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CHECKLIST OF CURRENT SECTIONS

Section	Issue Date	Section	Issue Date
Preface	October 16, 2006	Section 8	February 17, 2006
Checklist of Sections	October 16, 2006	Section 9	April 14, 2006
Table of Contents	Revised June 30, 2006	Section 10	To be issued
Section 1	Revised 10/16/06	Section 11	April 14, 2006
Section 2	10/16/06	Section 12	February 17, 2006
Section 3	10/16/06	Section 13	XXX, 2006
Section 4	10/16/06	Section 14	Unused
Section 5	March 3, 2006	Section 15	April 14, 2006
Section 6	March 10, 2006	Section 16	May 4, 2006
Section 7	Revised 5/19/06	Appendix 3a & 3b	10/16/06

[END OF SECTION]

SECTION 1--INTRODUCTION

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1. GENERAL

1.1. Introduction

- 1.1.1 ATT-TP-76401, Detail Engineering Requirements, delineates the requirements for providing detail engineering services to AT&TIS
- 1.1.2 Changes in this issue of Section 1 are summarized in Table 1-1.
- 1.1.3 AT&TIS assumes no responsibility for any costs incurred by a given manufacturer or supplier in conforming to the requirements of ATT-TP-76401. Further, conformance to all requirements in this document does not constitute a guarantee of acceptance of a given supplier's product/service for use in AT&TIS.
- 1.1.4 AT&TIS reserves the right, without prior notice, to revise ATT-TP-76401 for any reason.

1.2. Purpose

- 1.2.1 The purpose of ATT-TP-76401 is to:
 - a) Establish engineering requirements for Detail Engineering Service Providers (DESP) engaged in detail engineering;
 - b) Provide the information the DESP can expect to receive from the AT&TIS Equipment Engineer;
 - c) Provide guidelines for the expected output of the DESP;
 - d) Provide guidance on the required methodology used in constructing or correcting AT&TIS records;
 - e) Promote engineering compatibility with ATT-TP-76301, AT&TIS Installation Requirements.

1.3. Application

- 1.3.1 ATT-TP-76401 applies to all detail engineering services provided to AT&TIS and supersedes all detail engineering requirements documents previously issued by AT&TIS.
- 1.3.2 ATT-TP-76401 is applicable to all types of new and reused Information Services equipment.
- 1.3.3 ATT-TP-76401 is applicable to IS sites, antennas, controlled equipment vaults (CEV), and huts, as well as some customer premises locations per applicable contracts and tariffs. For the purpose of this document, all these locations are hereinafter referred to as "IS Sites". .
- 1.3.4 ATT-TP-76401 applies to Engineering, Furnish and Install (EF&I) orders, Engineering and Install (E&I) orders, or Engineering Only (EO) orders. The focus is on the "Engineering" activity, regardless of the "Furnish" or "Install" status.
- 1.3.5 In addition to contracted equipment DESPs, ATT-TP-76401 also applies to AT&TIS personnel who perform equipment detail engineering, as well as to AT&TIS personnel and contracted firms who provide building engineering services. In this document, these personnel and firms also are called DESPs.

1.4. Definitions

- 1.4.1 Definitions of certain terms used in ATT-TP-76401 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 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.
 - c) **Automated Equipment Order (AEO)** – The AT&TIS document to the DESP to authorize engineering services.
 - d) **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.
 - e) **DESP** – Detail Engineering Service Provider
 - f) **Detail Engineering Service Provider (DESP)** - The provider of detail engineering services, including Information Services equipment and building engineering service providers, as well as AT&TIS personnel who perform detail engineering.
 - g) **Shall** - Verb used to indicate mandatory requirements subject to audit
 - h) **Should** - Verb used to indicate recommendations that should be met if existing conditions allow.
 - i) **Space & Power Request Form** – The document the AT&TIS Planner will use to request site specific space and power assignments from the Capacity Manager.

- j) **Vendor Response Form (VRF)** – The document the DESP uses to confirm the acceptance of the job from AT&TIS.

1.5. General Requirements

- 1.5.1 The current issue of each section of ATT-TP-76401 as of receipt of the AEO is the issue in effect and shall be used. Revisions may be issued on a section-by-section basis. The Checklist of Current Sections at the front of ATT-TP-76401 indicates the date of issue. Along with the revised section(s), an updated Checklist of Current Sections will be issued to indicate the current date of issue for each section.
- 1.5.2 In addition to ATT-TP-76401, building codes, national (e.g., NEC) and local electrical codes or other ordinances, statutes, rules, or governmental regulations may be applicable to the job and shall require compliance. Where more than one requirement applies to any matter related to personnel safety or property protection, the strictest requirement applies.
- 1.5.3 ATT-TP-76401 is intended to be used in conjunction with the equipment manufacturer's product specific engineering information, product specific equipment drawings, and other documents listed herein or specified in any applicable contract between the DESP and AT&TIS. The DESP shall notify the AT&TIS Equipment Engineer for resolution of any discrepancy between the manufacturer's engineering information and ATT-TP-76401.
- 1.5.4 The DESP shall utilize only AT&T approved products.
- 1.5.5 Some requirements in ATT-TP-76401 are delineated by reference to other AT&TIS standards such as ATT-TP-76301 and industry standards. These standards are summarized in Table 1-2 and shall be considered part of ATT-TP-76401.
- 1.5.6 The DESP is responsible for:
 - a) Providing a completed VRF to the AT&TIS Equipment Engineer within 5 business days of official receipt of job information.
 - b) Obtaining all required documentation to engineer the order;
 - c) Ensuring detail engineering services are done in accordance with AT&TIS requirements and federal, state, and local laws and regulations;
 - d) Ensuring the equipment supplier's installation and interconnection requirements are met. This understanding is especially important when the DESP is not the equipment supplier. This document is not intended to provide specific equipment or interconnection engineering standards;
 - e) Ensuring licenses, copyrights, or permits are available if an equipment supplier requires them in the course of engineering;
 - f) Providing information and direction to the equipment supplier in accordance with the requirements established by AT&TIS's practices or requirements;
 - g) Developing and providing the detail specification(s) per ATT-TP-76401;
 - h) Request or provide office assignments via the ARF;

- i) Creating and updating AT&TIS records as required by Section 4, ATT-TP-76401;
- j) Ensuring that the job, as detail engineered, can be installed in accordance with ATT-TP-76301;
- k) Providing interpretation and direction to the installation supplier on questions related to the detailed engineering of the job.

1.5.7 The DESP shall contact the AT&TIS Equipment Engineer to request a variance from any ATT-TP-76401 requirement and any approval of a variance shall be in writing. The DESP 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 and/or code issues.

1.5.8 AT&TIS reserves the right to audit any job for compliance to ATT-TP-76401. The DESP shall correct non-compliance items within 30 days of receipt of the audit.

1.5.9 All required forms and documents shall be filled out completely and accurately.

1.6. Proprietary Information

1.6.1 Proprietary documents referenced in ATT-TP-76401 are available to contracted Suppliers through signed nondisclosure agreements or as detailed in current contracts between AT&TIS and the Supplier.

1.7. Ordering Information

1.7.1 Extranet access is available to approved suppliers for downloading electronic copies of ATT-TP-76401 and other non-proprietary AT&TIS standards. Information concerning extranet access can be obtained from:

Vickie Jefferson
111 S 3rd AVE, 1st Floor
Madill, OK 73446
Email: vj6542@att.com

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

1.7.3 AT&TIS personnel may access the ATT-TP-76401 from the Common Systems web site at:
<http://ebiz.sbc.com/commonsystems/>

1.8. Comments On ATT-TP-76401

1.8.1 Comments on ATT-TP-76401 should be submitted by e-mail or in writing to:

Laurie Gustin
Area Manager
102 Cross St., Room 201
San Luis Obispo, CA 93406
E-mail: lg1376@att.com

TABLE 1-1 – SUMMARY OF CHANGES IN SECTION 1

Change	Item in 10/01/03 Issue	Item in this Issue
Revised		
Deleted		
Added		

TABLE 1-2 – REFERENCES IN ATT-TP-76401

Reference	Title
ATT-TP-76200	Network Equipment Power, Grounding, Environmental, and Physical Design Requirements
ATT-TP-76301	AT&TIS Installation Requirements
ATT-TP-76900	AT&T Installation Testing Requirements
ATT-812-000-016	Common Systems Considerations For Determining The Affects On Floor Loading Of Superstructure Suspended From Ceilings
ATT-790-100-656	DC Power Distribution
ATT-TP76402	Internet Service Equipment on Access Flooring Engineering & Installation Requirements
ATT-TP76403	Grounding and Bonding Requirements for Internet Facilities
ATT-TP76408	Common Systems Network Facility Auxiliary Framing and Bracing Requirements
ATT-TP76409	Common Systems Network Facility Cable Rack Requirements
BSP 790-100-658MP	Standard Specification and Performance Requirements for Engine Alternator Sets
ATT-790-100-659	Standby AC Plants
ATT-TP-76201	Hardware Products and Materials Specifications
BSP 800-000-101MP	Network Equipment Anchoring Requirements
BSP 800-000-102MP	Central Office Equipment Framework Design Requirements
BSP 800-000-104MP	Bracing Requirements For Network and Data Equipment On Raised Floor System
ATT-812-000-032	Common Systems Through-Penetration Firestopping Requirements

Reference	Title
BSP 800-006-152MP	Floor Stanchion Supported Cable Rack System Requirement
BSP 800-068-150MP	Central Office Equipment Framework Support Requirements
BR 751-410-101 (Telcordia Technologies)	Common Language Standard Abbreviation List
BR 781-826-001 (Telcordia Technologies)	List of DSX Bellcore Practices
BR 781-826-004 (Telcordia Technologies)	DSX-1 and DSX-1C Engineering Guidelines
TM-ARH 001287	Research and Engineering Opportunities in the DSX-1 Environment
TM-NPL 008523	DSX-3 and DSX-4 Engineering Guidelines
TR-NPL 000320	Fundamental Generic Requirements for Metallic Digital Signal Cross-Connect Systems DSX-1,-1C, -2, -3
TR-NPL 000321	Generic Requirements Digital Signal Cross-Connect Frames DSX-1,-1C, -2
SBC Minor Material List (3/2/06)	
ADC Fiber Management System Application & Installation Manual	Network Equipment Fiber Distribution Systems
American National Standards Institute (ANSI) information	
Building Codes, National and Local Electric Codes, Ordinances, Statutes, Rules and Government Regulations	
Federal Communications Commission Rules	
National Fire Protection Association standards	
Nationally Recognized Testing Laboratory (NRTL) information	
Under Writers Laboratories standards	

[END OF SECTION]

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1. GENERAL

1.1. Introduction

- 1.1.1 This section describes the information that shall be provided to the Detail Engineering Service Provider (DESP) by means of the Automated Equipment Order (AEO).
- 1.1.2 Changes in this issue of Section 2 of ATT-TP-76401 are summarized in Table 2-1.
- 1.1.3 It is assumed the DESP has access to AT&TIS records and other information not included in the AEO, which may be necessary to perform the detail engineering function.

2. INFORMATION PROVIDED BY THE AT&TIS EQUIPMENT ENGINEER

2.1. General

- 2.1.1 The AT&TIS Equipment Engineer shall provide an AEO for every job issued (electronic if available) to the DESP to identify relative billing information, work effort and job schedules. The DESP shall receive an AEO and Purchase Order before issuing the detail specification.
- 2.1.2 The AT&TIS Equipment Engineer shall provide an appendix AEO when the job scope changes (i.e. additional services, assignment updates, date changes).

2.2. AEO Facesheet

- 2.2.1 The AEO Facesheet (iNEWT) shall contain, at a minimum:

- a) **Job address (Install at)**
- b) **P/A Oracle Number**
- c) **Automated Equipment Order (AEO) Number.**
- d) **CLLI Code.** Common Language Location Identifier code

Note: AT&TIS Equipment Engineer will provide the eight or eleven character CLLI code

- e) **FRC/Account Code.** Field Reporting Code or Account Code

- f) **Location Code.** AT&TIS Location Accounting Code
- g) **Appendix No.** Appendix number of the AEO. The original AEO will carry no Appendix No.. Subsequent appendices follow the pattern:001, 002, 003, etc.
- h) **On Job Want Date.** Date major material is to be delivered from the material supplier
- i) **Requested Engineering Start Date.** Date engineering is scheduled to start including detailed drawings.
- j) **Requested Engineering Complete Date.** Date engineering is scheduled to complete.
- k) **Requested Install Start Date.** Date installation is scheduled to start
- l) **Requested Install Complete Date.** Date supplier is scheduled to complete.
- m) **Ready for Service (RFS) Date.** Date equipment is in office and can be provisioned to provide service.
- n) **Final Destination.** "Final Ship To" location for material required for the job
Note: The AT&TIS Equipment Engineer shall include address and zip code.
- o) **Description.** A summary of the scope of work including; Activity, Equipment Type(s) and Quantity, and Circuit quantity
- p) **AT&TIS Equipment Engineer.** Name of the AT&TIS Equipment Engineer responsible for the job
- q) **Engineering Issue Date.** Date AT&TIS Equipment Engineer issues the AEO
- r) **Requested T&A Start Date.**
- s) **Requested T&A Complete Date.**
- t) **Phone Number & EMAIL.** Telephone number and e-mail address of AT&TIS Equipment Engineer
- u) **Responsibility Code Originating.** RCO of the AT&TIS Equipment Engineer.

2.3. Other AEO Information Including Attachments (AEO as defined in definitions Section 1)

- 2.3.1 The following information shall be included in the AEO as applicable per the scope of the job:
- a) A listing of AT&TIS provided equipment (a.k.a. "Information Services Equipment")
 - b) Equipment model number
 - c) Disposition of any removed equipment; i.e. junk, send to reuse, redeploy to another location, Retired in Place (RIP)
 - d) Specify whether cable mining is to be performed and to what extent cable mining is to be performed (a to z location)
 - e) Name and telephone number of the AT&TIS Representative

-  f) For new bays being added, provide the relay rack location via Space & Power Request Form (S&P) URL: <http://siteinfra.sbc.com/RequestForm.asp>
- g) Applicable specific installer notes to be included in the detail specification
- h) Any other office-specific information necessary to engineer the job
- i) The AT&TIS Capacity Engineer's name and telephone number for Power Assignment Log requirements
- j) The Installation Supplier company name, SPOC and telephone number, shall be provided to the AT&TIS Equipment Engineer for any job not engineered by the Installation Supplier.

TABLE 2-1 – SUMMARY OF CHANGES IN SECTION 2

Change	Item in Issue	Item in this Issue
Revised		
Deleted		
Added		

[END OF SECTION]

SECTION 3--DETAIL ENGINEERING SPECIFICATION REQUIREMENTS

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1. GENERAL

1.1. Introduction

1.1.1 This section describes the requirements for the Detail Engineering Specification.

1.1.2 Changes in this issue of Section 3 are summarized in Table 3-1.

1.2. General Detail Engineering Requirements

1.2.1 The DESP shall submit a completed Firm Price Quote (FPQ) upon request of IS work from the AT&TIS Equipment Engineer.

- 1.2.2 Upon receipt of the AEO/PO the DESP shall provide a final detailed specification for all items requested to the AT&TIS Equipment Engineer. The DESP shall not request a variance of this requirement from the AT&TIS Equipment Engineer.
- 1.2.3 The AT&TIS Equipment Engineer shall provide a final detailed specification to the installation supplier when the DESP is not the installation supplier.
- 1.2.4 The DESP shall obtain written approvals for a variance from ATTIS-TP-76401 from the AT&TIS Equipment Engineer
- 1.2.5 Established patterns within the IS site should be considered by the DESP.
- 1.2.6 The DESP shall insure that the correct P/A Oracle number is identified on the Spec for marking the material being shipped to the job site.
- 1.2.7 Any discrepancies in the information provided by the AEO/PO shall be resolved with the AT&TIS Equipment Engineer prior to issuing the final Detailed Specification.

1.3. Contents of Detail Specification

- 1.3.1 The completed output constitutes the detail specification. The detail specification shall include the following sections as applicable:
 - a) SPECIFICATION COVER SHEET - A facesheet or title page containing specific key information about the equipment order
 - b) SPECIFICATION -The information to be included in the detail specification, in the sequence listed below:
 - 1. General Job Summary
 - 2. General Installation Supplier Notes
 - 3. Work To Be Done By The Installation Supplier (Work Items)
 - 4. Specific Installation Supplier Notes
 - 5. Material Listing Notes
 - 6. Material Listings
 - 7. IS site Drawing Records List
 - 8. AT&TIS Equipment and Interconnect Drawing List (If Applicable)
 - 9. Reference Drawings List
 - 10. Cable Running List
 - 11. Equipment Inventory Update (EIU) (Future Tool)
 - c) APPENDICES OF SPECIFICATIONS - A listing of additions, modifications, and removals of information or material after a specification has been issued.
- 1.3.2 The format and arrangement specified herein for the detail specification shall be followed for all jobs. The contents of the detail specification, as delineated herein, shall apply to all jobs. Appendix 3-A of this section provides a template for the detail specification. The DESP may





utilize this template for the detail specification. Appendix 3-B provides an illustration of completed detail specification forms.

- 1.3.3 The DESP shall provide the completed specification forms (worksheets) in a single package.
- 1.3.4 By the Detail Specification Due Date, the DESP shall provide an electronic file of the detail specification to the AT&TIS Equipment Engineer.
- 1.3.5 This electronic file shall be compatible with the Microsoft Excel® release designated by the AT&TIS Equipment Engineer.
- 1.3.6 The DESP shall ensure that distributed paper copies of the detail specification are consistent in content and format with this electronic file.
- 1.3.7 The DESP shall place the following statement in the footer of each completed detail specification form:

RESTRICTED-PROPRIETARY

Not for use or disclosure outside AT&T Internet Services except under written agreement

The proprietary statement on the completed forms of Appendix 3-B of ATTIS-TP-76401 is for illustration only and does not render this appendix proprietary.

2. SPECIFICATION COVER SHEET

2.1. Contents of Cover Sheet

- 2.1.1 The Cover Sheet is the first page of a specification. It contains information from the AEO/PO Facesheet, as well as information to be provided by the DESP.
- 2.1.2 On the Cover Sheet, the DESP shall transfer all information from the fields of the AEO/PO Facesheet and add the following information:
 - a) P/A Oracle Number
 - b) Requisition Number
 - c) Supplier Order Number
 - d) SPEC Appendix No. The original detail specification shall carry Appendix Number 0, or 00. Subsequent appendices shall follow the pattern: i.e. 1, 2, 3 or 01, 02, 03, etc.
 - e) Date DESP received AEO/PO
 - f) List of AT&TIS AEO/POs and appendices if included in this specification
 - g) Table of Contents
 - h) DESP's Full Name (primary DESP – not subcontractor)
 - i) DESP's Contact and Telephone Number
 - j) DESP's actual Engineering Completion Date.

- k) Instruction to mark packages with AEO/PO Job Number

3. SPECIFICATION FORMS

3.1. General

3.1.1 If the detail specification is divided into sub-specifications, the sub-specification that contains the Cover Sheet shall also contain an index.

3.1.2 The following header information shall appear at the top of each specification page:

- a) City, State
- b) AEO Number
- c) Page X of Y (consecutively)
- d) CLLI
- e) Supplier Order Number
- f) Appendix Number of detail specification.

3.2. General Job Summary

3.2.1 The General Job Summary provides the scope of the entire job and shall contain the following information:

- a) Major items of equipment added, removed, etc. and description of work to be done
- b) Listing of associated jobs/orders
- c) Job sequencing/coordination requirements
- d) List of AT&TIS approved variances from ATTIS-TP-76401

3.3. General Installation Supplier Notes

3.3.1 General Installation Supplier Notes provide instructions to the equipment installer that are general in nature. General Notes shall be numbered consecutively, starting with "1." If appendices are issued, the General Notes should continue in sequence.

- a) General Notes shall always contain the following:
 - 1. All information in this specification shall be considered proprietary and may not be disclosed to subcontractors or third parties without written agreement from AT&TIS.
 - 2. The entire installation shall be in compliance with ATTIS-TP-76301.
 - 3. The installer shall make equipment acceptance tests in accordance with ATT-TP-76901 (Under Development) and all applicable practices. A copy of ATT-TP-76900 shall be retained on the job site for reference during testing.
 - 4. The installer shall send an MDR, per ATT-IS-TP-76301, indicating any installer corrected drawing activity and route corrected drawings to [The DESP shall provide the address].

5. The installer shall refer engineering questions pertaining to this specification to the detail engineer listed on the Cover Sheet.
6. The Installation Supplier shall record power load readings on the Power Assignment Log, and forward the worksheet to the AT&TIS Equipment Engineer (Implementation Engineer) and AT&TIS Capacity Engineer on all jobs that add a power load to the IS site.. The AT&TIS Capacity Engineer's approval is required prior to adding or terminating to circuit fuse/breakers. Instructions and worksheets are available on the extranet.
7. Certain types of asbestos containing materials may be found in the building and equipment. Such materials include resilient flooring, BDFB Power Boards, and cable hole fire stop covers. BDFB Power Boards and cable hole fire stop covers are to be removed intact. Activities which impact (e.g. removal, drilling) resilient flooring, such as asbestos containing sheet or rolled goods (e.g. linoleum), are prohibited unless performed by a Zurich approved abatement contractor in accordance with applicable regulatory requirements for work controls and training. Procedures for drilling into floor covering material containing Asbestos or Presumed to contain Asbestos are defined in ATTIS-TP-76301, Section G.

b) Additional notes shall be included after the above notes, as required by the job.

3.4. Work To Be Done By The Installation Supplier

3.4.1 The DESP's specific instructions (work items) to the installer shall be included on the Work To Be Done By The Installation Supplier form. These instructions may also direct work operations to be performed on existing Information Services equipment associated with the operation.

3.4.2 Detailed instructions to the installer shall be listed under the following headings:

- a) ITEM - The consecutive number of the individual operation instruction. Always start with "1"
- b) OPERATION - The type of work operation (work item) required to be performed, e.g., add, extend, modify, remove, etc.
- c) QUANTITY - The number of items to be added, extended, modified, removed, etc.(by specific unit of measure i.e. feet, number, weight, volume) if other than each.
- d) DESCRIPTION - A narrative description of the work operation required to be performed. The Description shall include references to current relevant drawings
- e) NOTES - Notes applying only to the installer, referenced by a letter which relate to a specific work operation, to be shown under the heading "Specific Installation Supplier Notes."

3.4.3 Operations such as the following shall be covered in Work To Be Done By The Installation Supplier:

- a) Adding, extending, or removing circuits or multiples

- b) Adding, relocating, or removing the wiring and apparatus in existing positions, sections, bays, frames, etc.
- c) Renumbering circuits, when no other wiring or apparatus changes are required
- d) Modifying equipment, or the installer cutting or disconnecting wiring furnished by the supplier to meet job requirements, except when covered by notes and standard drawings
- e) Adding, relocating, removing, or modifying apparatus or equipment, e.g., cable racks, frames, etc.

3.5. Operation Types

- 3.5.1 Installer work items shall include a specific Operation Type to be listed under the "OPERATION" heading. The various operations required are determined by selecting the appropriate term(s) "add," "extend," "modify," "remove," etc., identified below.
- 3.5.2 Only the following terms, under the heading "Work to be Done by the Installer," shall be used to specify "work operations" or "work items" in the OPERATION column.

ADD - Required when new or additional circuits, cabling, material or apparatus, are to be furnished. Any special instructions concerning cabling being added, or already in place, or instructions concerning modifications of existing equipment, shall be included in an installer's note.

ASSIGN - Required when spare or fully equipped idle miscellaneous circuits or terminals on equipment (i.e. DSX, fiber, BITS etc.) are associated with added equipment. Any special instructions concerning assignments made by existing cable shall be indicated in an installer's note. If an assignment is made from an Installer's Cable Running List, the term ASSIGN need not be expanded by an installer's note.

EXTEND - Required when existing circuits are to be extended into locations in which they did not previously appear. Give the location for all appearances in terms of sections, positions, panels, frames, racks, terminals, circuits, etc.

MODIFY - Required when apparatus and/or wiring of existing circuits are to be changed. Show only the figures and/or options directly associated with the modification.

MULT - Required when like leads are multiplied (mult) within the bay and mult wire/cable is ordered in the Summary of Material. The drawing number, figure and location shall be indicated under the wire/cable ordered in the Summary of Material.

Note: Mult information may appear in any of the Work To Be Done By The Installation Supplier, Specific Installation Supplier Notes or Material Listings pages.

REASSIGN - Required when a working circuit is to be disassociated from one circuit and reassociated with another circuit or if the assignments associated with equipment has changed. Use this term only when the reassignment can be made without recabling or no new cable needs to be ordered. List the wiring diagram number and figure numbers involved and show both present assignment or termination and the new assignment and termination.

RECABLE - Required when only the cabling, wiring or power cabling of a circuit is to be reterminated. Cover the exact changes required, give the present terminations as well as the new, and state what portion of the circuit is to be recabled if more than one cable termination is shown on the circuit.

RELOCATE - Required when apparatus and/or wiring of one or more circuits or when noncircuit apparatus is to be changed from one location to another.

REMOVE - Required when the apparatus, wiring, or both of one or more circuits is to be removed, or when non-circuit apparatus or equipment is to be removed. When disposition of removed equipment information is given in the AEO, include this information in an installer's note.

RENUMBER - Required when office numbering of present positions, relay racks, bays, frames, units, circuits, etc., is to be changed. This term should be used only when no other "work item" changes are involved. This term is to be used even though the actual work involved may be re-stamping, re-labeling, etc. Give the old numbering and new numbering of the affected circuits or equipment.

REOPEN & CLOSE - Required when cable holes or sleeves have to be opened and closed when routing cables or wire through an existing cable hole, slot, or sleeve. To reopen and close existing cable holes and sleeves, list the cable hole number, floor and location.

RETIRE IN PLACE - Required when the AT&TIS Equipment Engineer has indicated that equipment will be retired and left in place. All records shall be corrected to indicate the equipment is Retired In Place (RIP) or removed.

VERIFY – Required when directed to double check bay locations, assignments, routes, footages, etc.

3.6. Specific Installation Supplier Notes

- 3.6.1 Specific Installation Supplier Notes, which apply only to the installer and pertain to a specific item in the specification, shall be shown under the heading "Specific Installation Supplier Notes".
- 3.6.2 Each installer's note shall be cross-referenced to a specific entry in the Work to be done by Installation Supplier, Material Listing and/or Cable Running List sections.
- 3.6.3 Installer's notes shall be lettered beginning with "A". The letters "I" and "O" shall not be used since they could be misconstrued as numerals. Notes AA, AB, AC, etc. follow Note Z.
- 3.6.4 When these notes are referenced in the Material Listings page, the note reference shall appear in the Description Field.
- 3.6.5 Any information concerning an item involved in a change that will aid the installer in understanding the reason for the change, especially any modification item, should be given in an installer's note associated with the item.
- 3.6.6 If applicable to the job, specific instructions shall be included concerning the disposition of removed material and equipment.

3.6.7 If there is not an equipment standard drawing figure available depicting the lead termination pattern on terminal strips or patch panels an installer's note shall be included, containing a sketch if necessary, to convey the terminal strip lead arrangement.

