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&TIS 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 correcting and updating AT&TIS drawings.
- 1.1.4 Changes in this issue of Section S are summarized in Table S-1.
- 1.1.5 Additional information on updating AT&TIS drawings may be found in Section 4 of ATT-TP-76401.

## 1.2. Requirements

- 1.2.1 All installations, removals or assignment changes shall be marked on office drawings, if applicable, or by electronic application. (i.e., Framemate, TAB/db, power database, etc.).
- 1.2.2 The Installation Supplier shall compare the drawings with the equipment layout and make corrections as necessary so the "final" drawings reflect the actual office layout.
- 1.2.3 When a drawing is marked or corrected, there are normally one (1) or more associated drawings that also require changes. The Installation Supplier shall correct the affected drawing and ALL associated drawings.
- 1.2.4 When corrections are required to the drawings, the changes shall be legible and marked in color. Changes to the drawings shall be made as detailed below:
  - a) **Red** - Additions shall be marked or highlighted in red.
  - b) **Yellow** - Removals shall be marked or highlighted in yellow.
  - c) **Green** - New information concerning existing equipment shall be marked or highlighted in green. This indicates a "Record Only" change.
- 1.2.5 The Installation Supplier shall place one copy of each marked print in the job folder.
- 1.2.6 When changes to the drawings are required, the affected area shall be outlined in the appropriate color. It is not necessary to color the entire area. For example, an area outlined in red indicates that everything in that area has been added. However, everything possible shall be done to clarify the correction. Small areas (e.g., units mounted in a relay rack, added fuse, etc.) may be completely shaded; bay or circuit numbers may be colored over.
- 1.2.7 When a small area is outlined, it requires straight lines that define the affected area of equipment; a loose circle that covers part of the adjacent equipment shall not be used. However, large isolated areas may be circled, for example, if a complete bay or frame is being removed from a front equipment drawing, a circle may be used. The whole idea is to mark the drawing so the draftsman can accurately update the drawings.

## 1.3. Parameters for Drawing Changes - Additions

- 1.3.1 Where there is enough space to legibly enter the information, the Installation Supplier shall:
  - a) Outline the exact area in red.
  - b) Enter the information.
    - 1. Include locating dimensions.
    - 2. Use symbols to indicate bay sizes.
- 1.3.2 Where there is not enough space on the drawing to legibly enter the information, the Installation Supplier shall:

- a) Select a nearby vacant area.
  - b) Draw an enlarged outline of the area. Circle the outlined area and draw a line to the intended location on the drawing.
  - c) Enter the new information in the outlined area.
  - d) Position the information exactly.
- 1.3.3 Additions (red) and information (green) shall not be drawn on top of removals or changes (yellow).

**1.4. Parameters for Drawing Changes - Removals**

- 1.4.1 When equipment is removed, the affected area shall be outlined or highlighted in yellow.

**1.5. Parameters for Drawing Changes - Changes**

- 1.5.1 When equipment is to be replaced, the removal location shall be outlined or highlighted in yellow.
- 1.5.2 The Installation Supplier shall add the changes (new information and additions) using the rules detailed above for additions. Do not add the new equipment (red) over the removed (yellow) area.

**2. DRAWING DETAILS**

**2.1. Floor Plan Drawing**

- 2.1.1 The Installation Supplier shall show the following information on all updated floor plans:
- a) Bay number (inside bay symbol)
  - b) Bay name on front side of equipment
  - c) Bay size (length and width - see Symbol Table)
  - d) Clearance between adjacent bays
  - e) Distance between bay and columns
  - f) End guards
  - g) Aisle number
  - h) Aisle spacing (front & rear)

**2.2. Relay Rack Front Equipment Drawing**

- 2.2.1 The Installation Supplier shall show the following information:
- a) Bay sketch with reference to the height and width of the bay, size of mounting plates and supplier (Lucent, Newton, Hendry, etc.)
  - b) Supplier equipment name or designation
  - c) Bay number

- d) Shelf or panel number
- e) Name of unit

**[END OF SECTION]**

**SECTION T -- SYNCHRONIZATION**

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**TABLE T-1 – SUMMARY OF CHANGES IN SECTION T**

Change	Item in 09/08 Issue	Item in this Issue
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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&TIS installation specifications.
- 1.1.2 The Installation Supplier shall assure, 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 in a manner to assure compliance with the AT&T synchronization rules and policies.