3.7. Material Listing Notes

3.7.1 Material Listing Notes are lettered notes containing instructions and information about the material being provided. These shall be used to indicate the supplier or source, and any special handling requirements of material ordered in the Material Listings page, including instructions to the supplier and installer, as appropriate. This information may be provided by the AT&TIS Equipment Engineer in the AEO.

3.7.2 Notes shall be alphanumeric.

3.7.3 The note "symbol", e.g. A, B, C, etc., is to be placed in the "note" column of the Material Listing Notes page. The variable, worded portion of notes is to be placed in the "Description" column of the form.

3.7.4 When two or more notes with a particular alphabetical symbol are used, the note shall be given a numerical suffix: for example, three additional "T" notes would be numbered T1, T2 T3, etc.

3.7.5 When Material listing Notes are used, the following shall be used as standard designations. Other notes may be used, when there is a need.

AA - The length shown in the narrative is the minimum allowable length required for installation. The supplier can provide one length as specified in the quantity field or variable lengths as specified in the narrative.

HL - Denotes Header Line information. This one shall be shown against every line of Header Line information.

MXX - Denotes material manufacturer or supplier. The "XX" designates a specific manufacturer or supplier.

SPR – Denotes material designated as spare and can be a subset of the main material item.

T - Material designated "T" will be furnished by AT&TIS to the installer in accordance with -----
----- (indicate letter, (date), or AEO number).

NOTE: Use this note for material which is to be furnished by AT&TIS to the installer, from its own stock, from another IS site, from the holding account, from surplus, or from any other order. Show materials exactly as furnished by the AT&TIS Equipment Engineer in the case of sections, relay racks, and other units. Show the exact lists furnished, even though some lists may be removed and others added by the installer. Where "T" items in the same specifications, and associated appendices have different variables, the items shall be designated "T", "T1", "T2", etc.

TA - Materials designated "TA" have been advanced ordered, under the same order number, by the AT&TIS purchasing organization or AT&TIS Equipment Engineer in accordance with AEO _____.

NOTE: Use this note for material that has been ordered in advance (Pre-ordered) of the release of the complete detail engineered specification. The advance ordered material has been previously processed by the AT&TIS purchasing organization and should not be reordered when the complete specification is processed. Where "TA" items in the same specification and associated appendices have different variables, the items shall be designated "TA1", "TA2", "TA3", etc.

TIV - Material designated "TIV" is minor material to be provided by the Installation Supplier. The generic list of installation supplier provided minor material will be provided by the AT&T purchasing organization upon request. The material listed against this note shall meet AT&T standards.

3.8. Material Listings

3.8.1 The Material Listings shall provide a complete list of materials and equipment necessary for the job. Minor materials may be listed in detail or combined as one or more line items.

3.8.2 The DESP shall list material in the body of the Material Listings page under the following headings:

- a) OP - Include the appropriate operation type
- b) Main Item Number - Required for each item listed, numbered consecutively.
- c) Note - Enter the specified note as required per the Material Listing Notes
- d) Quantity - Enter the correct quantity of material ordered by the number of units, feet, etc.
- e) Material Identifier - Enter the manufacturer's part number including any sub-groups required to identify the unit to the installer.
- f) Material Description - Enter a description of the item, including relay rack, shelf or panel location, circuit number and unit of measure (if other than "Each").
- g) TASK (FRC)/ECN - This field should be completed if the information is known.

3.9. AT&TIS Records

3.9.1 The DESP shall list on the AT&TIS Records page the IS Site records updated as a result of the job.

3.10. AT&T Equipment and Interconnect Drawings

3.10.1 The DESP shall list on the AT&TIS Equipment and Interconnect Drawings page the following drawing(s), with issue numbers, used in engineering the job:

- a) Manufacturer's (equipment) drawings
- b) Circuit, interconnect and schematic (wiring) drawings

3.11. Reference Drawings

3.11.1 The DESP shall list on the Reference Drawings page any other IS Site records or equipment drawings that may assist the installation effort.

Note: Reference Drawings listed here are not sent to the installation supplier

3.12. Cable Running List

3.12.1 All interbay cable or wire to be run by the installer shall be listed under the subsection, "Cable Running List." Near-end and far-end termination locations shall always be specified.

3.12.2 The heading for a Cable Running List entry shall show the interconnect drawings, figures and options related to cabling of each end of the circuit.

3.12.3 The DESP shall provide the following information on a cable running list:

- a) Cable run number of each cable
- b) A reference note, if required, shall be cross-referenced to the applicable Specific Installation Supplier note
- c) The length of each cable run in feet
- d) The number of cables to be run
- e) The code/type of the cable being run
- f) When cable route diversity is required the DESP shall indicate "Diversity" in the cable route column.
- g) The from and to locations of the cable run. When diverse cables are required, the side of the bay or relay rack on which to run the cables shall be shown in the "TO DROP" and "FROM DROP" columns. Cable drop in feet may be included if desired. For example, L indicates drop on the left side of the bay, as referenced from the front of the bay, or 10L indicates a ten foot drop if the cable drop in feet is included
- h) The cable termination point on the equipment or applicable drawing figure.

3.12.4 The DESP shall not show combined lengths of multiple cables within a single run.

3.13. Equipment Inventory Update

3.13.1 The DESP shall provide a completed EIU where TIRKS inventory is required by the scope of the job and distribute as part of the detail specification.

- a) General Information
 - 1. Include the Project Number, AEO Number, CLLI Code, Telco Engineer Name and Phone, DESP Name and Phone, IE (In-Effect) Date, Order Type (add, remove, etc.)
 - 2. Also include, as required, Primary Gateway, HECI/CLEI Code, Model Number, SCID Code, and any other appropriate information.
- b) Cabling Information
 - 1. Equipment Information

- i) Equipment Description (FLM 150, TELLABS 532L, etc.)
 - ii) HECI/CLEI code (if required)
 - iii) Floor location where equipment is installed
 - iv) Relay Rack (Aisle / Bay) location where equipment is installed
 - v) Shelf / Unit or Group number
 - vi) Cable length (if required)
2. Termination Information
- i) DSX-1 and/or DSX-3 Floor, Relay Rack location, Panel, and Jack circuits
 - ii) DCS/EDSX Relay Rack location, Electronic Address (eleven-character CLLI), Shelf and Slot number and how used (STS, 3 to 3, 3 to 1)
 - iii) Distributing Frames
(MDF, CDF, TDF) Horizontal / Vertical location
Fiber Distributing Frame (FDF) Relay Rack location, Shelf number, Connector
COSMIC and SMDF frame module, shelf, block.
- c) Plug Slots Pre-equipped -- All Plug-in Units provided in the detail specification shall be specified if spare or pre-equipped.
- d) Notes
- 1. EIU Builder - Note Section provides:
 - i) Auto-populated Equipment Description and Configuration
 - ii) Auto-populated change information
 - iii) Free form text input
 - 2. EIU Form – Notes Section provides: Free form text field
- e) When D4 Channel Bank equipment is provided, indicate the mode, timing and whether it is equipped with Unitized SMAS. If MFT is provided, indicate single or double slot and whether it has Unitized SMAS. Where SMAS is provided, provide the following information:
- 1. SMAS system number
 - 2. Maintenance Connector number
 - 3. From and to relay rack locations
- f) When hardwiring to DCS equipment, the electronic addresses (SDF, Port, CLLI, HECI/CLEI, RR, and Unit) are required.
- 3.13.2 If any changes to the EIU information occur, the DESP shall notify the AT&TIS Equipment Engineer to revise the EIU information prior to vendor complete date.

4. APPENDICES TO SPECIFICATIONS

4.1. Purpose

4.1.1 The DESP shall provide an appendix detail specification when the job scope changes (i.e. additional services, assignment updates, equipment changes).

4.2. Appendix Preparation

4.2.1 A statement shall be made in the General Job Summary, describing the reason for the Appendix, and in general, the changes made. Include an Appendix Summary, identifying the portion of the original specification replaced, or the portion of the specification being added by the appendix.

4.2.2 Appendices shall always refer to the original specifications. The Appendix shall reflect the most recent changes in quantity, etc., noted in previous appendices.

4.2.3 When adding material on an appendix, continue numbering the items in sequence with the original specification or appendix.

4.2.4 The headings used to list material in the Appendix shall be the same as those used in the original specification, except for the following:

- a) Populate the "OP" column.
- b) The only valid designations for operations are shown below with their single letter abbreviations, to be used in the operation column throughout the appendix.

<u>DESIGNATION</u>	<u>ABBREVIATION</u>
ADD	A
DELETE/CANCEL	D
CHANGE	C
TO	T

- c) The term "ADD" is used to add an item or an additional line to a previous item. If you add more than one line to an existing item, the term "ADD" should be applied to each added line, with the item and line number shown for each line.
- d) The term "CHANGE" and "TO" are used in combination when changing an item, or a line within an item. If you change more than one line of an item, but not the entire item, the term "CHANGE" - "TO" is to be applied to each line changed. The "CHANGE" - "TO" operation should not be used to increase the quantity of equipment being ordered, as this may cause the original quantity ordered to be double shipped.
- e) The term "DELETE" is used for removing an item, or a line within an item. If you delete more than one line of an item, but not the entire item, the term "DELETE" is to be applied to each line deleted. Deleting the first line of an item only will delete the entire item.

5. SPECIFICATION DISTRIBUTION

5.1. General

DETAIL ENGINEERING REQUIREMENTS
AT&T Internet Services

Section 3, ATT-TP-76401
October 16, 2006

- 5.1.1 The DESP shall complete and distribute detail specifications and appendices to meet the detail specification due date. A copy of the final detail specification and appendices shall be sent to the AT&TIS Equipment Engineer no later than 30 calendar days following completion of installation.
- 5.1.2 For E&I or E, F, & I jobs, the detailed specification shall be forwarded to the DESP's installer. For E only jobs, the detailed specification shall be forwarded to the AT&TIS Equipment Engineer.

TABLE 3-1 – SUMMARY OF CHANGES IN SECTION 3

Change	Item in 10/01/03 Issue	Item in this Issue
Revised		
Deleted		
Added		

[END OF SECTION]

SECTION 4-- INFORMATION SERVICES EQUIPMENT RECORDS

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1. INTRODUCTION

1.1. General

- 1.1.1 This section describes the Information Services equipment records that are created, maintained, and used by AT&TIS to establish a permanent record of Information Services equipment.
- 1.1.2 Changes in this issue of Section 4 are summarized in Table 4-1.
- 1.1.3 The term Information Services record refers to office specific records in either a graphical/mechanical Information Services base drawing, tabular (database) format, or electronic document storage system. The term Information Services base records refer to records numbered in the Information Services base record numbering scheme described in this section.
- 1.1.4 The DESP shall correctly update and/or mark-up for update Information Services records as identified in Table 4-3. These records are the official AT&TIS documentation of Information Services equipment.
- 1.1.5 The Office records listed on Table 4-3 shall be maintained only in those regions where they are currently updated.
- 1.1.6 All Information Services records are the property of AT&TIS. Use of these documents is restricted for use by the Detail Engineering Service Provider (DESP), installation crews, or other subcontractors. The information contained in these records is proprietary and should be protected against unauthorized disclosure. Access to proprietary information should be limited to those having a "need to know."
- 1.1.7 Information Services records (as shown in this section) are not required at Enclosed Network Extensions (ENE). ENEs are defined as CEVs, CUEs, Huts, Premis, Radio Sites, etc.

2. AT&TIS RECORDS DESCRIPTION

2.1. General

- 2.1.1 Information Services records reflect the engineering and installation plan for description and location of equipment installed for each AT&TIS site. These records are continuously updated to reflect changes in building layout, equipment configuration, capacity, equipment standard drawing information and physical location of each piece of equipment.
- 2.1.2 The DESP shall ensure the appropriate base or bases are reviewed and updated because some IS sites may have more than one base number.
- 2.1.3 The existing drawing numbering scheme shall be followed when creating or updating drawings specified in Table 4-3.
- 2.1.4 The IS sites Base Numbering System is not applicable in the TAB/db environment.

2.2. Information Services Record Document Types

2.2.1 The following records shall be updated in the regions they are presently maintained.

Table 4-3- Information Services Record Document Types

Document Type Code	Description	Marked for Update	Updated By	Data Base
FP	Floor Plan	DESP	CSSP	Electronic
DF	Distributing Frame	DESP	Supplier/DESP/M DRC/AT&TIS	Graphical/Mechan ized/Electronic
BF	Battery Distribution Fuse Board (BDFB) and Secondary Power Distribution Unit (SPDU)	DESP	Supplier	Electronic – TAB/db
PB	Power Boards	DESP	AT&TIS Capacity Engineer	Electronic - PowerPro
FE	Front Equipment	DESP	Supplier	Electronic – TAB/db
AR	Assignment Record	DESP	Supplier	Electronic
AL	Remote Alarm Records	DESP	MDRC/AT&TIS	Graphical/Mechan ized/Electronic
FB	Fuse Bay (Where Records Exist)	Installation Supplier/DESP	DESP/Supplier	Electronic/Manual TAB/db or Bay Book (Fuse Bays shall no longer be used)
AC	PDSC AC Service records	DESP	AT&TIS Capacity Engineer	Electronic - PowerPro

*Note - Mechanical/Graphical – Archived Drawings are obtained from the electronic document storage system.

Electronic records are obtained from TAB/db, PowerPro and updated on line.

2.3. Floor Plan Records

- 2.3.1 AT&TIS creates Floor Plan Records from architect drawings and plans. The AT&TIS Capacity Engineer maintains floor plan records using Space Assignment Forms (SAF), as well as engineering and installation marked prints.
- 2.3.2 Floor Plan Records are building details necessary to engineer, locate, and install CO equipment.
- 2.3.3 Aisle spacing requirements for equipment lineups are contained in Section 9 of the ATT-812-000-003 document.

2.4. Distributing Frame Records

- 2.4.1 Distributing Frame Records reflect circuits and cables terminated on a specified Distributing Frame (DF). There are many types of DFs, varying in both method of construction and the type of equipment that terminates on them. Commonly used frame designations include:

MDF	Main Distributing Frame
LDF	Line Distributing Frame
CDF	Combined Distributing Frame
TDF	Trunk Distributing Frame
IDF	Intermediate Distributing Frame
SDDF	Subscriber Digital Distributing Frame
HFDF	High Frequency Distributing Frame
TPDF	Tie-Pair Distributing Frame
FDF	Fiber Distribution Frame
LPCDF	Low Profile Combined Distributing Frame
Modular (Cosmic)	Common Systems Main Interconnecting Distributing Frame

- 2.4.2 Distributing Frames can be either single-sided or double-sided. On a double-sided frame, the sides are referred to as the horizontal side and the vertical side. Some single-sided DFs are arranged with the horizontal elements located on the lower portion of the framework and the vertical elements on the upper part.
- 2.4.3 On the horizontal portion, each level within a bay is identified with a letter designation beginning with "A" on the lowest level, "B" on the next to the lowest level and continuing to the top of the framework, excluding alphas I and O. First is the level letter, followed by the bay number. For example, HMDF L15 refers to a frame block on the horizontal side of the MDF located on level "L" at bay 15.
- 2.4.4 On the vertical portion of the DF, the frame blocks are mounted in vertical rows. Each vertical is assigned a number, beginning with the numeric one at the first vertical, and continuing in consecutive order to the end of the framework. Frame blocks are assigned a level letter beginning with A at the bottom and continuing up in consecutive order to the top of the framework, excluding letters I and O. On the vertical side, specify the vertical number first, followed by the level designation. For example, VIDF 2E is a frame block on vertical 2, at level E of the IDF.
- 2.4.5 Although the numbering of vertical and horizontal positions on a frame is usually in one direction, a frame can grow in two directions. The Floor Plan Record shall be reviewed to

determine frame growth patterns and numbering. If a frame grows in two directions, the horizontal and vertical positions are numbered 1, 2, 3, etc., in one direction and 01, 02, 03, 100etc. in the opposite direction.

- 2.4.6 On the conventional DF CO base record, each frame block mounting position is shown as the space between the short cross marks on the horizontal or vertical.
- 2.4.7 COSMIC and modular ESS Distributing Frame Records are tabular and the records shall be maintained in Frame Mate. There is no graphical/mechanical CO base record.

2.5. Battery Distribution Fuse Board (BDFB) and Secondary Power Distribution Unit (SPDU) Records

- 2.5.1 The BDFB/SPDU Record is a tabular assignment record of secondary distribution circuits from the BDFB/SPDU to various frames and equipment served by the BDFB/SPDU which shall be maintained in TAB/db.
- 2.5.2 The BDFB/SPDU TAB/db Record provides a relational tabular data base of information associated with the BDFB/SPDU and shall include Company, office location, floor, lineup, manufacturer, fuse panels, fuse blocks, fuse positions, fuse assignments, and cable run list. Notes: shall include voltage drop information, fuse type, and other general information about the BDFB/SPDU and associated circuit distribution. (In addition, BDFB/SPDU information such as supply cable size, cable length, voltage, voltage drop, fuse type and installation information may be populated in PowerPro.)

2.6. Power Board Records

- 2.6.1 Power Board Records are maintained by the AT&TIS Capacity Engineer in PowerPro. The PowerPro DC Distribution Record contains the Power Board Manufacturer, Model Number, Power Plant Association, Bay Designation; Panel Description and Position(s); protection device size(s); and load assignments; etc.
- 2.6.2 The DESP shall submit DC Distribution (Power Board) assignments to the AT&TIS Capacity Engineer via PowerPro DC Distribution Worksheets (available on the Mechanization Team Web Site under the PowerPro Tab).
- 2.6.3 The archived Power Board Front Equipment Record (520 Series) shows the physical arrangement of the power board, i.e. fuses, breaker, bay mounted rectifiers and control equipment. These drawings are available on the electronic document storage system.

2.7. Front Equipment View Records

- 2.7.1 Front Equipment View Records are records of the physical location of equipment on various frameworks throughout the IS site. They contain equipment information in pictorial or tabular form. This information is related to the location, position, and specific mounting details of CO equipment as derived from supplier's standard equipment drawings. Other CO records, such as assignment records support the Front Equipment View Record.

2.8. Assignment Records

- 2.8.1 Assignment Records contain specific information for the interconnection and monitoring of the capacity of network elements. Assignment records may include DSX, Fiber Distributing Frame, and timing, fuse panels and alarm records (Remote Alarm Records are maintained manually).
- 2.8.2 The DESP shall maintain the assignment information in the appropriate Tabular Database system.
- 2.8.3 Remote Alarm Assignments reflects TBOS serial and discrete status/command terminations for Network Elements (NE) on a IS site (CO) Telemetry Alarm Unit (Dantel or Westronic).

2.9. Equipment Numbering Plans for Information Services Equipment

- 2.9.1 The numbering of bays and frames on all CO records shall be consistent with the Floor Plan Record.
- 2.9.2 Switching equipment shall conform to the manufacturer's lineup and frame numbering scheme.
- 2.9.3 New equipment frames or lineups shall be designated numerically. These numbers shall be unique and assigned only by the CSSP, per the AT&TIS Space Planning Guidelines.

2.10. Cable Hole Numbering Plans for Information Services

- 2.10.1 The DESP responsible for E&I jobs, shall submit the floor plan sketch to the Equipment Engineer where new cable hole(s) will be opened, before the start of the job.
- 2.10.2 The sketch shall accurately reflect new cable hole(s) size and relative distances from the column. The Equipment Engineers responsible for the job will forward the sketch to Common Systems Space Planner (CSSP) and obtain an approval of the location of new cable hole(s) before actual hole(s) being opened. CSSP is responsible for cable hole numbering.
- 2.10.3 Cable hole designations should be tracked on office floor plans by the CSSP as he/she is best equipped to know if a new hole will conflict with space allocation plans and, the CSSP will know if space allocation plans need to be adjusted for cable management reasons.
- 2.10.4 Information Services cable hole numbering may be encountered in AT&TIS buildings in one of two methods as follows:
 - A) Floor, Nearest column, Sequential letter designations radiating outward from the column. For example: 02G3B is second floor, near column G3, B representing the second cable hole designated near column G3.
 - B) Floor, Nearest column, Compass direction from the column, Sequential whole numbers in that compass direction. For example: 02G3W2 is second floor, near column G3, West side of column, second hole to West of column.
- 2.10.5 For existing IS site buildings, new cable holes shall be numbered in keeping with the established scheme in use in the building. For new IS site buildings, the second method above (utilizing compass direction) shall be used.

2.11. Grounding Records

- 2.11.1 The archived Grounding Schematic (650 Series) Drawings are available on the electronic document storage system. Office Principle Ground Point (OPGP) location changes, and the changes/additions of CO GRD, MGBs, COGs will be shown on revisions to the floor plan and shall be the responsibility of the Common Systems Space Planner (CSSP). Both the floor plan and archived Grounding Schematic (650 Series) Drawings will be used for overall CO Ground System reference.
- 2.11.2 The archived Grounding Schematic Drawing shows the following information. Subsequent location changes or additions only to the OPGP, CO GRD bus bars, or MGBs will be shown on the floor plan going forward as noted in Section 3, ATT-TP- 76400.
- a) Office Principle Ground Point (OPGP) location and terminations;
 - b) Vertical riser (if required);
 - c) Horizontal equalizers;
 - d) Location of the CO GRD bus bar;
 - e) Main Ground Bus (MGB) of the Ground window (when required);
 - f) Equipment ground bars;
 - g) Size of grounding conductors;
 - h) Grounding electrodes;
 - i) Driven ground rod system;
 - j) Cable Entrance Facility (CEF) ground bar

2.12. Power Equipment Records

- 2.12.1 Power Equipment Records are those CO records that include details of the equipment used to produce, control and distribute power to CO equipment. Power Equipment DC and AC Distribution Records shall be updated, as applicable in PowerPro, any time equipment is added, changed, or removed from a CO.

The following CO power drawing series records are archived and available in the electronic document storage system for reference:

<u>Dash Number</u>	<u>Power Equipment Drawings Description</u>
- 500-509	Power Battery Distribution; AC Service
- 520-529	Power Board - Front Equipment; Controllers
- 550-559	AC Service and BDFBs
- 650-659	Grounding Schematic; Power Equipment Emergency Engine;

2.13. Fuse Bay Equipment Records

- 2.13.1 New assignments shall no longer be made on Fuse Bays.
- 2.13.2 Fuse Bays were originally engineered to provide secondary distribution for many different, small amperage equipment types spread over a large area of the IS site. Dedicated power distribution units (PDU's) (feeding equipment in same rack) and non-dedicated (PDU's) (feeding equipment in an adjacent rack) are not considered Fuse Bays.

2.13.3 Some of the active Fuse Bays have been converted to TAB/db and the DESP shall maintain the Assignment Record when removing circuits. If the fuse bay record has not been created in TAB/db, the DESP shall include a specific installer note in the detailed specification to update the fuse record book associated with the bay for circuits is being removed.

2.14. AC Service - PDSC Records

2.14.1 The AC Service Records show the physical arrangement of the cabinet or panels, the source and capacity wire sizes, terminal lugs, and AC circuit assignments. The requirement for AC Power Drawing Record updates has been replaced by AC Distribution Record updates in PowerPro. The DESP shall submit AC Distribution (Power Distribution Service Cabinet (PDSC) Panel) assignments to the AT&TIS Capacity Engineer via PowerPro AC Distribution Worksheets (available on the PowerPro Web Site). The archived AC Service Drawing Records (550 series) Drawings are archived in the electronic document storage system for reference.

2.15. Wiring List and Block Schematic – Power Equipment Records (Discontinued)

2.15.1 Wiring List and Block Schematic Drawings are discontinued, and no longer available.

2.16. Ring, Tone And Cadence Records (Discontinued)

2.16.1 Ring, Tone and Cadence Record drawings are no longer available. Database records of Ring Plants and Components are populated in the PowerPro system by the AT&TIS Capacity Engineer.

2.17. Miscellaneous Power Records

2.17.1 Miscellaneous Power Records are specialized records that include information on power equipment layouts, bus bar, bus bar details, sectional views, standby power equipment, emergency AC equipment, and miscellaneous details of power ducts.

2.17.2 Miscellaneous Power Record Drawings are no longer available. Generic versions of CO power detail information in a AT&TIS Power Drawing format are available in the electronic document storage system for reference.

3. MANUFACTURER AND AT&TIS EQUIPMENT DRAWINGS

3.1. General

3.1.1 The appropriate CO records shall be updated or created to indicate the proper equipment drawings, as well as their associated lists, groups, figures, etc.

3.1.2 There are two types of equipment drawings:

- a) Manufacturer's equipment and interconnect drawings. These drawings should only be used if there is no existing AT&TIS drawing for the associated equipment.
- b) AT&TIS drawings. These drawings always supersede information shown on the associated manufacturer's drawings/documentation.

4. AT&TIS TABULAR AND GRAPHICAL/MECHANICAL AT&TIS RECORDS

4.1. General

- 4.1.1 Upon receipt of the AT&TIS Equipment Order (AEO), the DESP shall determine which CO records are required to complete the engineering process.
- 4.1.2 To determine which CO records are required, the DESP shall cross-reference Table 4-3. The following details the process for creating or updating CO records.

5. AT&TIS RECORDS CREATION AND UPDATING

5.1. General

- 5.1.1 This section details the procedures employed when creating or updating CO records listed on Table 4-3. Specific topics addressed include but are not limited to:
 - a) Creating records;
 - b) Marking and updating existing records;
 - c) Renumbering records;
 - d) Voiding records.
- 5.1.2 CO records shall be created or updated when:
 - a) Equipment is added to an office;
 - b) Equipment is removed from an office;
 - c) Equipment is relocated in an office;
 - d) Assignment record updates are identified;
 - e) Other changes take place, including renumbering records, record only changes and equipment modifications, which may change a list or option designation.
- 5.1.3 The DESP shall resolve any AEO assignment discrepancy with the AT&TIS Equipment Engineer.
- 5.1.4 The DESP shall make all required "as built" changes to tabular AT&TIS records no later than 30 calendar days following completion of installation.
- 5.1.5 The DESP shall mark the required "as built" changes on graphical/mechanical AT&TIS records (refer to Table 4-3) and forward marked hardcopy to the MDRC no later than 30 calendar days following completion of installation to:

MDRC Marked Print Desk
2600 Camino Ramon 2S500EE
San Ramon, California 94583

: Exceptions:

If in doubt, questions regarding transmittal of marked prints may be directed to the AT&TIS Equipment Engineer.

5.2. AT&TIS Drawing Title Block

5.2.1 The drawing title block shall appear on the first sheet and supplementary sheets of CO base records and shall contain the following basic information.

- a) Type of Record: Indicate the type of record such as "Floor Plan," etc. in the first line of the title, beginning at the top center of the title block
- b) Name of Equipment: Top center below Type of Record
- c) Equipment Designation and Numbering: Show the equipment designation (relay rack bays, frames, sections etc.) below the Name of Equipment in the title space as applicable. The numbering shall include the ultimate equipment when known both present and future, for which the record is designed. The range of bay numbers shall be updated to reflect added or removed bays
- d) Floor Number: Show below the Equipment Designation and Numbering
- e) Telephone Company Name: Show below the Floor Number
- f) Office Name: The office name is shown in the lower left hand corner
- g) Office Location: The Town and State is shown in the lower right hand corner
- h) Street Address: The street address may be included in the title block
- i) Common Language Identification (CLLI): The CLLI Code for an office must be shown in the upper left hand corner of the Title Box
- j) Sheet numbers shall be shown in the sheet box as follows
 1. Sheet 1 of 3* on first sheet
 2. Sheet 2 of 3* on second sheet
 3. Sheet 3 of 3* on third sheet, etc.*Last sheet number of the record
- k) Record Titles for Multi-sheet Records
- l) The first sheet of a multi-sheet records requires a title as described above
- m) The second and subsequent sheets of a multi-sheet record require a more abbreviated title as follows:
 1. Type of record
 2. Name and designation of equipment on record
 3. Office Name
 4. Town and State

5.3. AT&TIS Record Marking Standards

5.3.1 The following colors shall be used when manually updating CO records which will be returned to AT&TIS by the DESP:

- a) Red - Mark in red all equipment additions, relocations, assignment changes, and record title box changes representing equipment being added, reconfigured, modified, or reassigned. When the number of frames, units, etc. have been changed, also show the new quantities in red
- b) Yellow - Show in yellow all equipment being removed from a CO. Whenever frame numbers, quantities, assignments, etc. change, the old numbers, locations, or assignments are to be highlighted in yellow
- c) Green - Mark in green all record only changes. CO records which do not reflect equipment being added or removed, but which represent new information concerning existing COE configurations are record only changes and are marked in green
- d) Black - X-3 notes, which are instructions to the draftsman, shall be marked in black, encircled with the same color (red, green or yellow) as the associated change marking and with an arrow in the same color pointing from the X3 note to the marked change(s)

5.3.2 The following requirements shall be maintained whenever CO records are changed:

- a) All CO records submitted for update or shipped to a job site shall be clearly labeled with the DESP Name, Detail Engineer's Name or Initials, Detail Engineer's Phone Number and AT&TIS's AEO order number
- b) Only approved abbreviations shall be used. Refer to Telcordia Technologies document BR 751-410-101, Common Language Standard Abbreviation Master List for standard abbreviations
- c) The AT&TIS EDMS drafting symbols library shall be used for creating or updating CO base records
- d) Any new symbols added to the body of the record shall be defined in the General Notes
- e) All notes shall be referenced somewhere on the body of the record
- f) All applicable records shall be updated
- g) Whenever measurements are required, such as on floor plans they shall be shown and the appropriate records updated
- h) Entire records shall be provided in a legible format. Partial prints may be submitted, if attached and referenced to an entire record
- i) X3 notes shall be used on engineered marked records only to convey instructions to the draftsman. When X3 notes are used, they shall be color-coded as described above and formatted as follows.

X3: appropriate note to draftsman

5.3.3 The DESP shall bring any updated record to current standards as outlined in this section.

- a) Major record updates to correct record inaccuracies shall be authorized by AT&TIS Equipment Engineer.

5.3.4 The DESP shall submit all updated CO records to the AT&TIS Equipment Engineer per instructions on the AEO.

5.3.5 The DESP shall review any installer marked records and insure drawing standards violations are corrected prior to submitting to the AT&TIS Equipment Engineer.

5.4. Office Record Distribution

5.4.1 For E&I or E, F, & I jobs two (2) copies of all new and/or changed AT&TIS records, whether administered by the DESP or AT&TIS, shall be forwarded to the DESP's installer. For E only jobs, two (2) copies of AT&TIS records, as part of the installation package, shall be forwarded to the AT&TIS Equipment Engineer or the Installation Supplier as noted in the AT&TIS Equipment Order.

5.5. Updating Floor Plans

5.5.1 The DESP shall request the AT&TIS Equipment Engineer to resolve unexpected space requirements with the AT&TIS Capacity Planner.

5.5.2 The DESP shall forward information on blocked cable holes to the AT&TIS Capacity Planner.

5.6. Updating Distributing Frame (DF) Records

5.6.1 Modular Distributing frame records are maintained in the AT&TIS Equipment Engineer FrameMate system instead of a conventional drawing.

5.6.2 Conventional frame records are electronically maintained in FrameMate II. Marked prints shall be required for mechanical updates that are posted on electronic storage system as active (TBASE) records.

5.6.3 When a frame block is added, it shall be shown on the record by darkening the location at the chosen coordinates. The terminating circuit title, bay location, and circuit numbering shall be indicated.

- a) If insufficient space is available to show the information, an expanded sketch may be used. This sketch is identified by the location coordinates of the frame block. On the sketch, each tick mark is one row of connecting terminals on the frame block;
- b) When the expanded sketch is not used, and all of the rows of a frame block are not assigned, the abbreviation "SR" (Spare Rows) shall be used along with the quantity of spare rows remaining for example [10SR]. Only that portion representing rows of terminals utilized shall be darkened.

5.6.4 As Conventional DF equipment and circuits are added, removed, or relocated, the record shall be updated. The following information shall be shown on these records:

- a) Circuit title;
- b) Originating location;
- c) Spare rows;

- d) Circuit numbering;
 - e) Title box information;
 - f) Jack box and connecting block information - assignments and multiples;
 - g) Sketches showing individual circuit information, such as location, circuit title, spare rows, and circuit numbering.
- 5.6.5 The DESP shall update the "Location of Equipment" table on the drawing with information relating to wiring diagram numbers and figures, frame block code, and the horizontal or vertical location of the frame block.

5.7. Updating AC and DC Power Records

5.7.1 AC and PDSC Power Distribution Panel changes and Power Board DC Distribution Changes will be entered into the PowerPro Database. The DESP shall submit AC and DC Distribution (Power Board) assignments to the AT&TIS Capacity Engineer via PowerPro AC and DC Distribution Worksheets (available on the Mechanization Team Web Site under the PowerPro Tab.)

5.7.2 Battery Distribution Fuse Board (BDFB) and Secondary Power Distribution Unit (SPDU) RECORDS

- a) TAB/db:
 - 1. Fuse position number
 - 2. Fuse size
 - 3. Secondary distribution cable run length, size, and connector type
 - 4. Assigned network element relay rack number
 - 5. Assigned network element description and load designation
 - 6. L-2 type DC drain of the assigned network element(s)
 - 7. Total assigned drain per BDFB/SPDU load
 - 8. New BDFB/SPDU information as listed in the New BDFB/SPDU Worksheet.

5.7.3 The DESP shall forward the New BDFB/SPDU Worksheet to the Cluster Vendor and the AT&TIS Capacity Engineer within 5 working days of completing the BDFB/SPDU installation.

5.7.4 The Cluster Vendor shall input the information from the New BDFB/SPDU Worksheet into TAB/db.

- a) Engineered BDFB/SPDU Voltage Drop information shall be entered for each BDFB/SPDU into TAB/db.

5.8. Updating Front Equipment View Records

5.8.1 The Front Equipment View Records depict how relay rack (RR) frameworks in a CO are equipped. They shall contain the following items:

- a) RR height
- b) Height of first mounting plate from the floor
- c) Mounting plate width and height
- d) Individually added units depicting the correct location and number of occupied mounting plate spaces
- e) Manufacturer, equipment description, part number and list/group structure
- f) Unit/Panel numbering
- g) Circuit numbering
- h) Adapter arrangements where applicable.
- i) Miscellaneous and overhead equipment not occupying mounting plates within the frame (TAB/db only).
- j) Removed units eliminated from drawing when units are removed

5.9. Updating Assignment Records

5.9.1 Assignment records shall be updated in the appropriate database systems. They shall contain the following items:

- a) Equipment description and part number of equipment
- b) Wiring diagram number, quantity of units, circuits, figures
- c) Relay rack location
- d) Shelf/unit/panel numbering
- e) Circuit numbering
- f) Notes.

5.9.2 When a Network Element is terminated on an alarm surveillance unit, the DESP shall mark for update the alarm assignment drawing and forward to the MDRC except when the AT&TIS Equipment Engineer has updated the database previously.

5.9.3 The tabular assignment records for field assembled equipment bay fuse panels shall be updated to include the potential/polarity, maximum allowable and cumulative assigned current drain, fuse position and size, and the equipment type, interconnect figure and location. Assignment records are not required for fuse/circuit breaker panels when they are included as part of a preassembled bay.

5.10. Updating Switch Records

5.10.1 Switch internal assignment records, power distribution cabinet or frame records and other miscellaneous switch records shall be updated in accordance with the switch manufacturer's standards.

5.11. Voiding Records

- 5.11.1 CO base records may be voided for any of the following reasons:
- a) A record has been entirely substituted by a new record;
 - b) A new record has been established, and the order to which it applies has been entirely canceled;
 - c) The removal of equipment, circuits, framework, etc. that covers an entire record.
- 5.11.2 Records are placed on a void status, rather than destroyed, so that a record of equipment configurations is available in case the equipment is reused in another office. Voided records are retained in EDMS for three years. Voided records may be reinstated within the three-year period only by contacting the AT&TIS Equipment Engineer. Records shall not be voided without the concurrence of the AT&TIS Equipment Engineer

TABLE 4-1 – SUMMARY OF CHANGES IN SECTION 4

Change	Item in 10/01/03 Issue	Item in This Issue
Revised		
Deleted		
Added		

[END OF SECTION]

**SECTION 5 -- EQUIPMENT SPACE LAYOUT and
EQUIPMENT SPACE PHYSICAL REQUIREMENTS**

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1. GENERAL

1.1. Introduction

1.1.1 This section describes the general requirements for Internet Services Equipment (ISE) layout engineering.

1.2. Equipment Layout Requirements

1.2.1 If the AT&T IS Site Infrastructure has provided a marked floor plan or specific equipment locations, the non-272 Affiliates shall request the AT&T IS Site operations Engineer to resolve any equipment layout changes with the AT&T IS Site Infrastructure Engineer. Space assignments within a POP is the responsibility of AT&T IS Site Infrastructure Engineer, whereas AT&T IS equipment layout responsibility within the assigned space belongs to AT&T IS Site Infrastructure Engineer

1.2.2 The equipment installation design shall ensure that the technicians have optimum access to installed equipment.

2. EQUIPMENT FRAMES

2.1. Introduction

2.1.1 Equipment frames, as defined here, include relay racks, bays, and floor-supported cabinets comprised of a structural framework, and all equipment mounted thereon.

2.2. Equipment Frame Requirements

2.2.1 All equipment frames placed in the AT&T IS assigned area shall be in compliance with BSP 800-000-102MP, POP Equipment Frame Design Requirements.”

2.2.2 Cabinets for AT&T IS assigned areas shall be IS standard designs of Generic cabinet or Video cabinet, wide or standard width versions under purchase agreement from approved suppliers. Non-approved cabinets shall not be deployed.

2.2.3 Frames equipped for Nineteen-inch wide relay racks may be used in the assigned area by AT&T IS but should not be mixed with twenty-three-inch wide relay racks without the expressed authorization of AT&T IS Site Infrastructure Engineer.

2.2.4 All frames in a system or a line-up shall be the same height (7'-0”), unless authorized by both, the AT&T IS Site Infrastructure Engineer as well as AT&T IS Site Operations Engineer (refer to section 3.1).

2.2.5 Standard hole spacing shall be EIA 310D 5/8” 5/8” 1/2” spacing. Mounting holes shall be drilled and tapped for 12-24 mounting screw diameter.

- 2.2.6 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 SBC 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 and base filler shall be finished to match color of equipment frames.
- 2.2.7 All equipment frames, relay racks, bays, and floor-mounted cabinets shall have a hole pattern on the base of the frame for anchoring to floors. Equipment frames shall be supported and anchored per BSP 800-000-101MP.
- 2.2.8 Equipment frames placed on raised floor system shall be secured to building concrete floor unless access floor system at site is designed to permit securing of equipment frames direct to floor panel. Securing of cabinets to building floor shall conform to requirements in BSP 800-000-104MP. Only access floors constructed with pedestal head positively secured against lift from pedestal tube and floor panels corner locked to pedestal head shall permit through bolting of frames direct to floor panels.
- 2.2.9 Any frame, when packaged for transit and accompanied or supported by the usual handling facilities, shall fit through entrances four feet wide and eight feet high.
- 2.2.10 All frames shall comply with the following requirements to ensure a diversity of frame types will fit together in straight, orderly equipment frame line-ups:
- a) No part of any frame or apparatus attached to the frame shall extend beyond the front or rear edges of the base or guardrail of the frame;
 - b) The fronts of the base of all frames shall be aligned.
 - c) When the depths of the frames are different, transition devices shall be used from one frame to the next .
 - d) Rear aisle clearance shall not be less than 3 feet. Raised floor installations must maintain minimum of 1 full tile access (reference Section 3.14). :
 - e) End guards and guard rail closing details shall be provided on all frame uprights not adjacent to another frame or a building obstruction;
 - f) End guards for equipment relay racks shall cover all cable in the adjacent equipment frame; Cabinets shall have side panel installed for all units located at end of aisles.
 - g) End guards for relay racks shall be the same height as the frames they are installed on.

- h) End guards or end panels that do not match the same depth or overall foot print of the adjacent bay framework shall require a transition device. This transition device shall be required either on the front, rear or both sides of the end guard or end panel, which ever is appropriate.
- 2.2.11 The floor load from equipment frames, excluding the cable distribution system, averaged across the associated floor area, should not exceed 80 pounds per square foot above 7-foot environments and 115 pounds per square foot above 11-foot 6-inch environments. The AT&T IS Site Infrastructure Engineer shall ensure equipment frames do not exceed floor load capacity.
- 2.2.12 For planning the layout of equipment framework lineups, the "cold aisle" and "hot aisle" room cooling configuration shall be used. The "cold aisle" shall be the aisle where cool room air will be drawn into equipment intake (usually termed front or maintenance aisle) and the "hot aisle shall be aisle where warm exhaust air from equipment is discharged (usually termed rear or wiring aisle). The equipment should be configured so that all equipment in opposing lineups sharing the common aisle shall all be intake face or exhaust face to avoid mixing intake and exhaust flows in an aisle. This would result in every other aisle being either a "cold aisle" or "hot aisle".
- a) Minimum width of cold aisle shall be 4 feet. Minimum width of hot aisle shall be 3 feet.
 - b) In the raised floor environment, the front edge of the equipment framework shall be positioned at the edge of one full floor panel in the cold aisle allowing that aisle floor panel to be removed. At minimum two full floor panels in front of each equipment framework across the width of the cold aisle shall be removable. The hot aisle shall have at minimum one full floor panel to the rear of each equipment framework that can be removed. Hot aisles may have partial floor panels in addition to the one full panel when equipment framework depths exceed 24 inches.
- 2.2.13 With the exception of VHO, network elements cabinets, the base of each frame behind the front and rear guardrails shall have space for AC power distribution for convenience outlets. The sides of the frame base must have holes or be sufficiently open to facilitate distribution wire running through frames. The frame base/guardrail shall provide a means and location for appliance outlets.
- 2.2.14 The below conditions and interactions shall be incorporated into the space planning drawings developed by AT&T IS space planners. These conditions and interactions are intended to ensure initial equipment layouts are appropriately sized and configured, and that the integration of new technology into existing equipment environments can be accomplished in a manner most appropriate to floor and overhead cabling space utilization and network equipment interconnectivity.
- a) Equipment layouts shall be in accordance with the Company's standards per BSP 800-003-100 for network equipment environments.
 - b) Equipment layouts shall be in compliance with published equipment manufacturer's requirements/restrictions relative to actual placement of equipment.

- c) Equipment layouts shall be reviewed by a AT&T IS Site Operations Engineer representative(s) to ensure the physical relationship of network elements is appropriate and efficient from an equipment operations and maintenance perspective.
- d) Equipment layouts shall be reviewed by a person familiar with equipment environment cable management and superstructure engineering to ensure those matters are appropriately incorporated into equipment layouts. It is expected that AT&T IS Site Infrastructure Engineer will perform this function in association with AT&T IS Site operations.
- e) Equipment layouts shall be reviewed by a power engineer or person familiar with dc power distribution to ensure equipment power distribution has been sufficiently planned for and accommodated.

3. EQUIPMENT SPACE REQUIREMENTS

3.1. General

- 3.1.1 Aisle spacing shall be in accordance with [SBC-800-003-100](#) "Standards for Network Equipment Environments"
 - POP/Server equipment not less than 4 feet
- 3.1.2 Floor/Ceiling loading shall be in accordance with recommendations set in [SBC-800-003-100](#).
- 3.1.3 The iron work and cabling load supported by the ceiling anchors or embedded channels shall be in accordance with recommendations set in [SBC-800-003-100](#).
- 3.1.4 A clear ceiling height above equipment shall be in accordance with recommendations set in [SBC-800-003-100](#) in medium and large network facilities

3.2. Equipment Area Requirements

- 3.2.1 IS sites may be requested in AT&T central offices or equipment buildings shared with other services. The request from IS Engineer shall state the square footage of space required for housing their equipment. IS equipment shall be physically separated from network equipment because of IS equipment designs and operational needs. Where existing space is available and physically isolated from network equipment, the space may be used as configured with necessary provisioning for code compliance, equipment cooling needs, interconnection requirements, power feeds and room access restrictions. Where existing space is available but the space is shared on a common floor with network equipment, the area assigned for IS equipment shall be partitioned from network equipment space.
- 3.2.2 Space preconditioning for IS equipment are similar to that for network equipment. Floor load designs shall be 150 pounds per square feet. Concrete floors of at least 5 inch thickness are required. Embedded concrete anchors of up to 3-1/2 inches depth and 3/4 inch diameter will be installed in concrete floor to secure equipment frames. Overhead cable racks shall be suspended from building ceiling to embedded ceiling inserts with threaded rods. Expected live ceiling load may approach 20 pounds per square feet and 1200 pounds working load at each insert. Minimum ceiling height 14 feet 9 inches from floor to ceiling. Equipment cooling needs

shall be stated in the request and building cooling capacity is to be provided as part of the space requirements. Building cooling air shall be provided from overhead ducts unless access floors are applied.

- 3.2.3 Access floors may be requested for the IS sites. The access floor shall be installed across the full space designated. The access floor shall be used as an air plenum for equipment cooling and may be used for AC power distribution to video equipment only.

3.3. Partitioning Requirements

- 3.3.1 In AT&T Central Office space where partitioning walls are required for separation of IS floor space from network equipment space, the minimum requirements are that the space shall be erected with fire resistive wall, ceiling and joint system. The partitioned space shall have minimum fire resistive period of 1 hour. Penetrations through fire resistive walls and ceilings shall be protected by an AT&T approved firestop system and shall have an F rating of not less than the required rating of the wall or ceiling penetrated. Under no circumstances shall partitioning walls or ceilings be constructed around existing cables and cable racks without proper through penetration and fire stop system installed. For example, gypsum boards cut and fitted around existing cables and cable rack is not acceptable as a fire stopped penetration and shall not be permitted. 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. Joints between wall and ceiling, wall and floor shall be fire stopped to code requirements with approved fire stopping materials. Fire stop systems referenced in this paragraph includes smoke stopping to AT&T requirements
- 3.3.2 Partitioning walls and ceilings shall be constructed for seismic loads in UBC Zones 3 and 4 . Walls shall be supported at minimum to resist a load of 150 pounds at 5 feet height and mid distance of wall length with minimal deflection and wall buckling. At least two entries into partitioned space shall be provided with entries at opposite ends of partitioned space. The entries shall be provided with a fire resistive door of F-rating not less than the required rating of wall. Doors shall be minimum 36 inch width by 96 inch high with narrow lite glass.

3.4. Fire Protection

- 3.4.1 Fire suppression should not be required for Group B occupancy that this space should be categorized as, under UBC, Section 304.1 as electronic data processing facility and telephone exchange. However, if fire suppression is provided, water fire suppression systems of double actuated dry pipe system shall be used or a clean agent suppression system such as FE-227 shall be considered. Partitioned space that will be provided with water fire suppression system shall have floors sealed with a water proof finish. Any floor cracks or gaps greater than 1/6 inch shall be filled with joint sealer or crack injection material prior to sealing floor. All floor penetrations with covers or plates shall be sealed around covers with bead of silicone caulking prior to sealing floor. Floor penetrations for cable and cable rack shall be closed to required fire stopping methods.
- 3.4.2 Fire detection shall be provided in the partitioned space independent of the surrounding areas in the building. The fire detection system shall be provisioned for local alarm and remote alarm by a contact closure. Fire detection sensors shall be provided overhead of equipment with unobstructed path of smoke from equipment.
- 3.4.3 Current fire suppression practice for AT&T IS video installations is provided by gaseous clean agent systems such as FM-200 systems. While a corporate policy for fire suppression of equipment buildings has not been finalized, a draft practice has been developed in cooperation with Network Engineering and Corporate Real Estate and expected to be released in 2006. It is recommended that in the interim, all AT&T IS sites continue to deploy gaseous clean agents fire suppression until final written practice has been issued.

3.5. Raised Floors

- 3.5.1 Access floor systems if required shall be designed and constructed to minimum performance requirements stated in the following paragraphs. Access floor height shall be 24 inches from building floor to top of access floor panel. Clear height under floor system shall be minimum 22 inches. Floor surface shall be installed level to $\pm 1/16$ inch across 30 feet. Floor panel joints shall be even within $\pm 1/32$ inch with adjacent panels. Concrete sealer shall be applied to building floor prior to installation of access floor. Sealer is required for dust control or for water proofing if water fire suppression is used.
- 3.5.2 Floor panels shall be high strength all steel panels consisting of steel top sheet welded to a formed steel bottom pan with powder coated epoxy paint finish and panel is internally filled with a lightweight concrete product. Ultimate load of 4000 pounds, concentrated load @ 0.10 deflection for 1000 pounds, impact load 175 pounds and rolling loads 10 passes 1000 pounds, 10,000 passes 800 pounds. Each access floor panel will have a factory applied High-Pressure Laminate finish with router cut edges.
- 3.5.3 Air flow panels shall be of all steel welded construction with 25 percent open air perforated top sheet and shall be supplied with an adjustable damper assembly. Panels shall be capable of supporting a design load of 1250 pounds. Panels shall provide 525 CFM at a static pressure of 0.1 inch water.
- 3.5.4 A system of structural stringers rigidly bolted to the supporting pedestals shall be provided. Stringers shall be bolted to pedestal heads. Stringer height shall be 1-1/4". Stringer shall be

rectangular steel tubing. Stringers shall be provided in 24" lengths between pedestals of equipment lineup aisles and can be longer for other areas to permit access to under floor space.

- 3.5.5 The supporting pedestals shall be minimum 1-3/4 inch diameter steel tube with full bead weld to steel base. Pedestal base shall be minimum 3/8 inch thick steel of 6 inch by 6 inch secured to building floor with two mechanical concrete anchors such as Hilti Kwik Bolt-3, 1/4 inch diameter carbon steel anchors embedded to 1-1/8 inches. Pedestal securing with floor adhesive is unacceptable. Minimum lateral strength of individual pedestal shall be 250 pounds applied at the top of the pedestal with no more than 3" inch deflection.
- 3.5.6 Floor systems designed for direct through bolting of equipment frames shall have heavier duty pedestals and pedestal heads captured against vertical lift. The pedestal shall be secured to building floor with four Hilti 1/4" Kwik Bolt 3 anchors. The floor panels shall be screw fastened at corners to captured pedestal heads. Floor design for direct bolting of equipment frames shall be ASM Modular Floors SBT-6613 or ASM Modular Floors SBT-8825 (Zone 4) only.
- 3.5.7 Leveling head to be provided for pedestal with at least 10 inch threaded stud length. Adjustment nut will be provided to adjust for floor height. Stud diameter to fit into pedestal tube with diameter difference no greater than 3/16". Head shall be formed steel and full bead weld to stud. No resistance or spot welds permitted in joining head piece to stud. Cast aluminum heads are not permitted. Top stringer attachment holes to be tapped for stringer attaching screws. No sharp edges or corners shall be exposed from pedestal head when floor panel is removed.
- 3.5.8 Grounding of access floor system shall be in conformance to AT&T requirements stated in other documents.
- 3.5.9 No obstructions of pipes, conduits, detectors shall be permitted in space immediately under equipment lineups. The underfloor space under lineups is required for equipment frame securing, cable management and power access.
- 3.5.10 Ramps and steps are to be provided for transitioning to elevated floor areas if necessary. Where ramps are required, ramps are to be designed and installed to building code requirements. Hand rails are to be provided for ramp and step areas. Railings are to be installed where there is a drop in floor height. Railings shall be installed in conformance with building code requirements. Ramps shall be located outside of partitioned space where walls are used to partition the video services area. Floor pedestals provided for ramps and steps do not need to be SBT 6613 or SBT 8825 heavy duty pedestals as used in equipment areas. Pedestals provided shall be capable of normal traffic and rolling loads up to rating of floor panels.

3.6. Room Cooling

- 3.6.1 Overhead HVAC ducts shall be placed with top of ducts as near building ceiling as possible. Top of ducts shall not hang more than 6 inches from ceiling. Minimum of 11 feet from building floor to lowest point of air ducts shall be available for equipment frames and overhead cable racks. This clearance shall exist across the whole floor space area. Ceiling hanger rods of 5/8 inch diameter shall be installed in 5 foot grids in two directions from building ceiling. HVAC ducts shall be placed to permit hanger rods to be installed to ceiling anchorages. Diffusers for delivering cooling air to each cold aisle of equipment lineups with ceiling diffusers designed for vertical downward air projection to floor. Diffusers shall be provided at vertical height of not less than 7'-3" height and not greater than 8'-0" from building floor. Linear diffusers with two way throw should be provided for desired delivery of cooling air to front face of every equipment frame in

lineup. Corporate Real Estate shall coordinate with IS planners on locating equipment lineups and placement of diffusers in cold aisles.

- 3.6.2 Where access floors are used, the equipment cooling air shall be delivered from under the floor using the floor system as an air plenum. Perforated floor panels shall be provided in cold aisles and Corporate Real Estate shall coordinate with space planners on locating the perforated floor panels. Minimum of 11 feet from finished floor height of access floor to building ceiling shall be available for equipment frames and overhead cable racks.

TABLE 1-1 – SUMMARY OF CHANGES IN SECTION 5

Change	Item Issue	Item in this Issue
Revised		
Deleted		
Added		

[END OF SECTION]

SECTION 6 -- EQUIPMENT BUILDING ENVIRONMENT REQUIREMENTS

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1. INTRODUCTION

1.1. General

- 1.1.1 This section outlines environmental requirements for AT&T IS offices. Included are such considerations as temperature, humidity, and air quality. Specifically excluded are those considerations that fall under the control of the Environmental Protection Agency (EPA); i.e., air and ground pollution that results from AT&T IS activity.
- 1.1.2 Changes in this issue of this section are summarized in Table 6-1.
- 1.1.3 Requirements in this section apply to building engineering service providers. To ensure satisfactory operation of the equipment, the DESP shall consider the environment in which the equipment will be working.

2. THERMAL

2.1. General

- 2.1.1 Specific equipment heat dissipation requirements shall be coordinated with the AT&T IS Equipment Engineer.
- 2.1.2 The operating ambient temperature will be maintained by CRE to the levels in Table 6-2.
Operating ambient temperature indicates the central office aisle temperature rather than return air or thermostat temperature. Per Telcordia GR-63-CORE, ambient temperature should be measured 59" above the floor, 15.8" from the face of the equipment.