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

## **2. REQUIREMENTS**

### **2.1. General**

2.1.1 The Installation Supplier shall attach a sync assignment record book (approved 8 ½ x 11 size) to the bay upright at or near the BITS/TSG clock. The Installation Supplier shall perform all cable labeling operations, update sync assignment record books and match assignment updates in the regionally approved record keeping system (ex. TAB/dB, SyncTrac, or GeoLink) for all installations, rearrangements and removals.

2.1.2 Refer to Section J, ATT-TP-76301 for cabling requirements.

2.1.3 Refer to Section L, ATT-TP-76301 for labeling requirements.

2.1.4 Refer to Section K, ATT-TP-76301 for connecting requirements.

### **2.2. Building Integrated Timing Supply (BITS)**

2.2.1 Building Integrated Timing Supply (BITS) concept is the method of providing and sustaining intraoffice synchronization. The BITS plan specifies that each office shall have one master clock signal source called the BITS/TSG (TSG = Timing Signal Generator). Under the BITS concept, every externally timed digital Network Element (NE) in the office shall derive its timing DIRECTLY from that single source within the office. A timing capable Network Element is defined as any digital equipment piece that is able to conform to the BITS concept by accepting the appropriate timing signals from an external source. A Network Element is still timing capable although it may not be currently configured or equipped to accept external timing signals, but the option exists to allow it to be so equipped.

### **2.3. Synchronization Requirements**

2.3.1 The installation supplier shall wire every timing capable network element within a building directly from the BITS clock, as directed by the ATT-CO interconnection drawing. This timing shall NOT be wired through any intervening devices, other than BITS clock equipment. The Installation Supplier shall NOT run the timing leads from BITS clock OUTPUTS to the network element inputs through DSX jacks unless specifically instructed to do so in the detailed specification. (for exceptions refer to Sync Collocation documents and the use of Timing Bridging Office Repeaters (TBORs))

2.3.2 Any Network Primary Reference Source (PRS) shelf shall be mounted in the same or adjacent bay to the master shelf. The installation supplier shall contact the AT&TIS Equipment Engineer if the detailed engineering specifications contain instructions for mounting this equipment in any other manner.

2.3.3 The AT&TIS Equipment Engineer shall be contacted in writing in the event of BITS DS1 output signals or DS0/composite clock signals approach 80-90% exhaustion.

### **2.4. Diversity And Redundancy**

- 2.4.1 Redundant BITS (timing) clock input and output leads and any other leads requiring diversity or redundancy shall be routed via separate cable paths when and where possible.
- 2.4.2 When completely diverse cable paths can not be obtained, the redundant BITS clock leads may be routed on a common cable rack for the portion in common as follows:
  - a) Redundant leads shall be placed on opposite sides of the rack to the point they can take separate cable paths. For ladder type cable racks, the cables shall be secured every third strap. When panned cable racks are provided, the cable shall be loosely tied to the inside of the cable rack stringer or the cable rack horn every six feet
  - b) When/where redundant leads must pass through a common cable hole; the length of commonality shall be minimized. Separate cable routes shall be used as soon as possible on either side of the cable hole.
- 2.4.3 Redundant BITS clock input and output leads shall not cross at any point along their respective routes.
- 2.4.4 Redundant leads within equipment frames shall be routed on opposite sides of the frames.

**2.5. Output Cabling Requirements**

- 2.5.1 The timing leads from BITS clock OUTPUT ports to a network element shall be run using the approved 1175A red-jacketed shielded cable. The only exception to this is the allowance of the use of the gray jacketed 1175A cable in the legacy AT&T applications because the red color is used exclusively with power cables.
- 2.5.2 The Installation Supplier shall connect (DC/hard grounded) the shield/drain wire at the clock source end only.
- 2.5.3 The shield/drain wire shall NOT be connected via a DC/hard grounded termination at the network element.
- 2.5.4 The Installation Supplier shall NOT run the timing leads from the BITS clock OUTPUTs to the network element input(s) through DSX jacks unless specifically instructed to do so in the detailed specification.
- 2.5.5 All Critical network element timing leads shall originate from BITS/TSG shelves that have phase holdover capabilities. This includes expansion shelves associated with the Master shelf or Remote Master shelves that are equipped with Remote Track and Hold Cards (RTHC) or oscillators capable of phase holdover. Examples of critical network elements include:
  - a) All CCS7 related equipment (STP's, LPP's, FLIS, LIM, and D4 bays serving SS7 Links).
  - b) Slave/Remote master clock shelves.
  - c) Any other equipment specified by the AT&T Equipment Engineer or detail engineer as being "critical."
- 2.5.6 The Installation Supplier shall wire all redundant timing signal leads from BITS clocks as mated pairs, odd-even or alternate group assignments within a shelf. Outputs shall be equally assigned between each matched set of cards such that both cards will be exhausted at the same time period.

- 2.5.7 Redundant output timing signal feeders from new or vacant card slots shall be routed from alternate sides of the BITS shelf.
- 2.5.8 At the rear of the BITS shelf, the Installation Supplier shall butt and strip the cable sheathing in such a manner as to not allow cable sheathing to be placed on the fanning strip or within the rear protective cover of this strip. The butts shall be protected with heat shrink tubing only and spaghetti sleeve shall be placed on the sleeve lead (ground wire). Tape shall not be used at any time for this application.
- 2.5.9 All alarm and alarm return leads shall be run as pairs as specified by the job documentation.
- 2.5.10 There shall be only one or a single termination per clock port. No bridging allowed.
- 2.5.11 Alarms shall be wired per ATT-CO drawings, verified and tested as specified in the detailed specification and other sections of ATT-TP-76301 and ATT-TP-76900.
- 2.5.12 All clock terminations at the network elements shall be dressed with heat shrink insulation.

## **2.6. Input Cabling Requirements**

- 2.6.1 The Installation Supplier shall wire all input signal timing references to the BITS clock through a MINI-DSX in the BITS bay (when directed by the AT&TIS Equipment Engineer).
- 2.6.2 Input cabling shall be per the appropriate ATT-CO Wiring interconnection drawing for the element providing the input reference (ex. – PRS source (Cesium or GPS) or SONET OC-n derived DS1).

## **2.7. Power Requirements**

- 2.7.1 Dedicated BITS fuse panel(s) shall serve only BITS/PRS equipment in the same or its adjacent bay.
- 2.7.2 Battery and battery return leads from the BITS dedicated fuse panel(s) shall be cable tagged and routed down opposite sides of the equipment bay. "A" and "B" battery outputs of the fuse panel(s) shall be wired in a manner to correspond to the "A" and "B" battery inputs of the BITS equipment. This may require the mounting of two wire support brackets, one above and one below the fuse panel.
- 2.7.3 Both "A" and "B" battery and battery return leads from the BDFB to the added BITS and/or BITS fuse panel(s) shall have diverse routing.
- 2.7.4 All battery and battery return connections from the fuse panel(s) to the BITS equipment shall be made with ring terminals at both ends.
- 2.7.5 Battery and battery returns to the BITS dedicated fuse panel(s) shall originate from separate BDFBs where multiple BDFBs are currently provided on the same floor within the office and spare capacity exists. When multiple BDFBs are not available on the same floor, the leads shall originate from diverse loads within the single BDFB.
- 2.7.6 Battery and battery return leads to the BITS dedicated fuse panel(s) that originates directly at the Power Plant shall be fused on different rows.