3. FIRE RESISTANCE

3.1. General

- 3.1.1 Data processing interconnecting cables and connecting cables run through an air plenum do not require a plenum rating if the plenum meets the criteria of the National Fire Protection Association (NFPA) 70-465, and the plenum has a smoke detection system.

4. FIRE AVOIDANCE AND CONTAINMENT

4.1. General

- 4.1.1 This section is not a stand-alone document. It shall be used in conjunction with TP 76200MP, TP 76301 and **BSP 800-005-200MP** (?).

4.2. Products

- 4.2.1 Only approved smoke and firestopping products, as specified in **BSP 800-005-200MP**, Appendix 1, shall be used.

4.3. Cable Openings

4.3.1 All openings in floors, fire rated walls and partitions shall be fire stopped to an equivalent structure fire rating, per [ATT-TP-76301](#). This includes openings for building-related services, house telephone equipment service, openings for power (AC and DC), and other cables.

4.4. Fire Suppression Systems

4.4.1 Fire suppression systems shall be placed in all AT&T IS non-central office spaces including commercially leased spaces.

4.4.2 Priority for Fire Suppressions Systems in locations requirement fire suppression is:

- a) FM-200 Fire Suppression System
- b) Pre-action dry pipe.
- c) Wet pipe

4.4.3 Fire suppression systems shall not be used in IS facilities collocated in AT&T Telco COs unless directed by the local Fire Marshall.

4.4.4 If fire suppressions systems are required in IS facilities collocated in AT&T Telco COs, "dry" systems shall be used.

5. BATTERY ROOM VENTILATION

5.1. General

5.1.1 In shared spaces, where batteries are not compartmentalized from other equipment, the DESP shall follow the most stringent of the following ventilation alternatives:

- a) One air change every four hours;
- b) Two cubic feet per minute per string;
- c) Twenty cubic feet per minute per person (when occupied);
- d) Applicable codes.

5.1.2 In separate battery rooms, an outside air ventilation of two cubic feet per minute per string is required with a minimum of one air change every twelve hours.

5.1.3 Battery room air shall not be exhausted through any other equipment or administrative space, but shall be exhausted directly outdoors away from any building intake.

6. SEISMIC AND OFFICE VIBRATION

6.1. General

6.1.1 The DESP shall verify that the equipment is engineered to meet the criteria presented in the following AT&T LEC Practices:

BSP 800-006-150MP, Auxiliary Framing and Bracing Requirements
BSP 800-006-151MP, Cable Rack Requirements
BSP 800-000-100MP, Hardware Products and Materials Specifications

BSP 800-000-101MP, Network Equipment Anchoring Requirements
BSP 800-000-102MP, Central Office Equipment Framework Design Requirements
BSP 800-068-150MP, Central Office Equipment Framework Support Requirements
BSP 800-000-104MP, Bracing Requirements For Network and Data Equipment On Raised Floor System

- 6.1.2 Equipment shall be engineered for the appropriate conditions of the site. All offices in Zones 3 and 4 shall be designed to high seismic risk requirements as detailed in each of the above referenced documents.
- 6.1.3 Low seismic risk requirements have incorporated minimum equipment securing measures required for all sites to reduce risks for equipment overturning or equipment walking due to building vibration, accidental impacts, unbalanced loads or other physical mishaps.
- 6.1.4 Only seismic Zone 4 approved equipment framework shall be used for network equipment in all AT&T offices. Approved seismic framework permits future reuse of equipment in any AT&T site with minimal difference in framework costs. Approved seismic framework also permits freestanding configuration installation in all AT&T sites as recommended in above referenced documents.

7. AIRBORNE CONTAMINANTS

7.1. General

- 7.1.1 CRE will assure that minimum building filtration of "65% ASHRAE dust spot rating" shall be provided. Some local regulations are more stringent and shall supersede this stated requirement, see [ATT-IS-812-000-003](#).

8. ILLUMINATION

8.1. General

- 8.1.1 Illumination measurements can be affected by light meter characteristics and accuracy, the way the meter is used, and by the arrangement of lighting equipment. Field measurements shall be made with a light meter that gives relative responses to light arriving from all hemispheres.
- 8.1.2 Excessive luminance (photometric brightness) differences within the field of view cause discomfort, fatigue, and reduced efficiency. The luminance of surfaces immediately adjacent to the visual task shall be at least one-third that of the task, and they shall not exceed the luminance of the task. For more remote surfaces (i.e., an adjacent frame, bay or cabinet), the luminance of any significant surface normally viewed directly shall be between one-third and five times the luminance of the task.

8.2. Equipment Lighting

- 8.2.1 Fluorescent lighting shall be used to illuminate equipment, power and maintenance areas. Equipment lighting for network equipment frames and equipment related work areas shall be appropriate for the performance of routine network administration functions. Lighting for the performance of detailed equipment installation and circuit/service management activity shall be provided by the use of portable light fixtures appropriate for the activity being performed. Unless

otherwise specified for a particular network element or technology, equipment lighting shall be provided above equipment maintenance (front) aisles only.

- 8.2.2 In all new installations, T8 fluorescent lamps and electronic ballasts shall be used in equipment and operating areas because of their relatively high light output per watt. Fluorescent lamps with the most color correct rating shall be used (i.e., do not use pink, blue or other tinted lamps).
- 8.2.3 For equipment areas with overhead racking and raised floor cooling one of the lighting systems listed below shall be used:
- a) Airey-Thompson. See Common Systems [Minor Materials List](#) for ordering information.
 - b) H.E. Williams, Inc. [See Figure 6 – 1](#) for installation and ordering information.
- 8.2.4 For equipment areas with overhead HVAC cooling, LumiCool lighting fixtures shall be used. LumiCool fixtures include air diffusers. Reference [ATT-TP-76202](#) for engineering and installation details for the LumiCool fixture.
- 8.2.5 Minimum levels of illumination shall be maintained in equipment areas. New lighting systems shall provide initial illumination levels as least 25 percent higher (to account for losses due to lamp lumen depreciation and dirt accumulation in the lighting system), but no more than 50 percent higher than the levels listed in Table 6-3, "Maintained" column. Typically a fixture with a single 32W florescent lamp placed in a continuous line down the center of the maintenance aisle at approximately 7'4" height will provide adequate lighting. If dual lamp fixtures are used in the maintenance aisle, fixtures shall be 4' and spacing between fixtures shall not exceed 4'.
- 8.2.6 Low intensity lighting shall be provided as required on an individual office basis. Typically, low intensity equipment lighting practices shall be used in all equipment areas larger than 2000 ft.2 and where multiple equipment areas are contained on a single floor. Low intensity lighting consists of assigning the end fixtures of alternating rows of equipment lighting to a separate circuit and control switch so that a person can pass through an equipment area without having to turn on all of the equipment lineup lighting fixtures.
- 8.2.7 High-intensity lights in each equipment aisle are to be controlled by a switch designated for that aisle. In small offices all lighting can be switched at a single location.
- 8.2.8 Motion detector lighting controls (infrared technology) shall only be used in AT&T IS offices where special circumstances dictate their use (e.g., some collocation spaces). Typically, one motion detector should be used for every 30 feet of aisle space and connected in series with the light switch. Economic studies show that the pay back rate for motion detector equipment investments is typically 3 to 5 years or longer.
- 8.2.9 Light fixtures shall not be placed directly over batteries.
- 8.2.10 Additional frame and aisle lighting requirements are given in Section 8 of [ATT-TP-76401](#).
Illumination

8.3. Building Lighting

- 8.3.1 General building lighting for AT&T IS offices is provided by Corporate Real Estate.
- 8.3.2 Additional information may be found in [ATT-800-003-100](#).

9. EMERGENCY LIGHTING

9.1. General

9.1.1 General building lighting for AT&T IS offices is provided by Corporate Real Estate.

9.1.2 Additional information may be found in [ATT- 800-003-100](#).

TABLE 6-1 – SUMMARY OF CHANGES IN SECTION 6

Change	Item in Previous Issue	Item in This Issue
Revised		
Deleted		
Added		8.2.3 b)

TABLE 6-2 – OPERATING TEMPERATURE & HUMIDITY LEVELS

Area	Normal Operating Ambient Average Temperature Range	Normal Operating Relative Humidity Range
Mission Critical Data Room ²	68°F - 75°F ¹	40 – 55%
IS Equipment Area	55°F - 78°F ¹	15 – 55%
Power Room with Batteries	55°F - 77°F	5 – 55%

1. [See NOTE for paragraph 2.1.2](#)
2. Raised floor cooling and backup HVAC systems

TABLE 6-3--MINIMUM MAINTAINED ILLUMINATION LEVELS

AREA	LEVEL (Maintained) (FOOT CANDLES)
EQUIPMENT FRAME AREA Front/Maintenance aisle Rear/Wiring aisle - general (Use portable lighting units during maintenance) Wiring aisle - behind equipment designated as requiring rear aisle lighting	15 (Note 1) No design level 15 (Note 1)
DISTRIBUTING FRAME AREA Maintenance aisle Wiring aisle	20 (Note 1) 10 (Note 1)
POWER AND BATTERY AREAS Aisles and open spaces AC switchboards and DC Battery Distribution Boards (BDB)'s (Measure at center of board)	30 (Note 2) 20
CABLE ENTRANCE AREA Aisles and open spaces (Use portable lighting units during maintenance)	5 (Note 2)
CONTROL, TEST, AND MAINTENANCE AREAS Control center or test frame (measure on shelf) Print display board (measure at center of board) Desk top (measure on writing surface) Computers	50 50 50-70 20-30

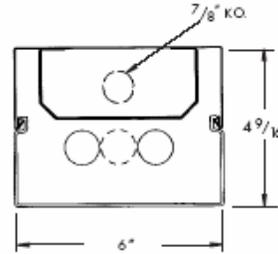
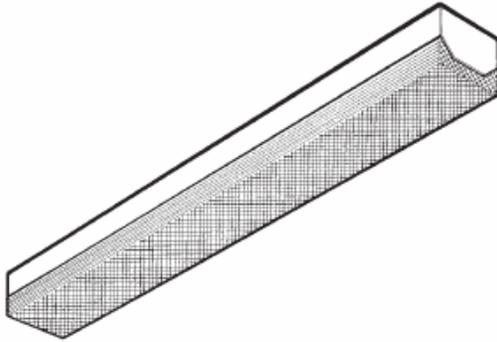
NOTES: 1. Measure illumination on vertical equipment surface 30 inches above floor with meter aimed across aisle. Do not allow shadows to fall on light sensitive cell.

2. Measure illumination in aisle center, five feet above floor, with meter aimed upward.

FIGURE 6 – 1, WILLIAMS LIGHTING SYSTEM

CEILING OR WALL MOUNT WRAP AROUND

SERIES **20**



VOLTA GE TYPE JOB _____

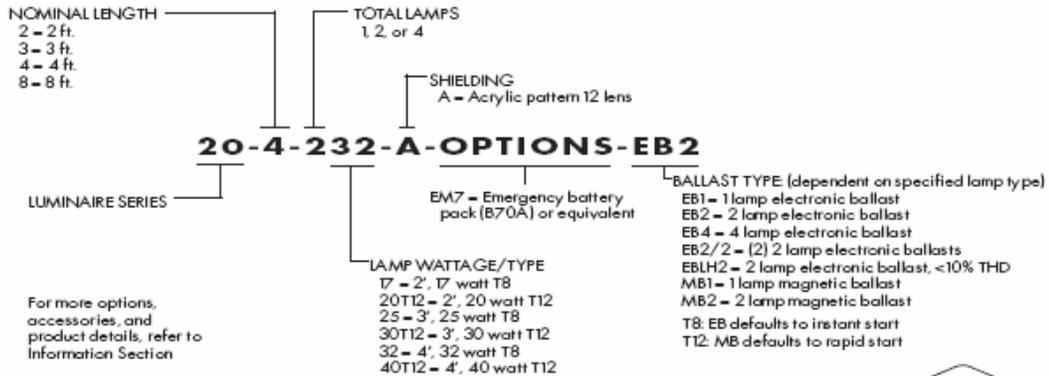
SPECIFICATIONS

- HOUSING – 22 Ga. die formed C.R.S.
- SHIELDING – clear acrylic prismatic diffuser
- FINISH – white powder coating with 5 stage iron/phosphate prepared metal. 92% minimum average reflectance
- ELECTRICAL – electronic ballast standard, (where available) rated Class P
- LABELS – UL listed as fluorescent fixture suitable for dry or damp locations. CUL listing for Canada available – consult factory
- MOUNTING – surface or suspended

FEATURES

- Diffuser provides uniform distribution and low brightness side illumination
- Continuous diffuser support system along luminaire sides
- Universal lamp bracket allows for field conversion from 1 to 2 lamps (or 2 to 1)
- 7/8" K.O. in ends for continuous row mounting
- Wireway is accessible without the use of tools
- Ballast secured by 2 captive bolts and nuts to ensure a tight, reliable fit for maximum heat dissipation and minimal ballast noise
- All parts painted after fabrication to facilitate installation, increase efficiency, and inhibit rusting

SUBMITTAL INFORMATION



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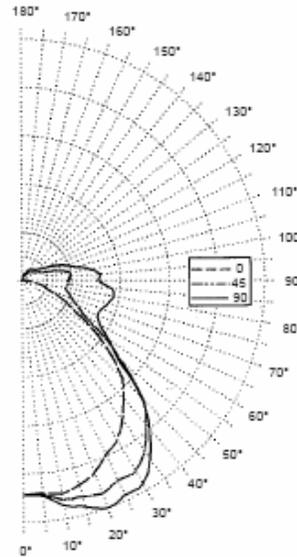
PHOTOMETRY INFORMATION

Williams Catalog #20-4-232-A-EB2-120
Test Report #9966.0, Dated 7/23/98

Lamp Type: F32T8/SPX35/RS
Lamp Quantity: 2

CANDLEPOWER DISTRIBUTION

VERT. ANG.	HORIZONTAL ANGLE			ZONAL LUMENS
	0	45	90	
0	1207.	1207.	1207.	
5	1199.	1207.	1216.	115.2
15	1187.	1256.	1313.	355.0
25	1081.	1237.	1329.	565.0
35	959.	1168.	1223.	709.7
45	781.	940.	937.	700.1
55	478.	556.	586.	486.5
65	256.	341.	460.	345.7
75	130.	266.	492.	303.6
85	43.	256.	497.	290.2
90	22.	256.	424.	
95	11.	266.	435.	263.2
105	9.	226.	314.	204.3
115	0.	114.	207.	117.0
125	0.	81.	119.	64.9
135	0.	66.	90.	44.7
145	0.	57.	81.	32.1
155	0.	39.	54.	16.2
165	0.	30.	39.	6.1
175	0.	0.	0.	0
180	0.	0.	0.	



LUMEN SUMMARY

ZONE	LUMENS	% LAMP	% FIXTURE
0 - 30	1035.	17.5	22.4
0 - 40	1745.	29.6	37.8
0 - 60	2932.	49.7	63.5
0 - 90	3871.	65.6	83.8
90 - 120	585.	9.9	12.7
90 - 130	649.	11.0	14.1
90 - 150	726.	12.3	15.7
90 - 180	749.	12.7	16.2
Total Luminaire			
0 - 180	4620.	78.3	100.0

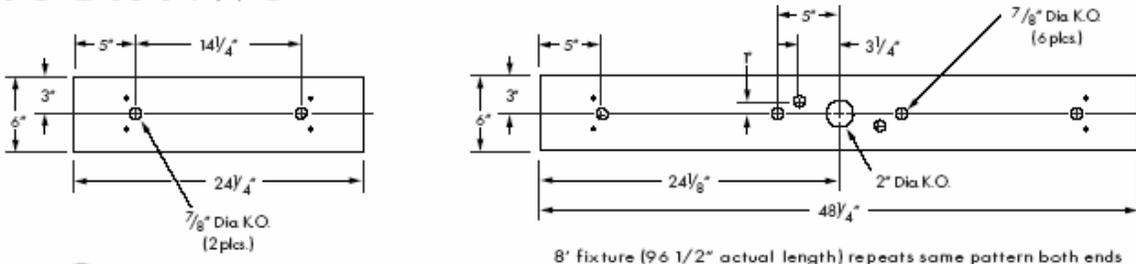
ZONAL CAVITY COEFFICIENTS

EFFECTIVE FLOOR CAVITY REFL = .20

CEILING WALL RCR	.80			.70			.50		
	.70	.50	.30	.70	.50	.30	.50	.30	.10
0	90	90	90	87	87	87	80	80	80
1	82	78	74	78	75	71	69	66	64
2	74	68	63	71	65	61	61	57	53
3	68	60	54	65	58	52	54	49	45
4	63	54	47	60	52	46	48	43	39
5	58	48	41	55	46	40	43	38	34
6	53	43	36	51	42	35	39	33	29
7	49	39	32	47	37	31	35	30	26
8	45	35	28	43	34	28	32	26	22
9	42	31	25	40	30	24	28	23	19
10	39	28	22	37	27	22	26	21	17

TOTAL LUMINAIRE OPTICAL EFFICIENCY = 78.3 %
SPACING CRITERIA: ACROSS=1.5 ALONG=1.3

MOUNTING



hewilliams inc • carthage missouri • www.hew.com • 417-358-4065 • fax: 417-358-6015
JP42826 04/02

[END OF SECTION]

SECTION 7 - WIRE, CABLE and FIBER REQUIREMENTS

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1. GENERAL

1.1. Introduction

1.1.1 This section covers the requirements for engineering switchboard cable, AC wiring, DC power cable, ribbon cable, coaxial cable, treatment of loose wires and the requirements for coaxial, ABAM, and terminal type connections.

1.1.2 Changes in this issue of Section 7 are summarized in Table 7-1.

1.2. Cable Holes

1.2.1 The addition of new cable hole penetrations shall be coordinated with the Equipment Engineer

1.2.2 Work items shall be included to ensure that all cable holes, sleeves and slots are properly closed and permanently fire stopped per ATT-812-000-032.

1.3. Cable Routing

1.3.1 The Design Engineering shall provide for cost effective cable routing, minimal number of cable holes, and minimal number, length and size of cable. Specific applications may require diverse routing and/or unique construction. In order to provide efficient and effective cable routing the DESIGN ENGINEER shall:

- a) Avoid blocked routes and cable rack overloading when determining routes for cabling operations;
- b) Provide the most direct available route;
- c) Select cable type to minimize the number of cables required;
- d) Provide the minimal required length and sized cable.

1.3.2 If specified by the equipment manufacturer or the Equipment Engineer, power and switchboard cables shall be run on separate cable racks. Unless otherwise specific by the Equipment Engineer, power cable shall not be run on panned switch rack.

1.4. Cable Securing and Bundling

NOTE: The requirements in this section are installation requirements and will be removed from TP 76401 when TP 76301, IS Installation Requirements is published.

1.4.1 Under no circumstances shall cable ties deform the cable sheathing.

1.4.2 When cables are bundled, bundling shall facilitate cable management and cable identification and shall meet all cable installation requirements, including minimum cable bend radius.

1.4.3 Cable bundles shall not be greater than 1 ½" diameter or 4 ¾" circumference. Bend radius, support, identification, management.....

1.4.4 Hook and loop tape (e.g. Velcro tie wrap)

- a) Hook and loop tape may be used at IS locations to bundle all braided coaxial cable; 100 to 600 MHz ohm unshielded, 4-8 pair conductor, twisted pair; Shielded ScTP 100 - 600 MHz ohm 4-8 conductor, screen twisted pair, STP 100 - 600 MHz ohm 4 - 8 pair conductor, shielded twisted pair, 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 minimum of one half of bundle diameter.

1.4.5 Coaxial Cables

- a) Hardline coaxial cable shall only be secured with approved metal tape (e.g straps).
- b) Coax cables in panned horizontal inter-rack trays and horizontal cross-aisle cable racks with cable horns shall not be secured.
- c) Coaxial cable runs in cabinets shall be secured with hook and loop tape.
- d) 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 should be placed no further than every 18 inches.
- e) Coaxial cables in unsupported vertical runs shall be bundled with hook and loop tape a minimum of every 8 inches.
- f) No coaxial cable shall be unsupported for greater than 30 vertical inches except when installed in conduit.
- g) Where it waterfalls off the cable rack, coaxial cable shall be secured using an approved sweep with hook and loop ties when possible. When a sweep cannot be used, cable shall be secured with waxed cord and sheet fiber.
- h) Coaxial cables on unpanned cable racks without horns shall be secured by either 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.
- i) Only hook and loop tape shall be used to bundle coaxial cables.
- j) Adjacent cable bundles may be fastened together with overall Hook and Loop tape.
- k) 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.

1.4.6 AC Power Cords in Equipment Cabinets

- a) Hook and loop tape or nylon tie wraps shall be used to secure and bundle all power cords in IS cabinets.
- b) Hook and Loop cable ties shall not be used under raised floors. Waxed cord or plenum rated nylon cable ties shall be used in this application.

2. SWITCHBOARD CABLING

2.1. General

2.1.1 Switchboard cable shall not be routed on dedicated power cable racks unless directly associated with power circuits.

2.1.2 Switchboard cable shall not be routed on fiber cable racks or raceways.

2.2. Common Items

2.2.1 When the equipment manufacturer provides a cabling method, that method shall be utilized.

2.2.2 All switchboard cable, connectorized cable, and cross connection wire shall be insulated tinned copper. Untinned wire is not approved for use in the AT&T IS equipment environment except for TIA/EIA categorized cables (TIA/EIA Standard 568B).

2.3. Relay Racks

2.3.1 The leads from one cable may be formed over one or more groups of mounting plates or relay rack units, but shall not be spread over more than one relay rack bay.

3. AC WIRING REQUIREMENTS

3.1. General

3.1.1 Working Space around all newly placed AC panels and serving equipment shall comply with the NEC, Article 110.26, Spaces About Electrical Equipment.

3.1.2 All wiring and conduit installed in the Non-Regulated/Non-Utility work space shall meet the requirements of the National Electrical Code (NEC),

3.1.3 AC feeders in Non-Regulated/Non-Utility equipment areas (including power rooms) shall be enclosed in rigid conduit (RMC), intermediate metallic conduit (IMC), electric metallic tubing (EMT), bus duct or metallic raceway. If EMT is used steel fittings shall be used.

3.1.4 Flexible metal conduit (FMC) or Liquidtight Flexible Metal Conduit (LFMC) may be used between the power trough and the power strip or between the PDU and the equipment being served.

3.1.5 All conduit raceways, regardless of the type, shall have an Equipment Grounding Conductor installed with the feeder or branch circuit conductors. Minimum size Equipment Grounding Conductors for raceway and equipment shall comply with Table 250.122 in the NEC.

3.1.6 AC branch circuit conductors may be enclosed in non-flexible metallic conduit or raceway, Flexible Metal Conduit (FMC), or Liquidtight Flexible Metal Conduit (LFMC) where conduit is not practical.

3.1.7 Liquidtight Flexible Metal Conduit shall be secured to the side of cable rack stringers, auxiliary framing or cable brackets over equipment areas or placed on a separate primary power distribution cable rack segregated from DC power cables, except where prohibited by state or local codes.

3.1.8 Type DP AC power cords shall be used to extend power from AC outlets located under raised floors to all AT&T Internet Services equipment, outlet strips or power distribution systems (PDUs)."

4. DC POWER CABLE AND WIRE

4.1. Approved Cable

4.1.1 All DC power cable (750 kcmil - 14 AWG single conductor, stranded or flex) shall be of the type approved by AT&T for the specified application as listed on the Minor Materials List (MML). Coated or tinned power cable shall be utilized, unless otherwise specified and approved by AT&T. Run all leads in continuous lengths unless it is necessary to reduce cable size at the equipment ends.

4.1.2 Previously installed power wire and cable shall not be reused. If it has been removed, relocated, or otherwise reconfigured following its initial placement.

4.1.3 When the equipment manufacturer provides a cabling method, that cabling method shall be utilized.

4.1.4 Currently approved stranded DC power cables for use are listed on the MML posted on the Common Systems Extranet Web Site.

4.1.5 Flexible DC power cables listed on the MML are approved for limited use as follows:

- a) Where sharp bends are necessary;
- b) Within battery systems and rectifiers;
- c) Where equipment is subjected to shock and vibration.

4.2. Battery and Battery Return Leads

4.2.1 The battery and battery return leads are a pair and shall be run closely coupled.

4.2.2 The battery return leads shall be approximately the length of its associated battery lead. Exception: When the primary battery return lead is required to pass through the ground window, the battery return lead may be run separately.

4.2.3 Primary battery and battery return leads shall be run on unpanned dedicated power cable rack.

4.2.4 Secondary power leads shall be run on existing, dedicated secondary power cable racks, whenever possible. If dedicated cable rack is not available, secondary power leads shall be run on existing non-dedicated cable rack utilizing compartment horns.

4.2.5 Unfused battery conductors and their accompanying battery return leads, such as those between the batteries and power boards, shall not be run on racks with other conductors. The rack shall be labeled accordingly.

4.2.6 Unfused battery conductors between the batteries and power board shall have properly sized, redundant leads to allow routine battery maintenance.

4.3. Vertical Power Cable Runs

4.3.1 Vertical power cable runs shall be made on cable racks no greater than 20" wide and should not exceed an ultimate pileup or accumulation of 7".

- 4.3.2 Vertical power cable runs of three or more floors without intermediate 20 foot horizontal runs or loops require one clamp (cable brake) per floor. No clamps are required when power cable runs are one or two floors.

5. RIBBON CABLE

5.1. General

- 5.1.1 Ribbon cable shall not be run on cable rack. Panduit type plastic trough (or equivalent) shall be provided for interbay installation.

6. COAXIAL CABLE

6.1. General

- 6.1.1 Waveguides and coaxial cables shall be routed outside the perimeter of the isolated bonding network, unless the cables are terminated within the isolated bonding network.
- 6.1.2 Coaxial cables used under raised floors shall be plenum fire rated.
- 6.1.3 Only 735C and 734C coaxial cables, with a UL-flammability rating of CMR, are approved for use in AT&T's network per ATT-E-00067-E note 12. These cables are limited to the transport of DS3 and STS-1 signals.
- 6.1.4 Coaxial cables used for DS3 shall be 75 ohm impedance with a single tinned copper shielded braid.
- 6.1.5 When 734 and 735 type soft dielectric coax cable is terminated, clear heat shrink is NOT required.
- 6.1.6 The following coaxial cables are intended to transport SMPTE 259M and 292M signals whose frequencies range between 5 MHz and 1.5 GHz as well as satellite L-Band signals whose frequencies range between 950 MHz and 1.45 GHz: 1855A Sub-Miniature type, 23 AWG center conductor; 1505A RG-59/U type, 20 AWG center conductor; and 1694A Low-Loss Serial Digital Coax type, 18 AWG center conductor. These cables are all UL-flammability rated as CMR.

7. SHIELDED CABLE

7.1. General

- 7.1.1 Only shielded cable approved by AT&T Common Systems shall be used whether ordered by AT&TIS or the installation vendor.
- 7.1.2 All cables used for DS1 shall be shielded and sized according to length, except jumpers, which do not need to be shielded.
- 7.1.3 Shielded cable shall be used when recommended by equipment manufacturer or when EMI issues are of concern.
- 7.1.4 Shielding requirements for timing cable can be found in Section 11.

8. CONNECTIONS

8.1. DC Circuits

8.1.1 DC power lead mechanical connections (e.g., thread pressure type, spring-pressure, etc.) shall not be used. Reuse equipment shall be updated to replace all mechanical connections.