## **2.8. Grounding Requirements**

- 2.8.1 Ground leads shall be individually run and properly terminated.
- 2.8.2 The sleeve/drain wire from the approved signal cable shall be insulated with a spaghetti-type sleeve.
- 2.8.3 If the timing lead to/from a network element within an isolated ground plane has an intermediate DSX appearance, the shield/drain shall be grounded at the network element and at the BITS clock, but left un-terminated at the intermediate DSX. If the lead does NOT have a DSX appearance, the shield/drain shall be grounded at the clock end only.
- 2.8.4 When/where a shield/drain ground connection is required; verify that the ground termination pin/point is DC-grounded.

**2.9. Cabling Requirements For SONET**

- 2.9.1 SONET terminal/ADM equipment configurations requiring BITS timing shall be individually timed from the office BITS, with primary and secondary DS1 feeder references from adjacent T1 (DS1) output cards, with odd-even or alternate group slot assignments per AT&T interconnect drawings. The Installation Supplier shall NOT daisy chain these timing lead to enable cascading of synchronization to all terminals within a bay framework. In the event of output port exhaust, arrangements shall be made with the AT&T Equipment Engineer to install additional BITS clock outputs.
- 2.9.2 Each SONET terminal/ADM shall have the "CLOCK IN" connections (PRIMARY and SECONDARY) cabled via the approved 22 AWG single pair shielded cable, type 1175A, to the BITS. Shield/drain lead conductors of all SONET sync input cables shall be DC-grounded at the BITS shelf only and left un-terminated and insulated at the SONET terminal/ADM connector.
- 2.9.3 The BITS "CLOCK OUT" signals shall be cabled to the SONET network element "CLOCK IN" signals connection.
- 2.9.4 The network element "CLOCK OUT" connections (PRIMARY and SECONDARY) shall not be cabled; except when required for office BITS clock reference. These connections should be available on separate wire wrap pins from the "CLOCK IN" connectors terminating on the network element. (GR-1244, R3-10).
- 2.9.5 External Clock Wire Wrap pins on the backplane of the shelf are the preferred method, but use of an adapter kit or equivalent is acceptable (GR-1244, R3-10).

**2.10. Cabling Requirements For Network Element (NE)**

- 2.10.1 Rather than use DB or RJ connectors, the use of external clock wire wrap pins is the recommended connection type for any NE within the AT&T Central Office environment.

**2.11. Removals**

- 2.11.1 At the BITS/TSG, the Installation Supplier shall remove and lay back all terminations associated with removed and/or displaced network elements.
- 2.11.2 The Installation Supplier shall verify all input/output timing leads before they are disconnected as follows:

- a) First, Installation Supplier shall make sure that a MOP was approved prior to any cable removal
- b) Second, verify and confirm the presence of a far end ground on the un-terminated shield/drain wire at the network element.
- c) Third, identify the cable at the BITS clock end and remove the shield/drain wire.
- d) Next, confirm/verify loss of ground on the shield/drain wire at the network element being removed. If ground is lost, the cable shall be disconnected at the BITS clock and the network element, in that order.
- e) If ground remains after the shield/drain wire is removed at the BITS clock, an incorrect cable has been identified and the shield lead shall be reconnected. To identify the correct leads, the Installation Supplier shall trace the timing leads from the network element to the BITS clock.
- f) Complete all cable removal operations, update the sync record assignment book and assure all updates match and are reflected in the regionally approved record keeping system (ex. TAB/dB, SyncTrac, or GeoLink).

**[END OF SECTION]**

**SECTION U -- STANDBY ENGINE/ALTERNATOR SETS**

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**TABLE U-1 – SUMMARY OF CHANGES IN SECTION U**

Change	Item in 09/08 Issue	Item in this Issue
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**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&TIS installation specifications.
- 1.1.2 The Installation Supplier shall assure, 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 general requirements for the installation of stand-by engine/alternator sets.

- 1.1.4 Changes in this issue of Section U are summarized in Table U-1.
- 1.1.5 For more detailed information refer to BSP 790-100-658JP and BSP 790-100-658MP

## **2. REQUIREMENTS**

### **2.1. General**

- 2.1.1 All exterior engines and associated support equipment shall be protected by bollards, covers, or other protective obstructions to prevent damage from vehicles or other traffic.

### **2.2. Exhaust Requirements**

- 2.2.1 Exhaust piping and duct connection joints shall not be insulated until full load testing has been completed and the bolts have been re-tightened.
- 2.2.2 Exhaust piping shall have a flexible section installed within 12" of the engine/alternator set manifold.
- 2.2.3 All exhaust components exposed to outside elements (module or building) shall be stainless steel.

### **2.3. Alarms**

- 2.3.1 The Installation Supplier shall extend and terminate all specified alarm leads as designated by the AT&TIS Equipment Engineer. The terminal blocks shall be stenciled per Section L.
- 2.3.2 All new standby engine/alternator sets shall have the capability of forwarding alarms via TCP/IP to the appropriate alarm center. The alarms specified shall be the AT&T minimum alarms per AT&T drawing ATT-P-05010-E.

### **2.4. Grounding**

- 2.4.1 All grounds shall be ultimately connected to the central office or AT&TIS site ground system.
- 2.4.2 The standby engine/alternator set control cabinet shall be grounded to the alternator frame with a flexible braided strap in accordance with BSP 790-100-658MP, *Standard Specification and Performance Requirements for Engine/Alternator Sets*.
- 2.4.3 The standby engine/alternator set control cabinet shall have a #6 AWG ground lead terminated with a two-hole crimped lug and be tagged.
- 2.4.4 When multiple parallel conduits are used a full sized grounding conductor shall be run in each conduit.
- 2.4.5 Equipment grounding conductors shall terminate within the engine/alternator cabinet provided for termination of phase conductors. Termination shall be made directly to a non-insulated ACEG bus bar.
- 2.4.6 To provide grounding continuity between the entire engine/alternator set and the equipment grounding conductors, the engine/alternator cabinet shall be electrically connected to the set frame in one of the following manners:

- a) By attachment hardware
- b) By a bonding strap of cross-sectional area equal to that of the grounding conductor specified.

**2.5. Connections**

- 2.5.1 All field wire and cable connections #10 and larger shall be made using compression type copper connectors manufactured by T&B or Burndy or equivalent. The finished crimp shall be circumferential. The crimping tool or dies shall emboss the crimped connection in such a way that it may be easily identified for correct tool embossment.
- 2.5.2 The installation vendor shall provide means to prevent field-installed connectors from turning at termination points.
- 2.5.3 The standby engine/alternator set output leads (either single or three phase) shall be connected to the transfer switch, Building AC or within a junction box termination point in the following manner.
  - a) The correct compression type splice connector shall be utilized when the conductors between the alternator and AC transfer switch are spliced or directly joined together.
  - b) Two-hole compression terminals may be utilized with a bus bar arrangement in the junction box or AC transfer switch when this arrangement is specified.
  - c) The split bolt type connectors, sometimes called kearnies, shall NOT be used.
  - d) The splice or junction box shall not be mounted on the emergency, engine/alternator set mounting assembly due to vibration.

**2.6. Fuel System**

- 2.6.1 Fuel systems shall meet all local, state and federal permitting requirements.
- 2.6.2 The installation of all fuel systems shall be reviewed by AT&T EH&S E.
- 2.6.3 Engine/alternator set fuel lines that are located outside the central office or AT&TIS site and exposed shall be protected from being crushed.
- 2.6.4 Both the fuel and return lines shall have flexible sections connected to the engine/alternator set.
- 2.6.5 All field installed fuel hoses shall be of proper length without any looping, sharp bends or excessive slack.
- 2.6.6 All engine/alternator set fuel piping shall meet the following criteria:
  - a) All fuel piping from the engine/alternator to the day tank shall be that stipulated within the Engine/Alternator Data Sheet.
  - b) Approved pipe sealant shall be used on all fittings.
- 2.6.7 Day tanks shall be equipped with spill containment dams of adequate capacity to contain the contents of the day tank.