8.1.2 Compression connections for DC power shall be installed in accordance with the Section 12 of TP 76401.

8.2. AC Circuits

8.2.1 All AC connections shall be made in accordance with the NEC.

8.2.2 Wire nuts (UL94-V1 or better) shall be used only for AC circuits installed in a metallic enclosure.

8.3. Coaxial Connections

8.3.1 Coaxial cable connections shall be 75 ohm.

8.4. Terminal Type Connectors (#10 AWG and Smaller)

8.4.1 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, such as the T&B STA-KON, Burndy VINYLUG, Lucent Technologies WP91412 or Panduit nylon insulated.

8.4.2 Ring terminal type connectors except #24 and #26 gauge shall be NRTL listed, and made of tin plated copper, having a welded seam and an insulated barrel.

8.4.3 Use the following color coded terminals for the following size wire:

Wire Size	Terminal Color
#26-#24 *	Yellow/Amber
#22-#18	Red
#16-#14	Blue
#12-#10	Yellow

*Not NRTL rated or listed

9. FIBER

9.1. Fiber Patch Cords and Cable

9.1.1 The DESIGN ENGINEER shall use only AT&T approved fiber patch cords and fiber cable shown in ATT-E-00136-E notes 9, 11, 12 and 15.

TABLE 7-1 – SUMMARY OF CHANGES IN SECTION 7

Change	Item in This Issue	Date
Revised	1.4	5/19/06
Deleted		
Added		

[END OF SECTION]

SECTION 8--CABLE RACK, AUXILIARY FRAMING AND LIGHTING SYSTEMS

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1. CABLE RACK

1.1. General

1.1.1 This section covers apparatus requirements for cable racks in Information Systems Equipment (ISE) areas. Changes in this issue of Section 8 are summarized in Table 8-1.

1.1.2 [ATT-TP-76409](#) provides additional network cable rack requirements.

1.1.3 Anchoring requirements shall be in accordance with [BSP 800-000-101MP](#).

1.1.4 Engineering of cable rack supports shall conform to the seismic risk level of the specific office,

1.1.5 Self-drilling anchors shall not be used to secure ironwork to ceilings under any circumstances.

1.2. Description and Sizes

1.2.1 All new installations of cable racks shall:

- a) be solid stringer (outside dimension of 2 inches by 3/8 inch) ladder-type in network equipment areas.
 - b) be 1-inch by 1/2-inch channel spaced on 9 inch centers and shall be welded to the stringers.
 - c) have first, last, and each alternate strap of the cable racks wider than 24-inches reinforced with a welded 1 x 1/4-inch bar.
- 1.2.2 Cable rack shall have a non-corrosive plated or painted finish.
- 1.2.3 Cable rack assembly hardware, including bolts, studs, threaded rods, nuts, washers, clips, clamps and similar material shall have a non-corrosive plated finish. Refer to [ATT-TP-76201](#) for on approved painted and electroplated finishes.
- 1.2.4 Bolt-on cable horn brackets, when used, shall be located on alternate straps of the cable rack and spaced no more than 18 inches apart. At crossing points and points where cables drop off the racks, it may be necessary to locate additional brackets to add protection for the cable.
- a) Brackets are used on cross-straps to separate single runs of cable on a wide rack;
 - b) The double bracket is provided for use on five inch cable rack.
 - c) The height of the cable horn shall not exceed the cable rack's maximum allowable cable pile up per Section J of [ATT-TP-76301](#) (expected publish date 3Q06).
- 1.2.5 Cable rack pans shall not be extended through a fire rated wall.
- 1.2.6 Metal is the only approved material that shall be used for cable rack pans.
- 1.2.7 Cable rack panning shall be provided in sufficient width to cover the cable rack without the need for multiple pans.
- 1.2.8 Cable rack with welded-on uprights (horns) shall not be provided.
- 1.2.9 Cable supporting brackets may be used for limited applications of dedicated cable runs.
- 1.3. Location**
- 1.3.1 The location of a cable rack shall be such that the clearances required for installation and maintenance of the ultimate equipment arrangement will be maintained.
- 1.3.2 Cable racking above new equipment areas shall be arranged as indicated in figures 8-18 to 8-21 depending on how BDFBs installed in the new area will be cabled.
- 1.3.3 A cable rack shall not be located close to pipes, radiators, windows, doors, or any other equipment that may subject the cabling to detrimental conditions.
- 1.4. Engineering Requirements**
- 1.4.1 Cable rack load limitations as stated in [ATT-TP-76409](#) be considered when engineering new cable racks or when additional cables are added to an existing cable rack.
- 1.4.2 Cable racks shall not be supported from the cross-straps.
- 1.4.3 Horizontal cable rack should be supported on five foot centers, and the spacing between supports shall not exceed six feet.
- 1.4.4 Cable rack support shall be provided within 30 inches of the free end of a cable rack.

- 1.4.5 Adjustable cable rack stringer connectors or friction splices may be used
- 1.4.6 Permissible pile-up of switchboard cabling on cable racks for normal and maximum spacing of supports is shown in Tables A and B [ATT-TP-76409](#).
- 1.4.7 Vertical switchboard cable runs shall not exceed an ultimate pile-up of 12 inches for switchboard cable racks or 7 inches for power cable racks. To provide the space required to properly close and fire stop a cable hole, the pile-up on all vertical racks shall be additionally limited so that the cable is not closer than 3 inches to the face of the cable hole. .
- 1.4.8 The Design Engineer shall engineer all cable mining activities to comply with [ATT-TP-76301](#), Section Q.
- 1.4.9 The maximum width of horizontal and vertical dedicated power cable racks shall be limited to 1 foot 8 inches
- 1.4.10 Safe loads for steel beam clamps, ceiling inserts, threaded rods, and lag screws, for the purpose of determining the spacing of supports other than normal are shown in Table C of [ATT-TP-76409](#).
- 1.4.11 Cable leaving the cable rack shall not be unsupported for a distance greater than three feet for equipment bays and four feet for conventional distributing frames. For 2/0 or larger power cable, the unsupported distance shall not exceed three feet.
- 1.4.12 To protect cabling at T-intersections of bar-type cable rack and cross-aisle rack, finishing caps shall be provided for the ends of all cross-straps that project within the T-intersection area as shown in [ATT-TP-76409](#).
- 1.4.13 Clamping details used for junctions of ladder-type cable racks are shown in [ATT-TP-76409](#). Where separation of metallic continuity is required, fiber insulation shall be provided.
- 1.4.14 Sections of ladder-type cable rack shall be assembled so that support for the cabling is provided every nine inches. At turns or junctions, in vertical or inverted horizontal cable runs, where the turn of the cables is such that proper support is not provided for the cables, 1/8 inch by 1 inch flat bar shall be placed diagonally across the rack in a manner to provide proper support for the cables.
- 1.4.15 The longest length of sections, and the fewest parts practical, shall be provided. No more than one splice shall be placed between any two adjacent points of support on horizontal runs. Each cable rack section shall have at least one point of support. Cable rack splices shall not be construed as support. A splice shall not be used beyond the last point of support when the end of a rack extends in cantilever fashion.
- 1.4.16 Ladder-type cross-aisle cable racks may be installed at the same height as the ladder-type over-frame rack. Consideration shall be given to clear lighting conduit or other obstructions. Continuous runs of ladder-type cross-aisle cable racks fastened above and across, over-frame cable rack with J-bolt fastenings, are permitted for addition to existing office configurations only and where ceiling heights are favorable.
- 1.4.17 Power distribution cables and grounding conductors, when carried in main or end aisle and where intermediate frames are omitted in frame line-ups, shall be supported from the main or end aisle

cable rack stringers by means of power cable support brackets. Where there are no main or end aisle cable racks, the cables shall be supported from auxiliary framing by means of power cable support brackets. In all applications, brackets shall be placed at a maximum interval of 18 inches.

- 1.4.18 The open ended sections of ladder-type cable rack shall be protected with an approved finishing cap.

1.5. Support of Cable Rack

- 1.5.1 Cable racks shall be supported by high- or low-type framing, other cable rack, threaded rods, floor-mounted pipe stanchions, and approved wall or ceiling mounted brackets.
- 1.5.2 Ceiling hanger suspended auxiliary framing shall be provided to support cable racks over equipment frames. Where ceiling hangers cannot be provided because of ceiling inadequacies or access problems, the cable rack may be supported from building floor by floor stanchions or equipment framework. In Zone 4 areas, floor stanchion supported cable rack shall conform to requirements of BSP 800-006-152. Circular pipe stands may be used in place of square tube floor stanchions for support of overhead cable rack in non-Zone 4 areas.
- 1.5.3 For cabinet supported cable rack, see requirements in [Section 5](#) of this document.
- 1.5.2 In low seismic risk locations both stringers shall be bolted at each end of the run and only one bolt is required at intermediate supports on alternate sides of the rack.
- 1.5.3 In high seismic risk locations, both stringers shall be bolted at every support.
- 1.5.4 Splicing of threaded rods should be avoided. When splicing is necessary, there shall be no more than one splice per rod. In no case shall splicing be done on threaded rod used to support mezzanine platforms.
- 1.5.5 Split nuts shall not be used to extend or add framing to existing threaded rods.
- 1.5.6 Vertical cable rack used to support cables in shafts shall be supported at each floor and ceiling level at the cable rack supporting framework.
- 1.5.7 Extended vertical runs of power cable rack, in excess of three floors, must have a minimum of 20 foot horizontal cable rack provided on every third floor to alleviate cable weight build-up.

2. AUXILIARY FRAMING

2.1. General

- 2.1.1 This section discusses the engineering of auxiliary framing.
- 2.1.2 Auxiliary framing above new equipment areas shall be arranged as indicated in figures 8-18 to 8-21 depending on how BDFBs installed in the new area will be cabled.
- 2.1.3 The following Bell Service Practices provide additional information on auxiliary framing and bracing requirements
[ATT-TP-76408](#) "Common Systems Network Facility Auxiliary Framing and Bracing Requirements"
[BSP 800-000-101MP](#) " Network Equipment Anchoring Requirements"
- 2.1.4 Auxiliary framing shall be provided in longest sections and largest increments possible to minimize splice joints and provide greatest continuity in performance. In high risk seismic offices,

minimum auxiliary frame installations should cover a building bay area for consistent bracing requirements.

- 2.1.5 Splices of horizontal runs of auxiliary framing shall be staggered at alternate runs and limited to no more than one splice between supports.
- 2.1.6 Primary auxiliary framing is the framing installed perpendicular to present or planned equipment frame lineups. This auxiliary framing serves as the primary means of support for office cable racks, equipment lighting and equipment frames within the equipment area.
- 2.1.7 Secondary auxiliary framing (sometimes referred to as supplemental framing) is framing installed above and perpendicular to the primary framing for seismic stiffening and supplemental cable rack support purposes. Secondary framing is generally a permanent component of the office auxiliary framing (superstructure) arrangement.
- 2.1.8 Auxiliary framing and auxiliary framing components shall be a non-corrosive plated type or painted. All assembly and securing hardware, including bolts, studs, threaded rods, nuts, washers, clips, clamps and similar material shall be non-corrosive plated type. Refer to [ATT-TP-76201](#) for specifications on approved painted and electroplated finishes.
- 2.1.9 The protruding ends of lower level auxiliary framing shall be protected with an approved finishing cap

2.2. Support Requirements

- 2.2.1 Where one or more additional row of frames is to be ultimately installed, the auxiliary framing shall be extended to allow for ultimate cable rack, ladder track, or lighting conduit.
- 2.2.2 In the placing of auxiliary framing a minimum clearance of 5 inches shall be maintained between the ends of the framing bars or channels and any building obstruction.
- 2.2.3 Locating the auxiliary framing under ceiling inserts will facilitate supporting the framing structure where frames are omitted. By locating alternate lines or sets of auxiliary framing immediately under the ceiling inserts, the auxiliary framing and cable rack can be temporarily supported by means of hanger rods.
- 2.2.4 Splicing of threaded rods should be avoided. When splicing is necessary, there shall be no more than one splice per rod. In no case shall splicing be done on threaded rod used to support mezzanine platforms.
- 2.2.5 Split nuts shall not be used to extend or add framing to existing threaded rods.
- 2.2.6 Auxiliary framing at the ends of frame line-up shall be located so that the distance between the end of the line-up and the last point of support will not exceed 2 feet 6 inches.
- 2.2.7 Frames and bays bolted together and supported from overhead to form, a continuous lineup shall have a top support approximately every 5 feet not to exceed 6 feet. Top support shall be understood to mean fastening with approved hardware to bars, channel or cable rack, independent of the frame itself, which are so constructed as to maintain the top positioning of the frame. Junction hardware between frames shall not be considered as top support. Cabinets and frameworks designed to be floor supported do not require top support

- 2.2.8 Physically isolated frames that normally require overhead bracing must be provided with two top supports. Isolated frames shall be understood to mean frames which cannot be fastened to adjacent frames with junction hardware.
- 2.2.9 In general, regular auxiliary framing shall not be placed over main or end aisles except as required for support of ladder track. Where support of main or end aisle cable racks extending into or across aisles is required, the framing shall be arranged as indicated in the unit covering cable racks.
- 2.2.10 Seven foot frames shall not be secured to auxiliary framing, except when adding to an existing line-up that is top supported.
- 2.2.11 Auxiliary framing over power boards shall be installed only where required for the support of bus bars or a cable rack above the power board.

2.3. Bracing

- 2.3.1 The entire auxiliary framing structure shall be braced in accordance with BSP 800-006-150MP.
- 2.3.2 Auxiliary framing shall be provided at cable holes and other openings in floors or walls as required to support the cable racks. Care shall be taken that framing will not interfere with the cabling at these openings.

3. CABLE DISTRIBUTION SYSTEMS

3.1. General

- 3.1.1 This section covers the equipment requirements for engineering of a system of cable racking called cable distribution systems.
- 3.1.2 For specific hardware and application information for cable distribution systems, refer to the manufacturer's documentation.
- 3.1.3 Cable distribution systems are a cable management system which provides a means for cable separation and are generally designed to attach to the top of six or seven foot equipment frames. Cable distribution systems may be independently mounted to allow for future frame growth.
- 3.1.4 Cable distribution systems may provide access between major like systems or unlike systems with proper hardware separation.
- 3.1.5 Cable distribution systems and assembly hardware shall be of a non-corrosive finish.

3.2. Applications

- 3.2.1 Cable distribution systems are provided over line-ups of equipment frames and are fastened to adjacent line-ups by cross-aisle racks, which are considered to provide a unitized top support for associated frames. Equipment frames which are bolted back to back and provided with cable distribution system are considered to be adequately supported.
- 3.2.2 Where frames are not provided under cable distribution systems, support stanchions shall be provided at five foot, not to exceed six foot intervals and at junctions of cable distribution system sections. Sufficient clearances shall be maintained to allow for future addition of frames. Support stanchions are not allowed in High Risk seismic zones (Seismic Zones 3 and 4).

- 3.2.3 Cable distribution systems shall be provided for the ultimate growth of an individual line-up whenever possible to allow for proper distribution of cabling and top support.
- 3.2.4 Cable distribution systems provide a completely or partially enclosed system for the running of unsecured cable. Cable separation within the cable distributions systems vary by design between manufacturers. Brackets, separators, or individual compartments may be used.
- 3.2.5 Where cable from cable distribution systems is run to common systems such as DF and power, gray ladder type cable rack and support shall be provided per applicable paragraphs of this Section 8.
- 3.2.6 Where cable distribution is part of an isolated bonding network, separation or insulating hardware shall be used between the two cabling systems

CAUTION - When cable distribution systems and associated equipment are located within the isolated bonding network, separation from all common bonding network members must be maintained.

- 3.2.7 Application of cable distribution systems shall take into consideration cable access to frames. Certain types of cable distribution systems limit access to high cable volume frames and may require cover removal or modification.
- 3.2.8 Cable distribution systems shall be designed in conformance with local seismic risk conditions.

3.3. Cable Distribution Systems for Fiber Optic Cable and Associated Equipment

- 3.3.1 Fiber optic tie cable/riser cable shall be run within its own dedicated rack or metallic conduit.
- 3.3.2 Fiber optic tie cable/riser slack shall be secured on dedicated fiber storage racking sized to accommodate minimum bending radius.
- 3.3.3 Fiber optic tie cable/riser slack shall not exceed 10 percent of total length of cable.
- 3.3.4 OSP Fiber optic cable service loops terminating to fiber distribution frame must maintain minimum bending radius.
- 3.3.5 OSP Fiber optic cable service loops terminating to fiber distribution frame should, where possible, be secured with lacing cord and be stored in the overhead rack. Where not possible cable must be secured and supported so as not to impede future installations.
- 3.3.6 Fiber optic patch cords/jumpers need to be installed in separate fiber protection system (FDF).
- 3.3.7 Fiber optic patch cord/jumper slack must not exceed 5 feet and shall be stored in vertical cable manager.
- 3.3.8 The use of innerduct shall not be used within the cable distribution system or between equipment lineups.
- 3.3.9 Refer to Section 9 of ATT-TP-76401 for equipment requirements for fiber optic cabling and its associated equipment, including: Fiber Splice Facilities (FSF), and the Fiber Distribution Frame (FDF). For specific hardware and application information for fiber protection systems, refer to the manufacturer's documentation.

3.4. Fiber Protection System(FPS)

- 3.4.1 The Fiber Protection System represents a separate and unique fiber optic protection system used only for fiber optic cross connect patch cords between Transmission and ISE equipment and the FDF. All equipment which uses fiber optic connectivity will hub to the FDF for all intraoffice connections. This protection system will provide both separation from all other cable racks and will provide a protection of the fiber optic patch cords from installation activity in a Central Office. As an additional means of providing fiber separation and protection from other types of cabling within the Central Office, The Fiber Protection System will also be identified by its own unique color which is yellow. **Note: The only color approved for use within the AT&T 13State region for Fiber Protection Systems is Yellow. No other color is approved for use.** The Protection System will provide routing capability for the SONET ring paths for both primary and protect connections from the Transport/Switch equipment to the FDF. The fiber pairs will be cross connected at the FDF to either OSP facilities or to other intraoffice equipment.
- 3.4.2 Diverse routing capability from the NE to the FDF for the primary and protect paths shall be required. Diverse routing may be accomplished in two ways: example 1) by placing working and protect fiber patch cords on opposite sides of the same physical raceway or example 2) by placing working and protect fiber patch cords in completely separate physical raceways. It is not necessary to add multiple raceways down the same line-up simply to achieve route diversity, thus a maximum of only one raceway path per lineup will be allowed. Route diversity will be achieved via main aisles not line-ups. Once a high speed Optical Carrier system such as OC-192, its equivalent or higher speed system has been placed in the central office, diverse routing for connections between the high speed Optical Carrier and the FDF shall be accomplished via example 2 listed above. Fiber diversity for Optical Carrier speeds less than OC-192 may be accomplished by example 1 or 2. Figures 8-22 through 8-27 provide examples of diverse fiber routing.
- 3.4.3 The FDF will be treated as the common cable entrance and cross-connect point. The Fiber Protection System will be the primary tool for fiber optic patch cords on each floor. When there is a need for a fiber optic connection to equipment on another floor or at a distant location on the same floor, a tie cable will be terminated in a shelf on the FDF and will be directly terminated on a new satellite FDF bay on that other floor or distant location using an FOT shelf. This will be accomplished in one of the following three methods:
- A) The preferred method is to place an outside plant fiber shelf with a pre-terminated and pre-connectorized cable stub in the existing FDF. An FOT shelf should be placed in the satellite frame and the pre-connectorized end should be terminated on the rear of the FOT shelf. The stub should be measured to the nearest exact length between the two shelves.

NOTE: In most cases, it is well advised to dedicate an entire bay for tie cables between the existing and the satellite FDF's.

- B) The preferred alternative to the above is to place an OSP fiber shelf with a pre-terminated and raw ended stub in the existing FDF. An FOT shelf should be placed in the satellite frame and the raw ended stub should be field mounted with the appropriate connectors and then terminated on the rear of the FOT shelf. The stub should be measured to the closest available length between the two frames.

- C) The following should be used only when absolutely necessary. Place an OSP fiber shelf equipped with a FLIP Splicing panel in the satellite FDF and a pre-terminated shelf in the existing FDF. Place the pre-terminated IFC cable measured to the closest appropriate length between the frames and splice the raw end at the FLIP panel.
 - D) All fiber optic cables terminating between Fiber Distributing Frames (FDF) or between Fiber Distributing Frames and Network Elements shall be required to utilize cable clamps and grommets to secure cables. Clamps and grommets shall be attached to the terminating shelf if there is 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.
- 3.4.1 Fiber Optic Cables (not to be confused with fiber optic patch cords or jumpers) shall not be placed in the raceway/duct work of the Fiber Protection System. Fiber Optic Cable placements within the Central Office will adhere to merged practice standards as outlined in [ATT-TP-76305](#).
 - 3.4.2 An approved Fiber Protection System (FPS) shall be used for fiber optic patch cords between the FDF and the equipment/network element. The FPS shall be dedicated for "fiber only" and clearly marked as such. The Fiber Protection System shall be provisioned along the entire length of the FDF and extended from the FDF to the associated network element.
 - 3.4.3 The Fiber Protection System will be provided to within 6 inches of the Fiber Distribution Frame (FDF) and located to the adjacent vertical trough and at the same level horizontally as the Transport/Switching Equipment termination point on the working and protect routes. Each bay in the FDF lineup should have a downspout positioned directly over its vertical troughs to within two inches of the top horizontal trough of the FDF.
 - 3.4.4 With the deployment of high capacity Optical Carrier systems such as OC-192 and higher, to the Fiber Distribution Frame, it is strongly recommended that any FDF that has the forecast to provision OC-192's within the next 5 years should have raceway routes from the Optical Multiplexers to the FDF provisioned with 12" wide Fiber Protection System troughs.
 - 3.4.5 The Fiber Protection System over the FDF shall have minimum 12" wide horizontal troughs and minimum 4" wide vertical troughs. Use of 2" FPS shall only be used when mounted inside cabinets.
 - 3.4.6 When placing 12" Fiber Protection system, if threaded rod supports are required, the installation vendor shall use 5/8" threaded rod only.
 - 3.4.7 Straight sections of 12" Fiber Protection System shall be supported on both sides of each junction within 6" to 12" of the junction. A maximum distance of 5' between supports shall be required
 - 3.4.8 12" Fiber Protection System fittings i.e. T's, elbows, crosses, downspouts etc., shall have support brackets placed directly beneath each fitting. If it is not possible to place the support bracket directly beneath the fitting then the support bracket shall be placed beneath the Fiber Protection System straight section as close to the fitting as possible.

- 3.4.9 When placing 12" Fiber Protection System fittings, whenever possible, support brackets shall be attached to the underside of the fitting with the self drilling screws supplied by the manufacturer. If support brackets cannot be attached to the underside of the fitting using the self drilling screws, then variable fitting support locators shall be used
- 3.4.10 Connectivity between the overhead Fiber Protection system (FPS) and C.O. network elements i.e. drop options, may be accomplished in one of two methods. Method 1 would be a Rigid arrangement and method two would be a Flex Tube (or corrugated split tube) arrangement. The overhead layout position of the FPS relative to the turndown and its position relative to the network elements uprights will determine which method or drop option should be used. In cases when the overhead FPS is positioned in such a manner as to allow the turndown to align directly with the network element bay uprights, the rigid drop option arrangement shall be used. In cases when the overhead FPS is positioned in such a manner that it does not allow the turndown to align directly with the network element bay uprights the Flex Tube drop option shall be used. Both Rigid and Flex Tube drop options can be configured using either Express Exits or Downspouts. Examples of the Rigid and Flex tube drop options can be found in **Figures 8-28** and **8-29** of this section. **Note: Spiral wrap shall no longer be used as a drop option method. Preferred method would be the rigid method.**
- 3.4.11 Do not permit cable buildup of fiber jumpers to exceed 2-inches in depth at any point within the Fiber Protection System. Fiber patch cords shall not be placed within the FPS with excessive slack or with a bend radius of two inches or less. Jumper slack shall not exceed 10'.
- 3.4.12 Fiber optic cross connect jumpers/patch cords between FDF panels (OSP-FOT), (FOT-FOT), (OSP-OSP) shall not be less than 6 feet and shall be ordered from an approved manufacturer.
- 3.4.13 Fiber cable shall not be placed in the Fiber Protection System (FPS).
- 3.4.14 Fiber cable shall be placed in/on its own dedicated fiber path and shall not be co-mingled with other types of cable. Dedicated fiber path shall be defined as either metallic conduit or yellow Optical Fiber Nonconductive Riser (OFNR) cable rack. In cases where space is limited and there is no room for dedicated fiber racking, cable rack horns that mount on the sides of cable racks and include an integral means of providing cable support/separation may be used where necessary for the support of fiber optic cabling. Such horns are generally referred to as compartment horns and shall be installed on racks no more than 9 inches apart.
- 3.4.15 On all new builds "L" brackets,"J" hooks, or cable rack horns shall not be used.
- 3.4.16 Factory connectorized cables are the standard, however, the use of Fusion Splices is acceptable. Testing and record keeping must be maintained per TP 76900.
- 3.4.17 For Fiber Protection System standards, refer to the **ATT-13STATE** Standard Drawing: ATT-C-50001-E-00.

4 FRAME AND AISLE LIGHTING - FLUORESCENT

4.1 General

- 4.1.1 Emergency lighting shall be battery backed-up (either integrated in the lighting fixture or provided via essential AC) or DC ballast powered by associated DC power plant.

- 4.1.2 This section outlines engineering requirements for framework supported lighting systems employing fluorescent fixtures. See [Section 6 of ATT-TP-76401](#) for emergency lighting and general building lighting.
- 4.1.3 In some cases, Processor Logic Control (PLC) systems fluorescent lighting is provided as an integral part of the equipment. In such cases, the manufacturer's specifications for lighting shall be followed.
- 4.1.4 All wiring, conduit and fixtures installed in Non-Regulate/Non-Utility locations shall meet the requirements of the National Electrical Code (NEC), local building code and shall be Listed.
- 4.1.5 For lumen levels see [Section 6 of ATT-TP-76401](#).
- 4.1.6 See the [Section 13 of ATT-TP-76401](#) for grounding of equipment in the conduit system.
- 4.1.7 AC lighting in battery, power and engine rooms shall utilize fixtures with protective covers that will reasonably prevent the dislodging or shattering of the light due to activity (e.g., "egg crate" grill or cage assemblies)..
- 4.1.8 All fluorescent light fixtures shall be equipped with positively fixed lamp guards.
- 4.1.9 Any 120 Volt AC branch circuit shall be as follows:
- a) 15 Ampere Fuse/ACB shall not exceed 1440 Watts;
 - b) 20 Ampere Fuse/ACB shall not exceed 1920 Watts.
- Electrical load for circuits supplying electrical load for fluorescent fixtures shall be calculated by multiplying the lamps wattage by 1.25 (this will compensate for the step up voltage transformer/ballast).
- 4.1.10 Typical arrangements shown on manufacturer's drawings may be varied to meet job requirements. Lighting fixture assemblies, other than those specified on the manufacturer's standard equipment drawings, shall be furnished only with the approval of the AT&T IS Implementation Engineer.