- 2.6.8 Day tanks of metallic construction shall have a #6 AWG stranded and tinned grounding conductor terminated with one 2-hole compression connector and extended to the CO or AT&TIS grounding system.
- 2.6.9 Any time the fuel system (i.e., Piping, day tank, fuel storage tank, etc.) from the standby engine/alternator set to any fuel tank supporting the engine/alternator set requires work, the Installation Supplier shall contact the AT&T Environmental Health & Safety at 1-800 KNOW EHS or for Legacy-B locations before beginning work.

**2.7. Guards, Labels and Nameplates**

- 2.7.1 All phase leads between the engine/alternator set and the control board shall be marked showing the phase rotation.
- 2.7.2 All piping shall be directionally labeled and isolation valves shall be position labeled.
- 2.7.3 All exposed surfaces with temperatures greater than 45° C / 113° F shall be marked with warning labels. Surfaces with temperatures greater than 60° C / 140° F shall be guarded as well as marked with warning labels. Non-asbestos insulation and/or ventilation guards shall be provided to protect the operator from accidental contact with the engine/alternator set exhaust system parts and piping or any other components with surface temperatures higher than 60° C / 140° F.
- 2.7.4 Suitable guards that meet OSHA requirements shall be provided to protect any operator from being harmed by fans, blowers, rotating parts of alternators and any other moving parts associated with the engine/alternator set to which the working personnel may be exposed.
- 2.7.5 All setscrews, bolts, keys or keyways shall have no projecting or sharp edges or be suitably guarded. All in-running gears and sprockets shall be completely enclosed or provided with band guards around the face of the gear or sprocket. Working personnel shall not be able to touch any rotating part.
- 2.7.6 The engine/alternator set AC panel shall have the power source labeled clearly.

**2.8. Testing and Acceptance**

- 2.8.1 The Installation Supplier shall verify the availability of lubricating oil and permanent antifreeze required for standby engine/alternator sets.
- 2.8.2 The Installation Supplier shall verify that the engine/alternator contains the proper levels of lubrication oils and water/antifreeze mixture before the initial test run.
- 2.8.3 All personnel working in the vicinity of operating engine/alternator sets shall wear ear protection.
- 2.8.4 The engine/alternator set shall not be started until a manufacturer's representative has performed the initial start-up.
- 2.8.5 The Installation Supplier shall provide resistive type load bank(s) and connection cables capable of absorbing 110 % of the engine/alternator's rated output in kilowatts during the on site load testing.

2.8.6 The Installation Supplier shall provide a representative to assist AT&T or AT&TIS personnel in acceptance testing.

**2.9. Batteries**

2.9.1 Anti-corrosion coating such as NO-OX-ID-A shall be applied to all battery terminals and connections.

2.9.2 All battery cables shall be secured to prevent chaffing.

2.9.3 The engine/alternator set start and control batteries shall be located so the cells are not exposed to excessive heat.

2.9.4 All batteries shall be contained in an appropriately grounded rack or other acceptable container.

**2.10. Radiator**

2.10.1 Any radiator not located on the engine/alternator skid shall comply with all 'remote' radiator requirements.

2.10.2 Radiator piping and AC conduit shall not be supported by the radiator stand.

2.10.3 All radiator piping shall be painted with a high temperature outside paint.

**2.11. Emergency Shut Down**

2.11.1 The emergency shutdown switch for the engine shall be designated and covered to prevent accidental activation.

**[END OF SECTION]**

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**TABLE V-1 – SUMMARY OF CHANGES IN SECTION V**

Change	Item in 09/08 Issue	Item in this issue
Revised	Revised to update document in comparison to TP76300	
Deleted		
Added		

**1.0 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&TIS installation specifications.
- 1.1.2 The Installation Supplier shall assure, 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 general requirements for hazardous materials and waste management in AT&TIS sites.

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- 1.1.3 This section covers general requirements for hazardous materials and waste management in AT&TIS sites.

- 1.1.4 The information in this section is not intended to be an all-inclusive guide. It is intended to provide an awareness of the types of hazardous materials that may be present in AT&TIS sites.
- 1.1.5 Proper handling and management of hazardous materials and waste is necessary to
  - a) Protect AT&TIS employee and installation supplier's health
  - b) Protect public welfare, and
  - c) Maintain AT&TIS's corporate objective to conduct, manage and maintain its operation in compliance with environmental laws and regulations with full regard to their potential impact on the environment and the community.
- 1.1.6 Compliance with environmental laws and regulations is the responsibility of every person working in an AT&TIS site.
- 1.1.7 For guidance regarding hazardous materials and wastes management the AT&TIS Representative can refer to the AT&T EH&S (Environment, Health & Safety) web site, <http://www.ehs.att.com/>, or contact the AT&T EH&S Hotline at 1-800-KNOW-EHS (1-800-566-9347) prompt 4.
- 1.1.8 Changes to this issue of Section V are summarized in Table V-1.

## **2.0 DEFINITIONS**

- 2.1 Hazardous Materials are useable materials that exhibit one or more hazardous characteristics – corrosivity, ignitability, reactivity or toxicity (e.g. acid and alkaline batteries, fuel, engine fluids, central office switch components containing mercury and/or PCBs boiler chemicals, fluorescent bulbs).
- 2.2 Hazardous Wastes are materials that exhibit hazardous characteristics described above and are no longer useful or valuable to its owner (e.g. spent batteries, leaking batteries, mercury and/or PCB central office switch components that are to be disposed).

## **3.0 REQUIREMENTS**

### **3.1 GENERAL**

- 3.1.1 The Installation Supplier shall adhere to all federal, state and local regulations regarding hazardous material/waste in addition to AT&TIS installation requirements.
- 3.1.2 The Installation Supplier shall be responsible for compliance with federal, state and local environmental regulations.
- 3.1.3 The Installation Supplier shall employ environmentally safe practices in the performance of their duties.
- 3.1.4 The Installation Supplier shall obtain the necessary environmental permits (e.g. standby engine permits), notifications (e.g. notification of regulating agency and AT&T EH&S) and training (e.g. Floor Drilling training) prior to the initiation of work activities.

- 3.1.5 The AT&TIS Representative shall direct the Installation Supplier regarding hazardous materials and waste management prior to, during and after completion of work activities.
- 3.1.6 The AT&TIS Representative shall adhere to guidelines and procedures established by AT&T EH&S, available on the AT&T EH&S (Environment, Health & Safety) web site, <http://www.ehs.att.com/>, or contact the AT&T EH&S Hotline at 1-800-KNOW-EHS (1-800-566-9347).
- 3.1.7 The Installation Supplier shall coordinate with the AT&TIS Representative before starting any activity related to hazardous material/waste.
- 3.1.8 Only vendors approved by AT&T's EH&S organization shall handle, remove, package, purge, transport or dispose of hazardous waste.
- 3.1.9 In the event of any of the following occurrences, the Installation Supplier shall immediately contact the AT&TIS Representative who will contact the appropriate AT&T organization:

Type of Occurrence	AT&T will contact...
<ul style="list-style-type: none"> <li>• Regulatory agency inspector visit to site</li> <li>• Accidental release/spill of hazardous material or waste</li> <li>• Accidental exposure to workers</li> </ul>	AT&T EH&S:  <b>1-800-KNOW-EHS (1-800-566-9347)</b>

**3.2 HAZARDOUS MATERIALS AND WASTES**

- 3.2.1 Installation Suppliers often handle hazardous materials in the course of their work activities. Handling of hazardous wastes requires specialized training and knowledge. Therefore hazardous wastes are managed only by AT&T EH&S approved vendors.
- 3.2.2 The following hazardous materials, not to be considered inclusive, may be encountered in AT&TIS sites:

Hazardous Material	Typical Environment Encountered
Asbestos	Floor tile, cable holes and covers, cable sheath, ceramic resistor washers, asbestos textiles, asbestos sheets, generator, boiler insulation and transit ducts
Arsenic Trioxide	Cable Sheath around older cables
Electrolyte (battery acid/alkali)	Wet-cell, gel cell, Ni-Cd batteries
Lead	Lead Sheath, solder and paint wastes
Mercury	Switches, relays, tubes and interrupters. These may be frame mounted, plug-in units or mounted on plug-in circuit boards, fluorescent light tubes
Petroleum Products	Fuel for emergency power generating equipment and in lubricating fluids and solvents