4.2. Engineering Requirements

- 4.2.1. The Design Engineer shall provide the installer specific work items for the placement of conduit, fixtures and switches for frame and aisle lighting
- 4.2.2. All equipment lighting apparatus including wire and electrical raceways shall be Listed.
- 4.2.3. Conduits should be securely fastened at 5'0" intervals, and shall not exceed 6'0".
- 4.2.4. Conduit shall not be run in locations normally occupied by auxiliary framing, cable racks, etc.
- 4.2.5. Conduit shall, where possible, be run parallel and adjacent to superstructure to assure maximum headroom and to provide easy access to cable racks.
- 4.2.6. Conduit shall not be run on cable racks.
- 4.2.7. All conduit and fittings shall be metallic..
- 4.2.8. The conduit system for a light fixture shall support only that fixture. The conduit fittings shall be steel. .

- 4.2.9. Lighting circuits supplied by multiphase service shall be assigned to balance the load on the different phases as closely as practicable.
- 4.2.10. Lighting equipment and convenience outlet circuits shall not be supplied by the same branch circuit.
- 4.2.11. Wiring for lighting equipment and convenience outlet circuits shall be run in the same conduit wherever possible.
- 4.2.12. Motor wiring shall be run in a separate conduit.
- 4.2.13. All fluorescent type lighting fixtures over equipment areas shall be rigidly attached and shall not be supported with chains.
- 4.2.14. Listed solderless connectors shall be used for making all splices in junction boxes and fixtures.
- 4.2.15. When 3-way switches for controlling equipment aisle fixtures are located in the endguard, the switches shall be located at each end of the aisle.
- 4.2.16. For aisles having an ultimate length of 15 feet or less, a single switch shall be used to control the aisle fixtures. This switch shall be mounted on the end toward the main cross-aisle. In cases where only one aisle fixture is required, this fixture shall be connected to the essential AC bus. If the line of frames is less than 15 feet, but it is to be extended at a later date, a 3-way switch shall be provided at the originating end. Initially, this switch is connected for single-pole operation, when the line-up is extended, another 3-way switch shall be provided for the growing end, and the switches shall be connected for 3-way operation.

5. CONVENIENCE OUTLETS AND MISCELLANEOUS CONDUIT

5.2. General

- 5.2.1. Convenience outlets will be provided as an integral part of the Non Regulated/Non-Utility installations.
- 5.2.2. All wiring and conduit installed in the Non Regulated/Non-Utility offices shall meet the requirements of the National Electrical Code (NEC), local code and shall be Listed.

5.3. Convenience Outlets

- 5.3.1. The Design Engineer shall provide the installer specific work items for placement of convenience outlets and risers.
- 5.3.2. Convenience outlets shall be furnished in accordance with the drawings associated with the equipment to be served. All Convenience outlets shall be NEMA 5-20R duplex receptacles.
- 5.3.3. Convenience outlet risers shall be located at the nongrowth end of partial lines of frames or at either end of frame gaps or complete lines.
- 5.3.4. 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. Conduit shall be run parallel to and between 6" and 10" from the lighting fixtures and shall be supported every 5 feet minimum.

- 5.3.5. Convenience outlets may be placed in the front and rear of bays / cabinets. Given load utilization variations the installer shall install no more than 10 duplex outlets per 15 ampere circuit breaker or 13 duplex outlets per 20ampere circuit breaker. Circuits shall be labeled at the electrical panel and on the face of the outlet cover with a mechanically printed label.
- 5.3.6. Convenience outlets located in bays shall be spaced every third bay, not to exceed 10 feet. A single or stand-alone frame shall have an outlet provided and placed in the base. When required, convenience outlets shall be placed in the front and rear of bays.

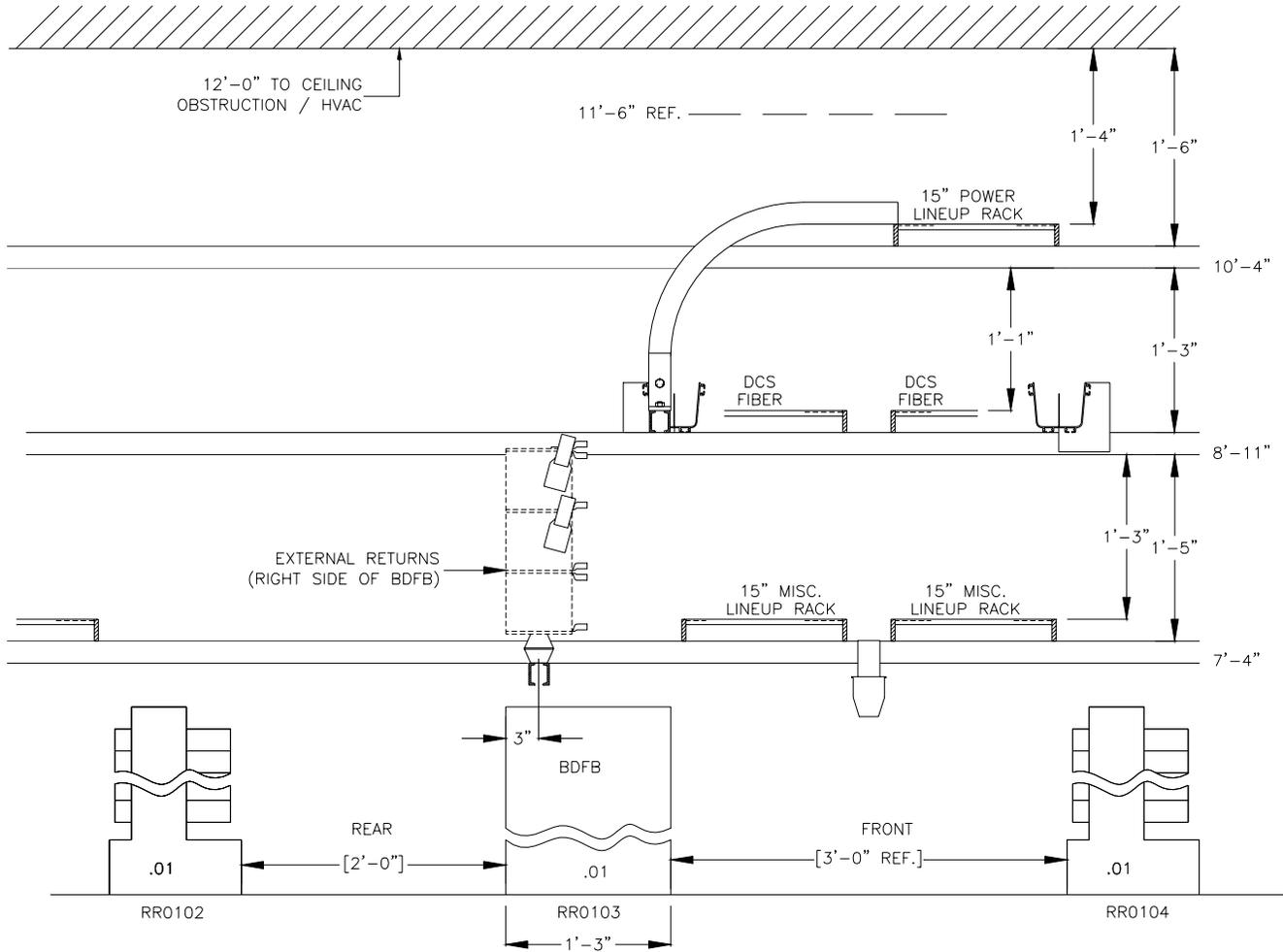
TABLE 8-1 – SUMMARY OF CHANGES IN SECTION 8

Change	Item in Issue	Item in This Issue
Revised 2/17/06	Various administrative edits Renumbered 4.1, 4.2.8, 5.3.5	
Deleted		
Added		

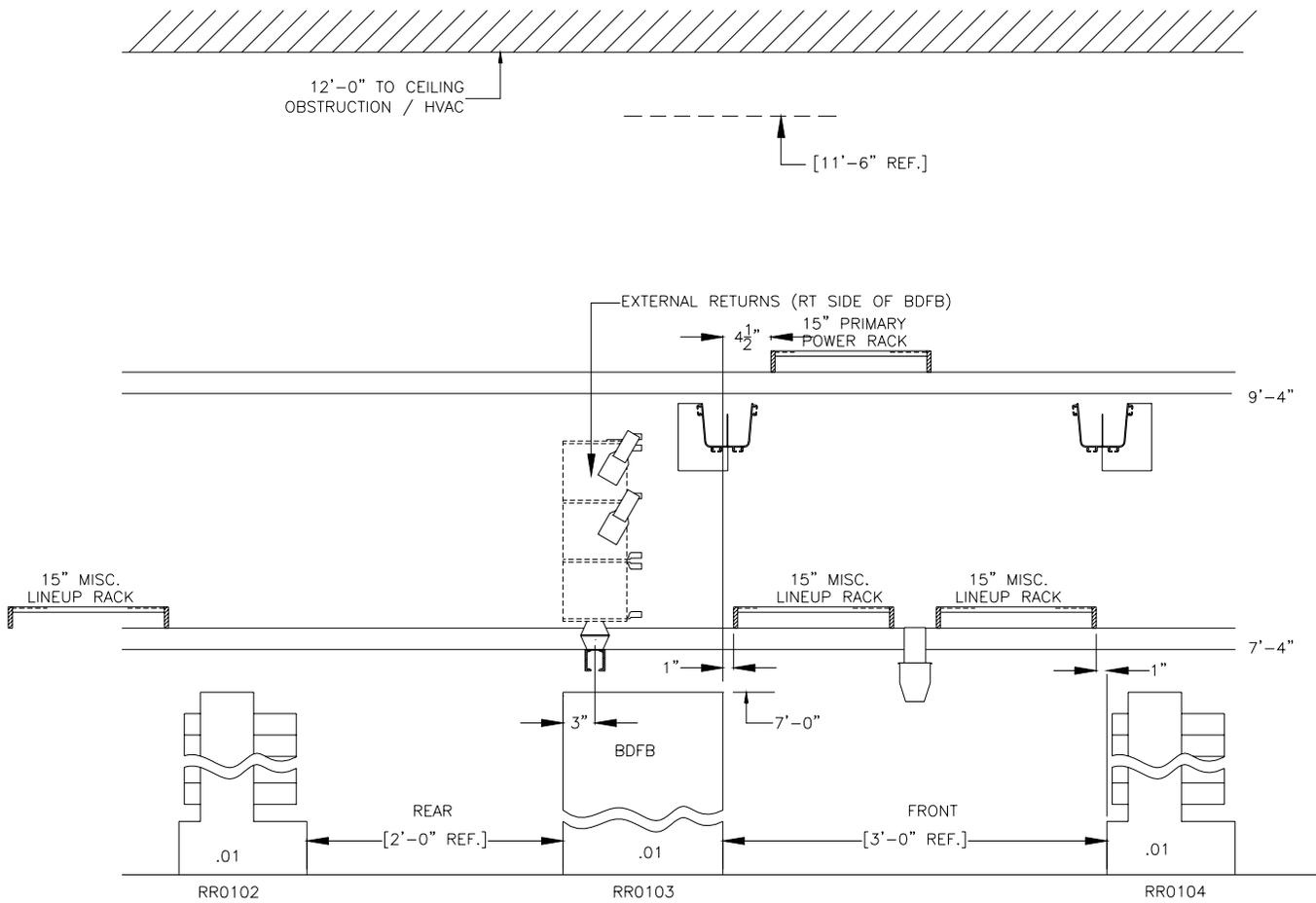
TABLE 8-2 -- CABLE RACK, AUXILIARY FRAMING & LIGHTING SYSTEMS REFERENCES

DESCRIPTION	BSP NUMBER
Network Cable Rack Requirements	ATT-TP-76409
Network Facility Auxiliary Framing and Bracing Requirements	ATT-TP-76408
Network Equipment Framework Support Requirements	BSP- 800-068-150MP
Network Equipment Anchoring Requirements	BSP-800-000-101MP
Floor Stanchion Supported Cable Rack System Requirements	BSP-800-006-152MP
Network Equipment Fiber Distribution Systems	ADC Fiber Management System Application & Installation Manual
Network Facility Hardware Products and Materials Specifications	ATT-TP-76201

**FIGURE 8-1A – TYPICAL CROSS SECTION OF NEW AREA WITH 3-TIERED CABLE RACKING
 INTERNAL RETURNS AND EXTERNAL RETURNS AT SIDE OF BDFBs**



**FIGURE 8-1 B – TYPICAL CROSS SECTION OF NEW AREA WITH 2-TIERED CABLE RACKING
INTERNAL RETURNS AND EXTERNAL RETURNS AT SIDE OF BDFBs**



**FIGURE 8-2 A – TYPICAL PLAN VIEW OF NEW AREA WITH 3-TIERED CABLE RACKING
 INTERNAL RETURNS AND EXTERNAL RETURNS AT SIDE OF BDFBs**

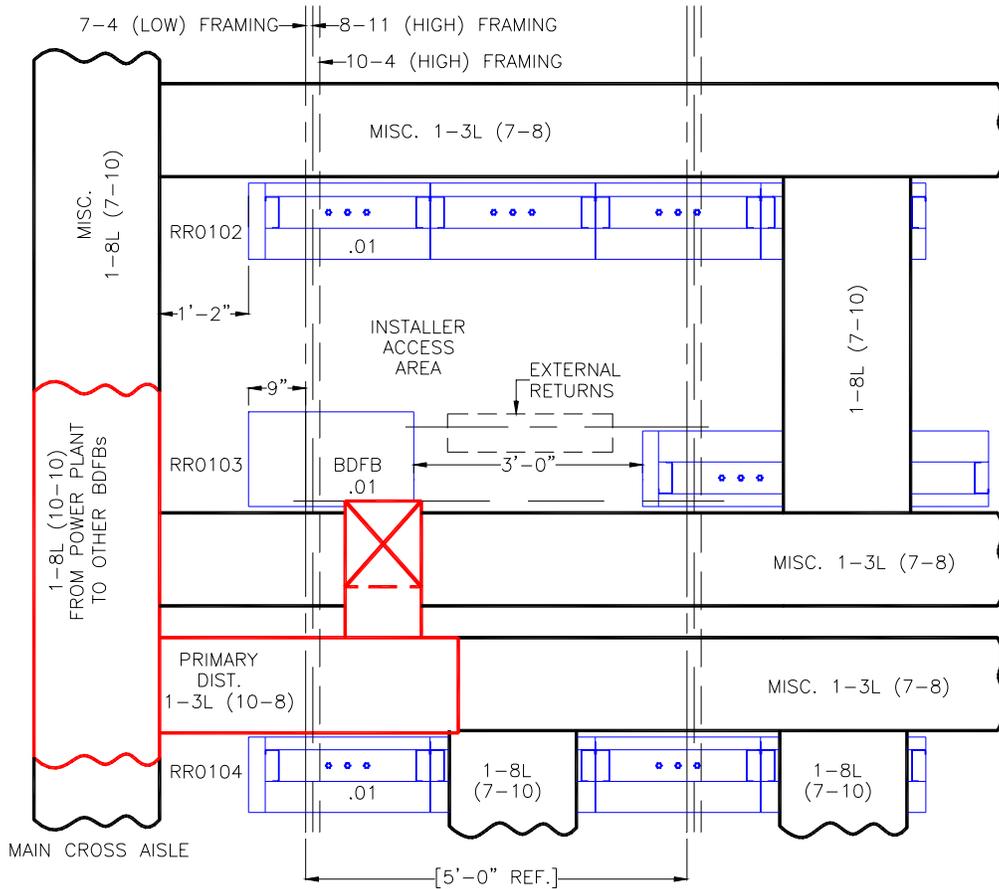
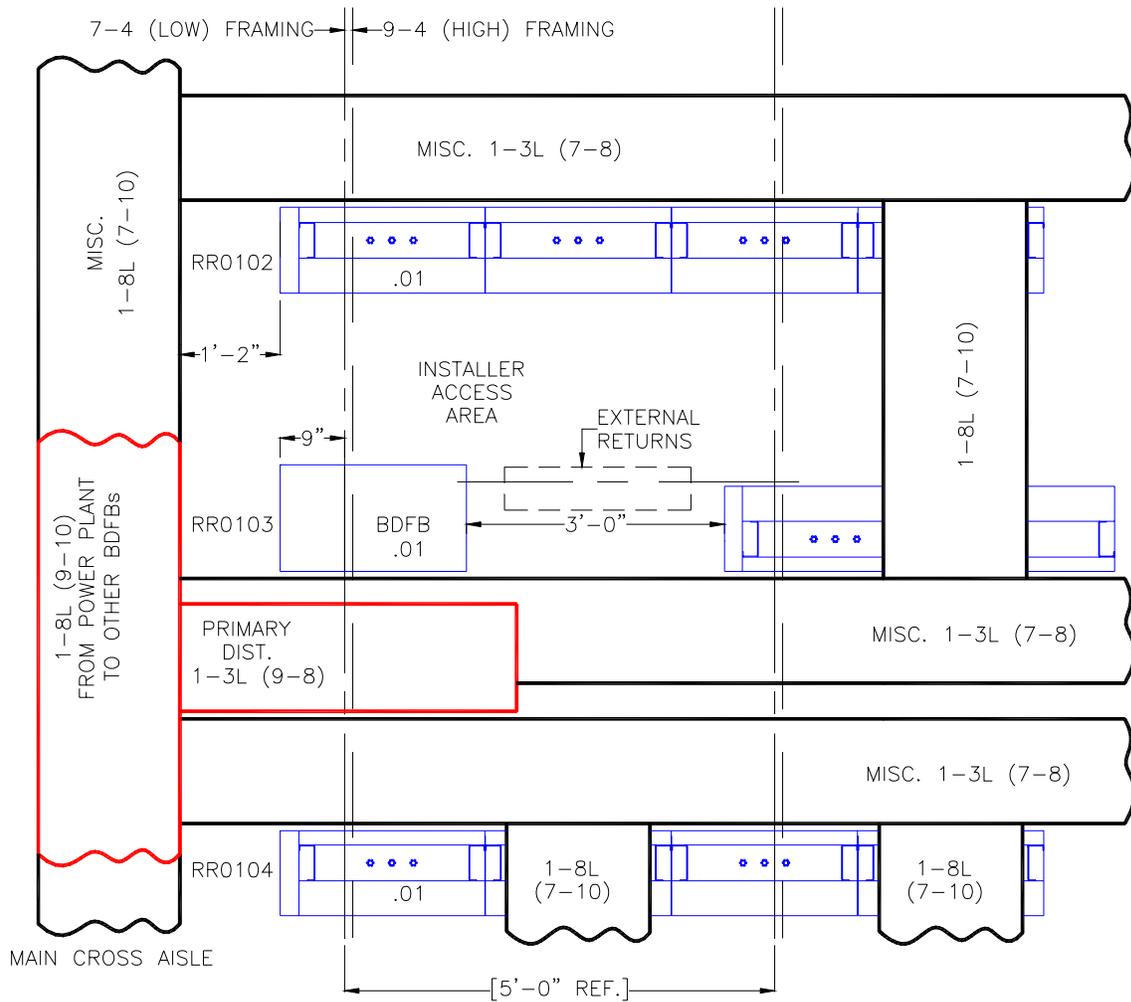
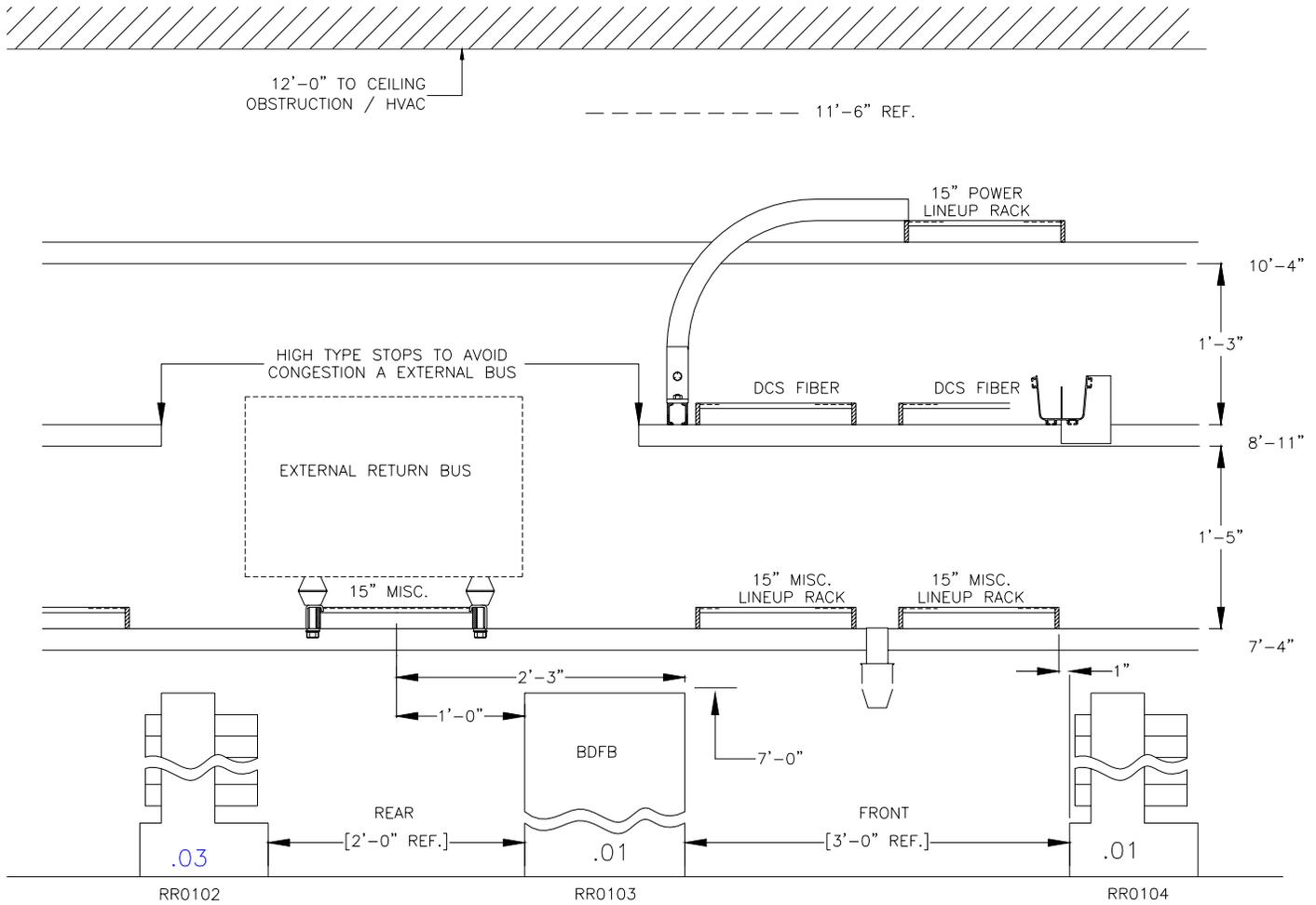


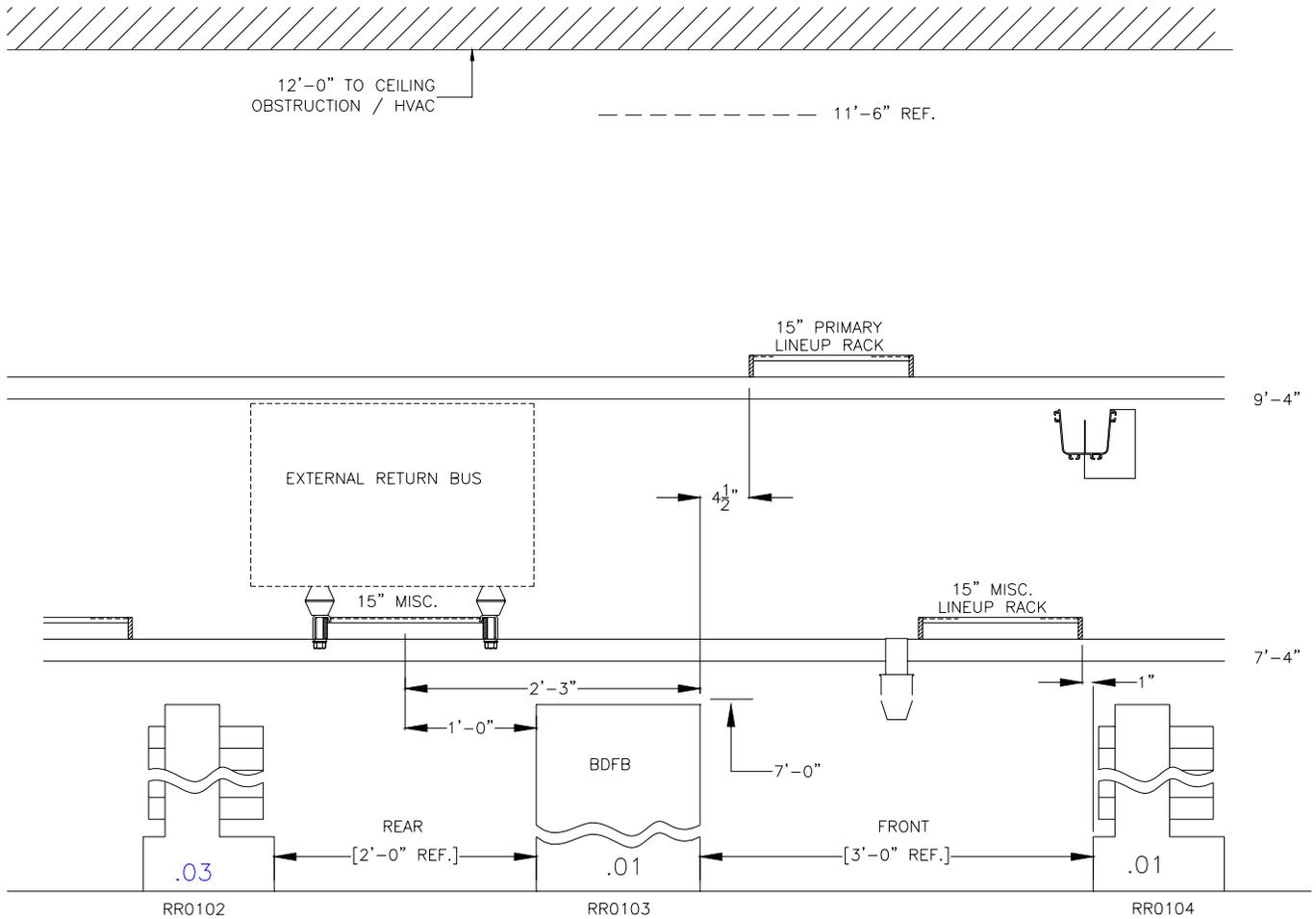
FIGURE 8-2B – TYPICAL PLAN VIEW OF NEW AREA WITH 2-TIERED CABLE RACKING INTERNAL RETURNS AND EXTERNAL RETURNS AT SIDE OF BDFBs