Polychlorinated Biphenyls (PCBs)	Capacitors, power supplies, frequency generators, motor driven interrupters, fluorescent light ballasts and oil filled transformers
Radioactive Materials	Cold cathode tubes, fire detectors, emergency exit signs, vacuum tubes
Compressed Gases	Gases like nitrogen may be found in cable vaults, non-empty (pressurized) aerosol cans, MAPP Gas cylinders and propane cylinders.

- 3.2.3 Installation Supplier shall issue appropriate warnings to, inform and educate its employees, agents, subcontractors, other invitees, and the employees of any of them, entering AT&TIS sites of the above information in accordance with applicable laws and regulations.
- 3.2.4 When equipment containing hazardous material (e.g. 1-AESS switches, transformers, rectifiers, relays, etc) is moved between AT&TIS sites, the Installation Supplier shall notify AT&T EH&S through the AT&TIS Engineer prior to transportation to ensure compliance with environmental regulations.
- 3.2.5 Equipment containing hazardous material that is removed during routine maintenance and repair shall be segregated and stored in appropriate and properly labeled containers and AT&T EH&S contacted to assist with proper disposal using an AT&T EH&S approved-vendor.
- 3.2.6 If equipment contains components that contain hazardous material, such components are considered hazardous waste when the equipment is determined to be of no additional use. Before the Installation Supplier removes equipment that is to be sold as scrap, the Installation Supplier shall contact the AT&TIS Equipment Engineer to have all equipment components containing hazardous material identified and removed. The Installation Supplier shall not remove such hazardous components unless the Supplier is an AT&T EH&S approved vendor.
- 3.2.7 An Installation Supplier shall not transport or dispose of hazardous materials or waste unless the supplier is an AT&T EH&S approved-vendor.

**3.3 Shipping Batteries for Removal or Reuse**

- 3.3.2 When batteries are removed for non-reuse, procedures described in section V shall be followed.
- 3.3.3 Batteries staged for reuse shall be prepared for shipment as noted below. Cells shall be marked and reinstalled in the same order as placed in the original installation. Miscellaneous battery items such as spark arrestors and thermometers shall be packed and stay with the cell in which they were originally installed.
- 3.3.4 Vents shall be covered with a shipping cap.
- 3.3.5 Filling tubes shall be plugged and terminals shall be protected against short circuits with tape, caps or protective packaging.

- 3.3.6 Each container or unit shall be marked with proper identification and address of the assignee and consignor. Also a 4" x 4" label, with the word "corrosive" shall be applied to each container or unit.

#### **4.0 DOCUMENTATION**

##### **4.1 General**

- 4.1.1 The Installation Supplier shall use documents identified by the EH&S organization to manage hazardous materials/wastes. These may include:
- a) Hazardous Waste Manifests
  - b) Bills of Lading
  - c) Material Disposition Record Forms
    - 1. Material Disposition Record ("MDR") – A document completed from the point or site where central office scrap is generated, itemizing the type of material, location address, and project information. A MDR shall be completed by the installation or removal contractor and the AT&TIS equipment engineer. A copy of this document is kept with the project folder and an additional copy shall accompany the material that is sent to the material reclamation center.
- 4.1.2 The AT&T Engineer shall forward to the Resource Recovery Center (AT&T RRC, Attn: RRC Record Keeper, 308 South Akard Street, Rm. 1700, Dallas, TX 75202) the original documentation as described in Section 1.1.7 and place a copy in the job folder.

#### **5. QUESTIONS**

##### **5.1 General**

- 5.1.1 Further questions or clarifications regarding the proper management of hazardous materials or wastes may be directed to the AT&T EH&S (1-800-KNOW-EHS).

**[END OF SECTION]**