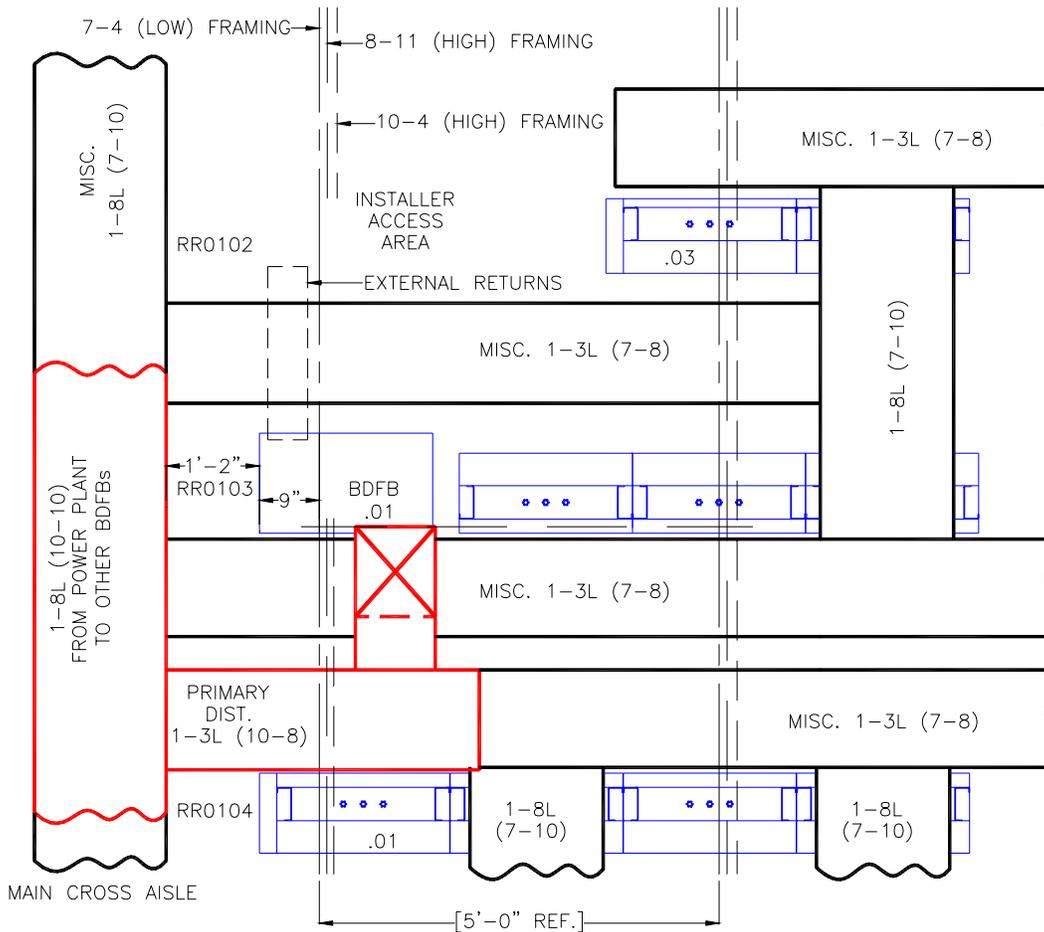
**FIGURE 8-3A – TYPICAL CROSS SECTION OF NEW AREA WITH 3-TIERED CABLE RACKING
 EXTERNAL RETURNS AT REAR OF BDFBs**



**FIGURE 8-3B – TYPICAL CROSS SECTION OF NEW AREA WITH 2-TIERED CABLE RACKING
EXTERNAL RETURNS AT REAR OF BDFBs**



**FIGURE 8-4A – TYPICAL PLAN VIEW OF NEW AREA WITH 3-TIERED CABLE RACKING
 EXTERNAL RETURNS AT REAR OF BDFBs**



**FIGURE 8-4B – TYPICAL PLAN VIEW OF NEW AREA WITH 2-TIERED CABLE RACKING
EXTERNAL RETURNS AT SIDE OF BDFBs**

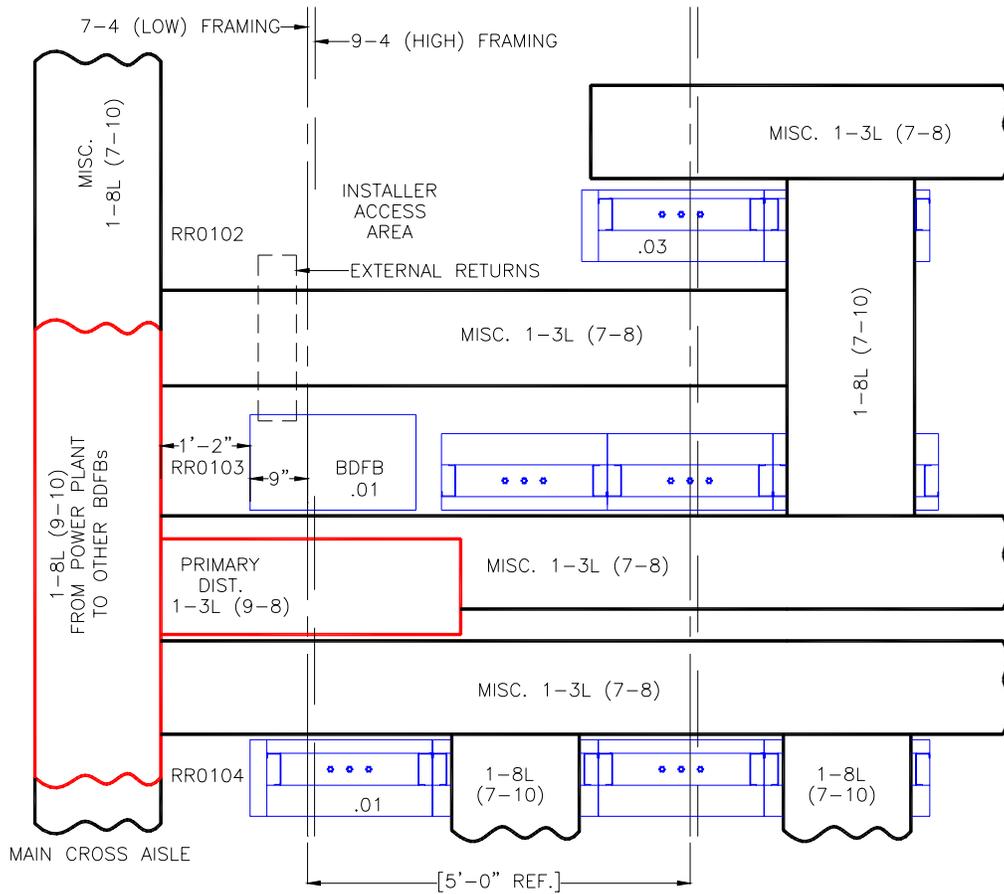


FIGURE 8-5 – DIVERSE ROUTING FROM FDF TO OC48 USING THE SAME PATH

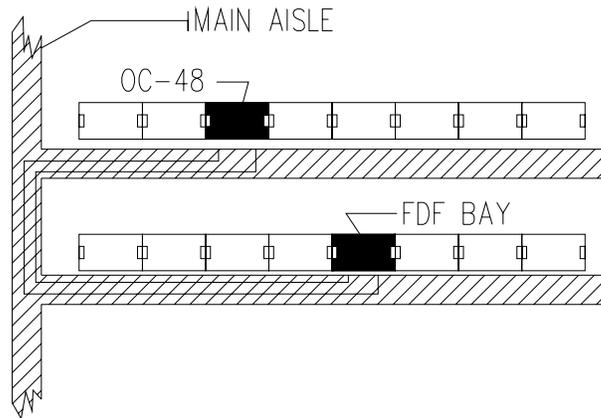


FIGURE 8-6 – DIVERSE ROUTING FROM FDF TO OC48 USING THE SAME PATH AND FROM FDF TO OC192 USING SEPARATE PATHS

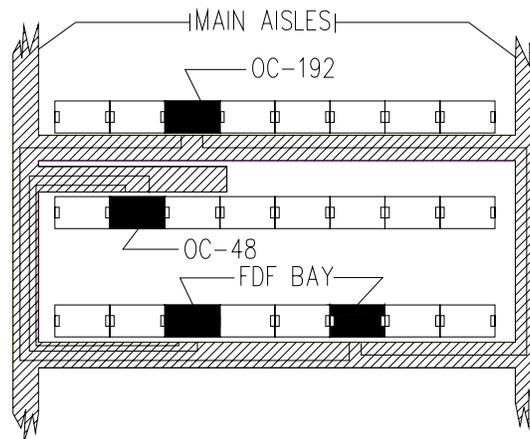


FIGURE 8-7 – DIVERSE ROUTING FROM FDF TO OC48 AND FROM FDF TO OC192 USING DIFFERENT PATHS.

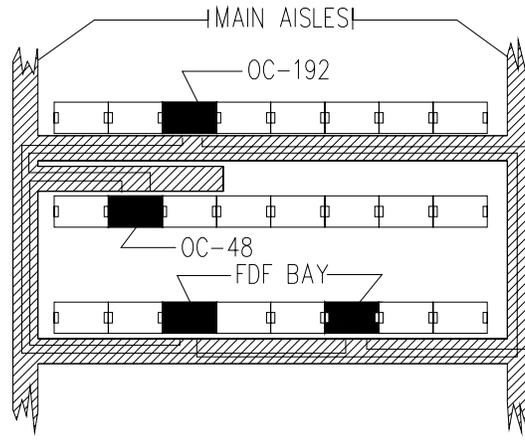


FIGURE 8-8 – DIVERSE ROUTING FROM FDF TO OC192 USING SEPARATE PATHS.

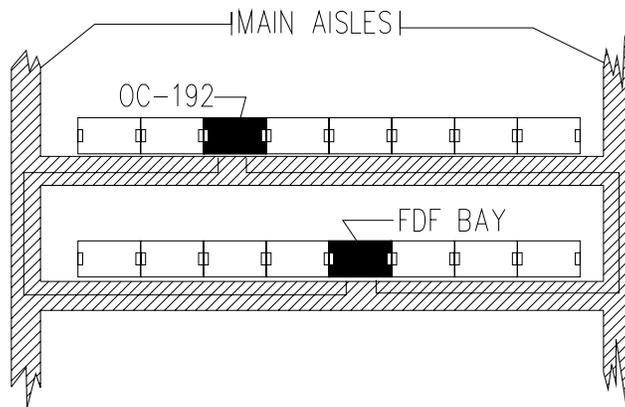


FIGURE 8-9 – DIVERSE ROUTING FROM FDF TO OC48 USING THE SAME PATH AND FROM FDF TO OC192 USING SEPARATE PATHS.

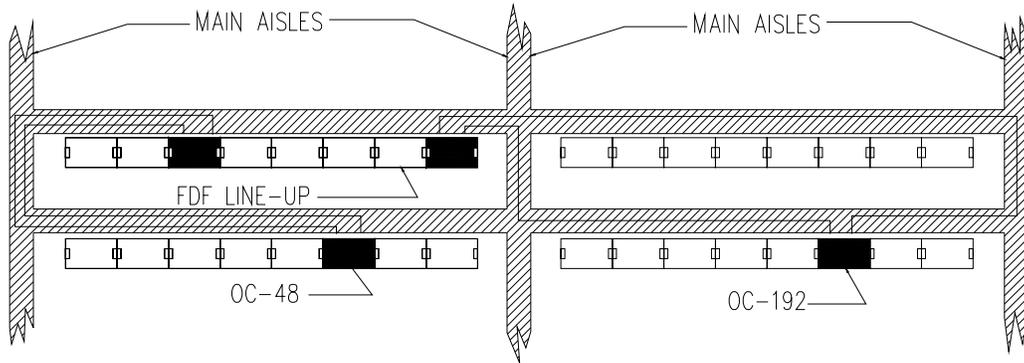


FIGURE 8-10 – DIVERSE ROUTING FROM FDF TO OC48 USING SEPARATE PATHS AND FROM FDF TO OC192 USING SEPERATE PATHS.

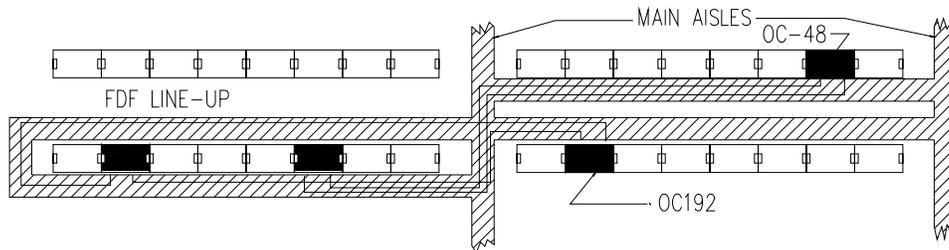
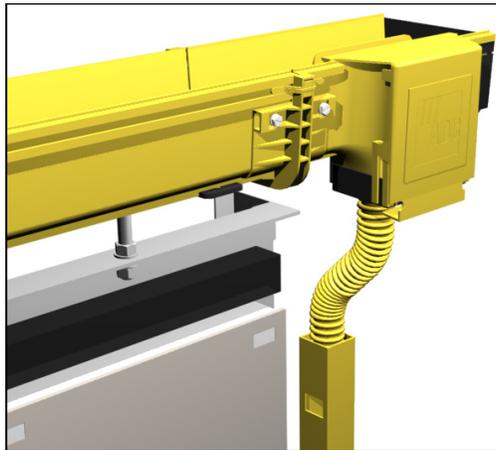
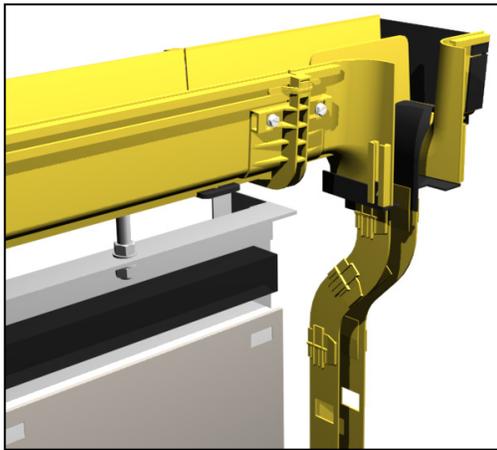
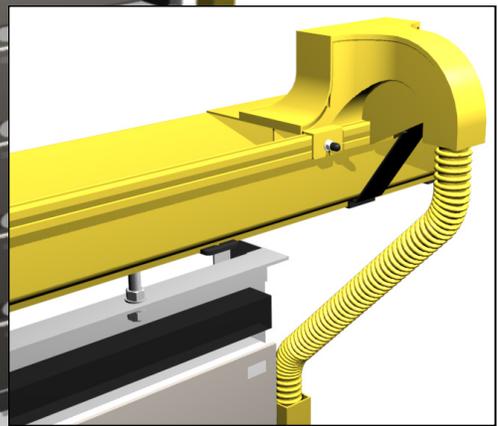
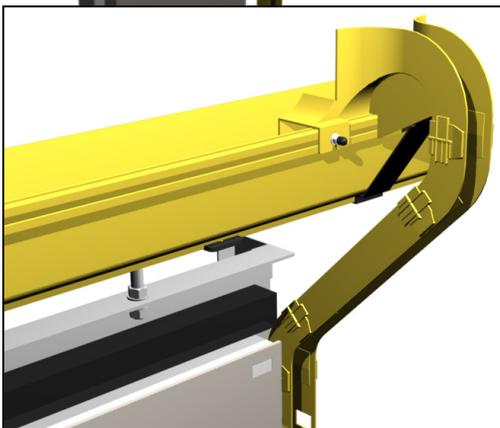


FIGURE 8-11 – DOWNSPOUT DROP OPTIONS



F

EXIT DROP OPTIONS





[END OF SECTION]

SECTION 9 - CROSS CONNECT SYSTEMS

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1. GENERAL

1.1. Introduction

- 1.1.1 The cross-connect network is comprised of conventional Distributing Frames (DF), modular DF, manual Digital Cross-connect (DSX1 and DSX3) frames, Fiber Distributing Frames (FDF), and Ethernet Distributing Frames (EDF).
- 1.1.2 Changes in this issue of Section 9 are summarized in Table 9-1.
- 1.1.3 Providing optimum flexibility and economy in the network is the objective of cross-connect engineering. Successful engineering of the network components requires efficient work operations, while avoiding blocked line-ups, premature jumper trough congestion, lack of equipment spread, and tie cable overuse.
- 1.1.4 Interfloor ties for IS equipment shall be fiber.

2. DISTRIBUTING FRAMES (DF)

2.1. General

- 2.1.1 Distributing frames (DF's) are manually operated, cross-connection devices used for the efficient connection between different pieces of IS equipment and outside plant fiber cable facilities.
- 2.1.2 The Distributing Frame supports the interconnection needs for customers, carriers, other technology platforms, transport equipment, and cable facilities within the serving IS equipment area.

3. COPPER CONNECTOR BLOCKS

3.1. General

- 3.1.1 The standard connecting block for AT&T IS frames is the 89-type block. Note: The term, "89" type block, is intended to define a block with the general characteristics of Commscope's 89 type blocks. This reference is commonly used as a method of identifying these blocks. It is not meant to imply or infer any kind of approval of Commscope's product line.
- 3.1.2 Frame assignments shall be provided by the Site Operations Engineer.
- 3.1.3 The Design Engineer shall contact Site Operations Engineer specified by the AT&T IS Equipment Engineer in the AEO.
- 3.1.4 All blocks on the frames shall have wire wrap terminations, unless the embedded base of existing blocks on the frame is made up of Quick-Clip/punch down, type blocks. In that case the quick clip blocks will be allowed.
- 3.1.5 Bifurcated (read dual) pins are required for connecting blocks used for IS equipment. This facilitates half taps for cutovers, cable throws and "from/to" service orders.
- 3.1.6 Only AT&T IS approved frame blocks shall be used.
- 3.1.7 No variances from 3.1.6 shall be allowed.

4. MANUAL DIGITAL SIGNAL CROSS-CONNECT (DSX)

4.1. General

- 4.1.1 A DSX frame provides a manual method of cross connecting DS1 and DS3 services. The recommended services and applications which should terminate on a DSX1/DSX3 are ones such as: DS1, DS3 and DIA.
- 4.1.2 The following fundamental functions performed at a DSX frame are: Termination, Cross-Connecting, Testing, Patching and Rolling.

4.2. DSX-1 Considerations

- 4.2.1 Planning of the DSX1 lineup will dictate careful consideration of the AT&T IS layout. It is important to place the DSX1 lineups (if multiple) in a parallel arrangement with appropriate troughs for adequate jumper placements
- 4.2.2 The length of the lineup may be up to 120 feet with the correct provisions.
- 4.2.3 DSX-1 Rear Cross Connect bays/line-ups shall require rear aisle lighting to meet with the minimum foot candle requirement for Equipment Frame Area Maintenance Aisle standards as described in Table 6-3 of Section 6 in TP76401.

4.3. Interbay Patch Panels

- 4.3.1 Interbay patch, or Beltline, panels, give local personnel the ability to patch/restore circuits without using excessively long cords (short cords to the panels on either end with engineered cable between the panels).
- 4.3.2 New DSX1 and DSX3 lineups shall have one inter-bay patch panel appearance every five bays.
- 4.3.3 For any existing four bay interbay panel configurations, continue to use those same bays for additional interbay panels from new lineups and extensions of existing bays using the five bay format. When the next new interbay is identified, place it five bays away from the last four bay interbay panel on the end cap. Continue on the existing lineups using the five interbay format. Connect these to the existing four bay interbay panels interspersed throughout the frame. Any existing pattern other than the one per five arrangements shall be capped.

4.4. Cross-Aisle Tie Pair Panels & Bridges

- 4.4.1 Cross-aisle tie pair panels are used in DSX1/DSX3 lineups to provide the ability to cross-connect two DS-1 or DS-3 or circuits terminated on different DSX1/DSX3 lineups.
- 4.4.2 The DSX1 cross-aisle tie circuits consist of five wires terminated at each end on the rear of a cross-aisle tie pair panel. Some older DSX1 equipment may use six wire cross-connection, with the sixth wire used to connect the ground leads from the fuse and alarm panels. This insures a consistent ground reference for tracing lamps.
- 4.4.3 These tie pair panels shall be strategically placed in the same interbay panel bays in both DSX1/DSX3 lineups to avoid tie pair cable congestion and long cross-connect jumpers.
- 4.4.4 New Cross-Aisle Bridges shall be a preferred alternative to Cross-Aisle Tie Pair Panels.

4.5. DSX-1 Cross-Connect Rules

- 4.5.1 In order to maintain complete flexibility, planning of the AT&T IS equipment area size is of primary importance and determines the ultimate size and layout of the DSX1 and should be made according to the following guidelines:
- A.) Minimize the amount of multiple jumpers.
 - B.) Use both the bottom and top horizontal troughs for jumpers that will traverse over two panels distance.
 - C.) Each AT&T IS office shall maintain the consistent standard at which point the jumpers are reversed to connect two T1s.
 - D.) Larger troughs shall be purchased and installed when the jumper depth reaches the top of the trough panel at any point in the lineup.
 - E.) Work all disconnects and remove all jumpers and inter-bay cross-aisle panels and erase the circuit identification on the faceplate of the panels.
 - F.) Provide slack on the horizontal trough of each panel not to exceed 4 inches nor be less than 2 inches
- 4.5.2 To alleviate cable congestion in the relay rack duct, 5 inches of space shall be provided between each 56 port/panel-bay.
- 4.5.3 To alleviate cable congestion in the relay rack duct, 7-1/2 inches of space shall be provided between each 84 port/panel-bay.
- 4.5.4 It is recommended to either install a skeleton bay (subject to future availability) to pre-equip the required horizontal troughs and appropriately sized vertical rings or to place a complete set of troughs and vertical rings (subject to future availability) when each new bay is installed in a lineup. Additional bays in a DSX1 lineup may result in possible cable congestion in the overhead racks
- 4.5.5 DSX-1 panels shall be located no more than 9 feet above the floor in new installations of 9ft and 11ft-6in bays. In Grandfathered locations where there is an 11 foot 6 inch environment, the existing lineups will be finished out at the existing height.
- 4.5.6 Any tie cable panels should be mounted at the top of the DSX-1 bay at the 6-7 foot level.
- 4.5.7 For new DSX-1 lineups in AT&T IS offices high-density bantam type jack panels shall be provided.
- 4.5.8 All DSX patch panels shall be physically and electrically compatible in the same DSX1 lineup.
- 4.5.9 An upper and lower express trough shall be provided for each bay.
- 4.5.10 All hardwired cables between the connecting equipment and the DSX1 shall be sized according to length as follows. The 22, 24 and 26-gauge cables preferably should be wire wrapped at the AT&T IS element; but may be connectorized. The following length limitation tables from a DSX1 panel apply to AT&T IS elements.
- A. Length limitation from DSX1 panel to the AT&T IS element:
 - 1.) 22 gauge 612.5 feet (STANDARD FOR USE)
 - 2.) 24 gauge 507.5 feet

3.) 26 gauge 407.5 feet

B. When hardwired DS1 Cable length runs are in excess of the transmission range of 26 gauge cable, use 22 gauge cable. In some instances 24 gauge will be used due to connectorization requirements as defined in [ATT Standard Drawings](#).

The above stated Length limitations from DSX-1 panel to an AT&T IS element may be adjusted downward/reduced in length to allow for longer DSX-1 Y2, 24 gauge Cross-Connect Lengths, in excess of the stated 85 foot limitation, which may be up to a maximum of 120 feet in length.

4.5.11 Transmit and receive signals shall be in separate cables from the transport equipment to the DSX1 except as manufacturer requirements dictate.

4.6. DSX-3 Considerations

4.6.1 All hardwired cables between the connecting equipment and the DSX-3 shall be 75 ohm coaxial cable with a single tinned copper shielded braid. When hardwired cable length runs are in excess of the transmission range of 735C coaxial cable, use 734C coaxial cable. Note: 734C is the thicker, longer range, coaxial cable and 735C is the thinner, shorter range, coaxial cable.

4.6.2 The maximum hardwired cable length between the DSX-3 and connecting equipment is 427.5 feet for 734C coaxial cable. If 735C cable is used, the maximum cable length between the DSX-3 and connecting equipment is 227.5 feet. The above stated length limitations from DSX-3 panel and connecting equipment may be adjusted downward/reduced in length to allow for longer DSX-3 standard outer diameter (735C type) cross-connect cords, in excess of the stated 45 foot limitation, which may be up to a maximum of 70 feet in length.

4.6.3 To alleviate coaxial cable congestion in the relay rack duct, 5 inches of space shall be provided between each front cross-connect DSX-3 bay

4.6.4 To alleviate coaxial cable congestion in the relay rack duct, 7 ½ inches of space shall be provided between each rear-rear cross-connect DSX-3 bay.

4.6.5 Vertical rings shall be provided for each bay between the troughs.

4.6.6 Cross-aisle jumper troughs shall be mounted in the rear for rear cross-connect bays and at the front for front cross-connect bays

4.6.7 Kings BNC connectors are the AT&T IS standard in AT&T West, Southwest and East. Trompeter BNC connectors are the AT&T IS standard in AT&T Midwest. Special crimp tools will be required to crimp these connectors. It is very important to understand that the tools specifically identified as Newhall Pacific Tools are used ONLY for crimping the center pin and outer hex sleeve of the Kings connectors. Also, the tools specifically identified as Trompeter Electronics Tools are used ONLY for crimping the center pin and outer hex sleeve of the Trompeter connectors. NEVER use the Newhall Pacific Tools to crimp Trompeter connectors and NEVER use the Trompeter Electronic Tools to crimp Kings Connectors; otherwise BNC connector failures WILL OCCUR.

4.6.8 The hardwired cables from the connecting equipment to the DSX-3 shall be provided in one of the following *two* ways, as authorized by the AT&T Equipment Engineer:

A. One end factory crimped and the other end field crimped, within an AT&T IS office, by an AT&T approved Installation Supplier.

B. Bulk coaxial cable requiring field crimping, within an AT&T IS office, by an AT&T approved installation supplier on BOTH ends.

- 4.6.9 All Network Equipment DS3s originating from an equipment unit should appear on the same DSX-3 bay.
- 4.6.10 The maximum number of bays in a DSX-3 lineup shall not exceed 20, but the most critical issue is the maximum cross connect length.
- 4.6.11 In the 7-foot environment, two horizontal troughs, one on the bottom and one at 7 feet 6 inches shall be provided. In the case of the 11'6", three troughs, one on the bottom, one at 7'6" and one at the top of the bays shall be provided.
- 4.6.12 DSX3 lineup interconnects should not exceed three parallel adjacent lineups.
- 4.6.13 Tracer lamp colors shall be Red.:
- 4.6.14 DSX-3 Rear Cross Connect bays/line-ups shall require rear aisle lighting to meet with the minimum foot candle requirement for Equipment Frame Area Maintenance Aisle standards as described in Table 6-3 of Section 6 in TP76401.

4.7. DSX Cross-Connect References

[ATT-002-316-041](#), DSX-1 Deployment Standards

[ATT-002-316-042](#), DXS-3 Deployment Standards

ATT-E-01115-W ATT-Interconnect Drawings (DSX-3) FX

ATT-E-01115-E ATT-Equipment Drawings (DSX-3) FX

ATT-E-01175-E ATT-Equipment Drawings (DSX-1) RX

ATT-E-01175-W ATT-Interconnect Drawings (DSX1) RX

ATT-E-01117-W ATT-Interconnect Drawing DSX-3 RX

ATT-E-01117-E ATT-Equipment Drawing DSX-3 RX

ATT-E-01150-E ATT-Drawings BOR-SWBT version DS3/STS-1 IOR/BOR

ATT-E-01150-W ATT-Drawings BOR-SWBT version DS3/STS-1 IOR/BOR

ATT-E-01101-E ATT-Equipment Drawings DS1-IOR

ATT-E-01101-W ATT-Interconnect Drawings DS1-IOR

5. FIBER DISTRIBUTING FRAMES (FDF)

5.1. General

- 5.1.1 An FDF architecture shall be the primary interface between outside plant (OSP) fiber optic facilities entering and leaving a building and the fiber optic equipment installed within a building.

- 5.1.2 In smaller legacy POPS (a pre-existing facility typically less than 2000 square feet) fiber may be run directly from the splitter shelf to the NE.
- 5.1.3 The FDF shall provide a centralized point for the organization and administration of the fiber optic facility and intrabuilding equipment cables, providing a flexible platform for future fiber growth, and providing rearrangeable connections between any two terminations or appearances.
- 5.1.4 FDF systems are suitable for use in both large and small POPS.
- 5.1.5 FDF systems are modular in design and shall serve as centralized termination, test access, cross-connect and distribution points for all fiber network elements.
- 5.1.6 The FDF shall be the primary interface and cross-connect point for all Fiber Optic products, cabling and equipment.
- 5.1.7 The FDF shall be the direct cable cross-connect point for all AT&T Internet Services Network Elements to one another. However, Interbay LAN connections (typically multimode) may be run NE to NE without the use of a FDF.
- 5.1.8 Connectivity from one Network Element to another within the same Network Equipment footprint shall only be permitted as a hardwire (permanent) arrangement for connectivity of equipment issues.
- 5.1.9 Passive devices such as Optical Splitters and WDM technologies shall fit within modules developed for use in the miscellaneous 12-slot vertical shelf or shall be required to be hard-cabled to an off-site location from the FDF, with the exception of LAN elements.
- 5.1.10 Optical Carrier systems that use primary and protect paths for signal transmission shall have path diversity for cross-connects and cabling within the AT&T IS building beyond the initial Network Equipment lineup in accordance with ATT-002-316-087, *Intraoffice Routing Diversity for the AT&T IS office*.
- 5.1.11 Fiber cabling **within** a Network Element system using one or multiple bays within the same footprint may be cabled directly without termination on a FDF.
- 5.1.12 Fiber provisioning within the same floor not separated by a firewall, floor or ceiling shall use Fiber Raceways and Jumpers for interconnection.

Network Elements placed outside of this area that need to be connected to another area shall require the use of fiber cable, not jumpers, to be run and terminated to the FDF.

Fiber Optic Tray (FOT) assemblies shall be comprised of:

- (1) an overall housing that is rack mountable and designed to manage all fiber cable within
- (2) the fiber enclosure shall be loaded (IE: contain enough bulkheads or adapter plates to fully populate the enclosure; some of the plates may be blanks to complete this requirement)
- (3) Adapters shall be of the type that corresponds to the fiber interfaces on the equipment being installed.
 - a. Like interfaces reduce the needs for expensive custom-made hybrid patch cables
 - b. Maintaining an inventory of hybrid patch cables lengths is not cost effective

- 5.1.13 The full cross-connect architecture provided by the Fiber Distributing Frame shall be used in the AT&T Internet Services Companies.
- 5.1.14 Fire-retardant ribbon fiber optic cables should be pre-terminated on the Outside Plant (OSP) shelf in the FDF bay and shall be spliced to optical OSP facilities either in the cable vault or in the first manhole.
- 5.1.15 Outside plant cable shall not exceed 50' within the building unless enclosed in conduit.
- 5.1.16 Fiber optic pre-connectorized interconnect cables from optical transmission and switching equipment shall be terminated on a Fiber Optic Termination (FOT) shelf in an adjacent FDF bay.
- 5.1.17 The FOT and OSP terminations shall be cross-connected via cross connect fiber optic jumpers at the time a service request is initiated.
- 5.1.18 Alternating bay arrangement shall be used except in offices that contain only one bay. The alternating bay arrangement segregates OSP terminations and Fiber Optic Transmission (FOT) equipment terminations into alternate bays and ensures an efficient and short jumper arrangement.
- 5.1.19 The FDF shall always utilize the cross-connect methodology. Transmission equipment shall not be directly terminated on the front access ports of the OSP panels. Transmission equipment shall be terminated on FOT panels and cross connected to any other panel.

5.2. Satellite Fiber Distributing Frame

- 5.2.1 When the equipment placement is located on another floor or a non-contiguous equipment area, a Fiber optic tie cable terminated on OSP panels shall be placed from the FDF to that remote area and terminated on a satellite FDF in its own bay.
- 5.2.2 When Satellite Fiber Distributing Frames are placed, Fiber Protection Systems (FPS) shall be placed to allow easy access to support the eligible area for each Network Element.
- 5.2.3 The remote area shall be supported through Fiber patch cords to the Network Element.
- 5.2.4 Fiber Protection Systems and Fiber Optic patch cords shall not traverse firewall partitions and floors.
- 5.2.5 Fiber Protection Systems in a 7' environment shall be provisioned between the 7' and 9' heights, unless otherwise obstructed.

5.3. FDF Applicability

- 5.3.1 The **Generation II** is a medium density Fiber Distribution Frame using a bay arrangement. This is AT&T IS' **STANDARD FOR USE**. This FDF has 72 fiber optic ports per panel and up to 9 panels per 7-foot high bay. This FDF will fit in a standard frame relay rack as a Network Bay having a 23-inch interior and 26-inch exterior width and a 15-inch depth.
- 5.3.2 The **Generation III** FDF is a High Density Fiber Distribution Frame (HD-FDF) that utilizes a new frame arrangement consisting of high-density port panels located within a multi-trough high-density bay arrangement. AT&T CS has approved the Generation III frame for general use. This FDF will not fit in a standard frame relay rack. It will be required to fit within a large bay configuration having a 36" x 36" width and depth with actual dimensions of 30" wide by 24" deep.

5.3.3 **Generation III** FDF bays/line-ups shall require rear aisle lighting to meet with the minimum foot candle requirement for Equipment Frame Area Maintenance Aisle standards as described in Table 6-3 of Section 6 in AT&T-TP-76401.

5.4. The FDF

5.4.1 The top shelf (9) in each bay shall be reserved for special applications such as test access, administrative access, passive devices such as WDM and Fiber Splitter applications and interlineup FDF bridging.

5.4.2 All passive devices shall conform to the AT&T IS standard for the vertical Miscellaneous Panel (12-slots modules) only. The Miscellaneous panel shall be the only version permitted on the Generation II and future Generation III FDF.

5.4.3 The FDF shall be limited to a seven-foot environment.

5.4.4 The FDF shall be ordered to include storage of excess jumper slack between bays.

5.4.5 The Generation II FDF uses a high-density trough system that permits the routing of fiber optic cross-connect jumpers of varied lengths to fit into the system without the need to custom fit or splice connectors. IMPORTANT NOTE: Excess fiber jumper slack shall not exceed 6-feet in length.

5.4.6 The preferred method is to set frames in the normal arrangement of OSP-FOT-OSP-FOT. However, in extremely small IS offices, the first FDF bay may be used in a combination mode with the FOT panels on the bottom and the OSP panels on the top. Any growth beyond the first bay shall require the existing pattern be carried out through out the lineup.

5.4.7 The Generation III FDF shall have a different physical placement requirement of the lineup. The lineup shall be placed to accommodate both front and rear access providing for a full 36-inches between parallel lineups on both front and rear. If a new lineup is started using the Generation III bays after an embedded Generation II (standard bay) arrangement is already in service, strive to place the new lineup adjacent to the Generation II lineup, or within the closest proximity. A transition bay from the NGF to the NG3 will be required to migrate from these two systems.

5.4.8 Standard bays (Generation II) and large bays(Generation III) FDF's shall not be intermixed in the same line-up without the office first being considered constrained which will require the placement of special modified equipment as follows:

- A. Transitional end guards shall be provided
- B. Fiber raceways shall be provided to compensate for transition choke points between these two types of frames.
- C. Transition Bay

5.4.9 FDF layouts will vary in size based upon the needs of business and the complexity of the existing office topology. The new Generation III FDF has three major components:

- A. The FOT Bay used for Network Equipment.
- B. The OSP Bay used for Outside Plant Cabling terminations.
- C. The Miscellaneous Bay used for additional slack storage, phone, drawer, etc.

- 5.4.10 It is expected that the FOT and OSP bays shall alternate in placement in the same lineup with the Generation III Miscellaneous bay being placed in the forecasted center of the overall frame lineup. It is not anticipated to have more than one Miscellaneous Bay per FDF lineup and will not be deemed necessary for bay arrangements less than 5 bays.
- 5.4.11 A Fiber Optic Jumper is defined as a cross-connect jumper located at the FDF to cross-connect the OSP termination to the FOT termination. Fiber Optic Patch cord is defined as the connection between the Network Element and the rear of the FOT shelf located in the FDF.
- 5.4.12 Fiber optic cross-connect jumpers shall be ordered in the near correct lengths in order to properly place the connection from the two fiber panels (OSP-FOT), (FOT-FOT), or (OSP-OSP) on Generation I FDF systems. DO NOT PERMIT EXCESS CABLING TO BE ORDERED OVER 6 LINEAR FEET FOR ANY JUMPER.
- 5.4.13 On Generation II (IS-Standard) and beyond FDF systems, the fiber jumpers shall be provided in 5-foot increments, but shall not be less than 6-feet for any one-jumper cross-connect. Sufficient storage is available on 72-96 panel fiber systems.
- 5.4.14 On Generation III (IS-Standard) and beyond FDF systems, the fiber jumpers shall be provided in 5-foot increments, but shall not be less than 6-feet for any one-jumper cross-connect. Sufficient storage is available on 72 panel fiber systems.
- 5.4.15 If ordered by IS, Fiber Optic jumpers/patch cords shall be ordered from a Procurement approved supplier.

5.5. Fiber Splitters

- 5.5.1 Optical Splitters are either SingleMode or MultiMode optical glass devices used to distribute fiber optic signals to multiple fiber optic output locations. Optical Splitters produce output signals in varying combinations. The most common splitters provide a 90/10 or a 50/50 percent split of the input signal intensity.
- 5.5.2 The Optical Splitter provides a tool for measurements that can be placed as a terminus point for IS provisioned services without interrupting the primary service. The Optical Splitter is to be used at the overall ends of a point-to-point service only.
- 5.5.3 Fiber Optic Splitters shall not be placed in a back-to-back mode.
- 5.5.4 The number of fiber optic splitters in the overall circuit shall not exceed three.

5.6 Optical Terminations and Connectors

- 5.6.2 Fusion splices are rated as Standard in AT&T IS and shall be used.
- 5.6.3 Mechanical Splices will only be permitted on an exception basis for the immediate service restoration of damaged facilities.
- 5.6.4 Mechanical splices shall not remain in place for any longer than 30 days before conversion to a fusion splice.

5.6.5 Mechanical splices in fiber optic patch cords/jumpers shall not be converted to a fusion splice. The entire jumper shall be replaced within 30 days.

5.7 Attenuators

5.7.2 Attenuators are placed at the Fiber Distribution Frame (FDF) panel supporting the Network Element. FOT and OSP panels in the FDF normally are ordered with a 0-dB (or no) attenuation. The connector may be changed in the FDF and replaced with the proper attenuator in the connector socket to pad the signal in 5-dB increments.

5.7.3 These "Bulkhead" attenuators are flush mounted with the panel face and are color coded for proper use. In addition, "In-Line" attenuators may be placed to pad the signal and shall only be placed between the FOT panel and the fiber jumper when services used have high power requirements as shown in the following table:

Service Type	Not Multiplexed	Multiplexed with WDM, DWDM, etc
OC-1	In-Line Optional ¹	In-Line Required
OC-3	In-Line Optional	In-Line Required
OC-3C	In-Line Optional	In-Line Required
OC-12	In-Line Optional	In-Line Required
OC-48	In-Line Optional	In-Line Required
OC-48 (High Power)	In-Line Required	In-Line Required
OC-192	In-Line Required	In-Line Required
OC-768	In-Line Required	In-Line Required

5.7.4 Attenuators shall not be placed between two fiber optic jumpers in the FiberProtection System (Yellow Raceway) or the FDF troughs

5.7.5 For all new installations, attenuators shall be placed in the FOT panel itself. In legacy locations attenuators may be installed at NE when necessary.

5.7.6 In-line bulkhead attenuators shall be used at the FOT panel.

5.8 FDF References

ATT-002-316-011, AT&T SingleMode Fiber optic Splitters

ATT-002-316-026, AT&T SingleMode Passive Wave Division Multiplexer (WDM) for the FDF

ATT-002-316-043, AT&T-FDF Frame Deployment Standards

ATT-002-316-053, ATT-Fiber Raceway Deployment Standards

ATT-002-316-066, ATT-Breakout Bay Deployment for the Nortel OPTera Connect DX System

ATT-002-316-072, ATT-BPON FTTH Provisioning (ATT-West Trial Only)

ATT-002-316-074, ATT-Fiber optic bridging for the FDF

ATT-002-316-078, ATT Fiber Connector/Mode Policy

¹ In-Line Attenuators will be the long-term best value with higher capacity services.

[ATT-002-316-079](#), ATT Fiber Connector/Mode Policy Addendum by Applied Services

ATT-002-316-090, ATT-BPON Common Systems Provisioning Standards

ATT-E-00136-E, ATT-Fiber Patch cords, Cable and Attenuators

ATT-E-01140-E-01, ATT-Fiber Distributing Frame Drawings

ATT-C-50001-E-00, ATT-Fiber Raceway Drawing

TABLE 9-1 – SUMMARY OF CHANGES IN SECTION 9

Change	Item	Item in This Issue
Revised		
Deleted		
Added		

[END OF SECTION]

SECTION 11 -- SYNCHRONIZATION

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1. GENERAL

1.1. Introduction

- 1.1.1 This section has been prepared to provide general guidelines necessary to assure compliance with the AT&T IS synchronization rules and policies.
- 1.1.2 Changes in this issue of Section 11 are summarized in Table 11-1.
- 1.1.3 Building Integrated Timing Supply (BITS) concept is the AT&T method of providing and sustaining interoffice synchronization. The BITS plan calls for each office to have one master clock set of signals (TSG = Timing Signal Generator) source called the BITS. Under the BITS concept, every timing capable digital Network Element (NE) in the office shall derive its timing signals from that single source within that office. A timing capable Network Element is defined as any digital equipment piece that can conform to the BITS concept by accepting 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, but the option(s) exists to allow it to be so equipped.

2. synchronization requirements

2.1. General

- 2.1.1 The minimum acceptable stratum level for any/all office master BITS clock is stratum 3E (ST3E). A master TSG shelf is that one shelf in each IS office that houses the redundant ST3E/ST2E master oscillators, is redundantly DS-One signals fed, has PRS-traceability and has TL1 interoperability.
- 2.1.2 Each IS office meeting any of the following conditions or qualifying under any of the categories must be modified to comply with BITS:

- a) An office with a digital switch (host or stand alone) or a digital switch remote that is external timing capable;
- b) An office with a SONET network element;
- c) An office with at least three independent timing capable digital network pieces of equipment.

2.1.3 All timing capable network elements within a building shall derive timing input signals directly from a BITS/Timing Signal Generator.

2.1.4 Any Network Primary Reference Supply (PRS) shelf must be in the same bay or an adjunct/adjoining bay to the master shelf. When a PRS is installed, the master shelf must be converted to the shelf that meets the master clock definition and NOW be equipped with Stratum 2E oscillators.

2.2. Diversity

2.2.1 Multiple cable routes to/from the BITS shall be provided when/where possible such that redundant timing leads can be routed via two separate cable paths. This is generally accomplished by engineering lineups and/or cross-aisle cable racks on both sides of the BITS frame. The AT&T IS Equipment Engineer shall be consulted regarding the addition of new cable racks in existing equipment areas.

2.2.2 Redundant BITS input/output timing signals leads may be routed on a common cable rack when multiple cable rack paths are not possible as follows:

- a) Redundant leads shall be placed on opposite sides of the rack to the point separate cable paths can be taken.
- b) One pair/set of redundant leads associated with CCS7 equipment and Composite Clock/DS-Zero feeders between the master BITS and remote master BITS shelves shall be placed in innerduct for the distance the leads are run parallel on the same rack (top of bay to top of bay), and
- c) Innerduct shall be of the solid (un-slit) corrugated design having a maximum 1.25-inch diameter and shall be riser rated (minimum), (e.g. C701-123-671). Innerduct application is for critical leads protection rather than identification; as all sync input/output signals leads are 1175A cable runs.

2.2.3 When redundant leads must pass through a common cable hole, their cable routes shall be diverse up to the cable rack entering the hole and as soon as possible after exiting the hole on the other side.

2.2.4 Engineered cable routes shall NOT require redundant leads to cross at any point along their respective routes.

2.3. Engineering Requirements For BITS

2.3.1 Operationally, the BITS equipment shall be located in a low traffic area near the majority of Network Elements that it serves.

2.3.2 A dedicated bay shall be provided for the BITS equipment.

- 2.3.3 All timing signal leads from a BITS clock OUTPUT ports to network elements shall be run using Lucent 1175A(C108-672-874), red jacketed, single pair, 22 AWG, foil shielded BITS timing cable. The shield/drain wire shall be DC/hard grounded at the clock end only. The shield/drain wire shall NOT be DC/hard grounded at the Network Element. Connection of the shield/drain wire at the Network Element shall be Manufacturers' equipment specific; optionally left insulated and unterminated or properly AC/capacitive-coupled grounded. When the network element manufactured timing signal cables do not meet this criteria, conforming cables shall be ordered to meet this condition (GR-1244, R3-9).
- 2.3.4 Timing signal leads from the BITS clock OUTPUT ports to network element inputs shall NOT be run through DSX jacks. The only exception being instances when the network element timing input connection must be accessed via a DSX jack. In such cases, the BITS OUTPUT signals must be run to a DSX jack and cross-connected to the network element DSX jack. The network element jack should be as close as possible to the modified sync jack; as overall source-to-termination linear cable distance limitations now make DS-One signals equalization a necessary consideration. The DS-One output of the BITS should be connected on the OUT jack, hardwired side of the DSX jack. Transmit and receive signals equalization require the (IN) jack should be terminated with a 100 ohm resistor. (See Figure 11-5).
- 2.3.5 The sleeve/drain ground wire of the 1175A cable shall be insulated with spaghetti sleeving (Protective Tubing R-4563//C401-652-078).
- 2.3.6 All critical network element timing leads shall terminate only on the office master BITS shelf or one of its expansion shelves or a Remote Master Shelf equipped with Remote Track and Hold Cards (RTHC). The AT&T IS Equipment Engineer shall be notified when this is not possible. This applies to existing installations as well as new ones. Critical network elements are:
- a) All CCS7 related equipment (STPs, LPPs, LIMs, FLIS, IDST, SECURE7, ACCESS7 and D4 bays serving SS7 Links).
 - b) All Remote Master Clock (Slave) Shelves
 - c) Any other equipment specified by the AT&T IS Equipment Engineer.
- 2.3.7 All timing signal output cards shall be deployed in adjacent mated pairs, odd & even assignments within a shelf. Outputs shall be equally assigned in matched set of cards such that both cardsets will exhaust at the same time period. Output timing signals feeds shall be routed from alternate sides of the BITS shelf. Since all timing cards are mated pairs, odd numbered DS-Zero and DS-One outputs shall be run from the right side of the BITS shelf and even numbered DS-Zero and DS-One outputs shall be run from the left side, as viewed from the rear or wire-wrap output field of the BITS shelf. The DESP shall not change existing wiring arrangements of the BITS shelf without approval of the AT&T IS Equipment Engineer.
- 2.3.8 The DESP shall provide the sync assignment record book, record book holder and assure all assignments accurately match in TAB/dB with initially provided BITS Master shelf.
- 2.3.9 The DESP shall specify that the alarm and alarm return leads be run as a pair and terminated per BSP 801-601-900MP.

2.4. Timing Reference Inputs

- 2.4.1 The AT&T IS Equipment Engineer will provide for timing reference input signals. Appropriate schematic figures for these references are shown in Figures 11-1 through 11-4.
- 2.4.2 Timing reference signals to the BITS shall be diversely routed from points of origin to the BITS shelf inputs points of termination.
- 2.4.3 All sync jacks, if used, shall be equipped with appropriate markers indicating SYNC. These markers should include the modified DSX jack, the originating facility jack and terminating network element jack.
- 2.4.4 The DESP shall provide the appropriate sync DSX jack schematic (see figures). The schematic within the manufacturer's BITS clock documentation should be replaced with the actual schematic utilized.

2.5. Power Requirements

- 2.5.1 A dedicated fuse panel shall be a part of each initial BITS installation. If no existing dedicated panel is available, a new dedicated fuse panel shall be provided. This fuse panel may serve BITS equipment in adjoining/adjunct bay(s) only.
 - 2.5.2 Only BITS or associated BITS equipment located in BITS bays shall be fused by the dedicated fuse panel.
 - 2.5.3 Battery feeders to the BITS fuse panel shall originate from separate BDFBs when multiple BDFBs are currently provided on the same floor within the office and spare capacity exists.
 - 2.5.4 Battery feeders to the BITS fuse panel that originate directly at the Power Plant shall be fused on different rows.
 - 2.5.5 Both "A" and "B" battery load and battery return leads from the BDFB to the BITS fuse panel shall have diverse routing in the following order of preference:
 - a) Provide two separate and distinct cable routes from the BDFB to the BITS fuse panel, via existing cable racks;
 - b) Provide one cable route from the BDFB to the BITS fuse panel. The power cables shall be routed on opposite sides of the same cable rack.
 - 2.5.6 Battery load and battery return leads from the fuse panel to the BITS equipment shall be routed down opposite sides of the equipment bay.
 - 2.5.7 "A" and "B" battery outputs of the fuse panel shall correspond to the "A" and "B" battery inputs of the BITS equipment.
 - 2.5.8 Battery load and battery return connections from the fuse panel to the BITS equipment shall be made with ring terminals at both ends unless the existing fuse panel is designed with mechanical (screw) terminations.
- ## **2.6. Grounding Requirements**
- 2.6.1 Clock shelf chassis (frame) ground and logic/signal ground leads shall be individually run and properly terminated.

- 2.6.2 Timing source signals input leads to a BITS clock from a network element must be shielded and ATT specification cable. If the lead has a DSX appearance, the shield/drain shall be grounded at the network element and the clock, but left unterminated at the DSX. If the lead does not have a DSX appearance, the shield/drain shall be grounded only at the timing source signal origin.
- 2.6.3 Where a shield/drain ground connection is required, verify that the ground termination pin is a DC-ground and not grounded through an AC-coupled capacitor at the timing source.

2.7. SONET Network Elements

- 2.7.1 SONET terminal/ADM equipment configurations requiring BITS timing shall be individually timed from the office BITS. Primary and secondary DS-One reference signals shall be from adjacent DS-One output cards, with odd-even slot assignments per AT&TIS interconnect drawings.
- 2.7.2 In the event of DS-One output card exhaustion, daisy-chaining to enable cascading of synchronization to all terminals within a bay framework is NOT an AT&T IS option and shall not be permitted. Arrangements must be made to provide additional BITS outputs.
- 2.7.3 Each SONET terminal/ADM shall have the “CLOCK IN” connections (PRIMARY and SECONDARY) cabled via 1175A red jacketed, single pair, 22 AWG, foil shielded BITS timing cable to the BITS. Shield lead conductors of all SONET sync signals input cables shall be DC-grounded at the BITS shelf only and left insulated and unterminated at the SONET terminal/ADM connector\terminal strip.
- 2.7.4 Except when required for office BITS reference, the “CLOCK OUT” from the network element shall not be cabled. Without exception, a wire-wrap adapter or equivalent shall be provided at the network element, if the primary and secondary “CLOCK OUT” leads are contained in the same connector\terminal strip (GR-1244, R3-10).
- 2.7.5 In limited/controlled applications, if DB9 connectors are required, all 22 AWG “CLOCK IN” shielded cables, terminating on DB9 connectors, shall use right angle connectors. The cable conductors shall be properly crimped or soldered to their associated pins. Wire wrap shall be used to terminate timing leads to a DB9 connector

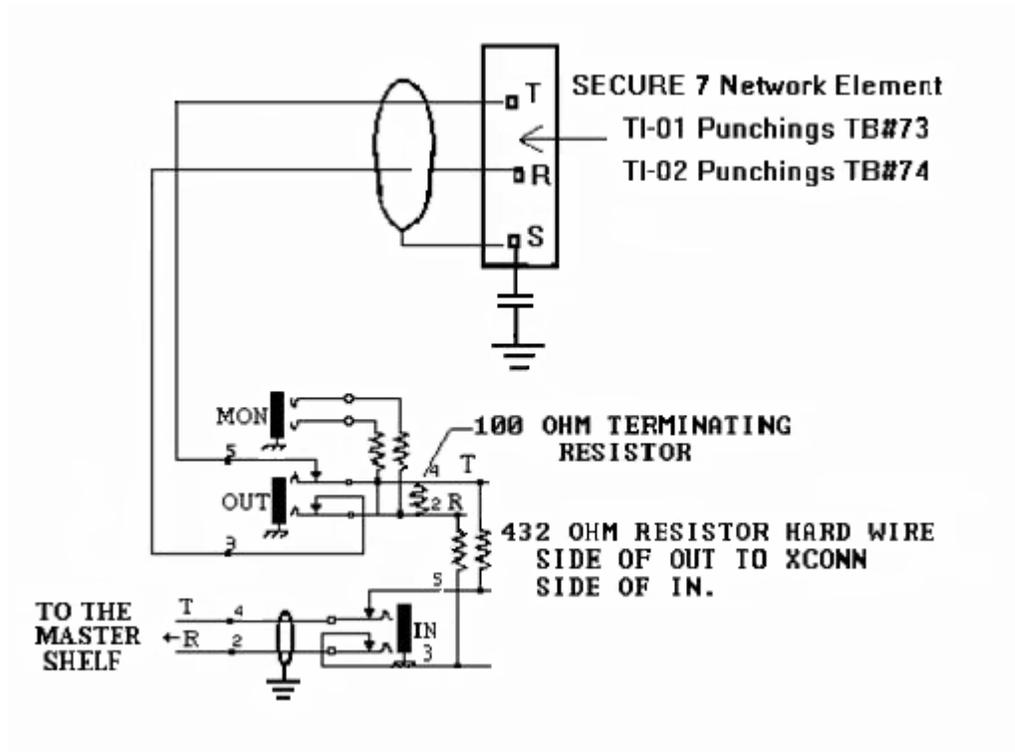
2.8. Removals

- 2.8.1 All Network Elements that are removed and have timing leads shall have the timing leads disconnected at the BITS.\
- 2.8.2 Complete all cable removal operations, update sync record assignment book and assure all updates match and are reflected in TAB/dB.

TABLE 11-1 – SUMMARY OF CHANGES IN SECTION 11

Change	Item in Issue	Item in This Issue
Revised		
Deleted		
Added		

FIGURE 11-1--SCHEMATIC OF SYNCHRONIZATION JACKS USING SECURE 7 REFERENCE SIGNAL

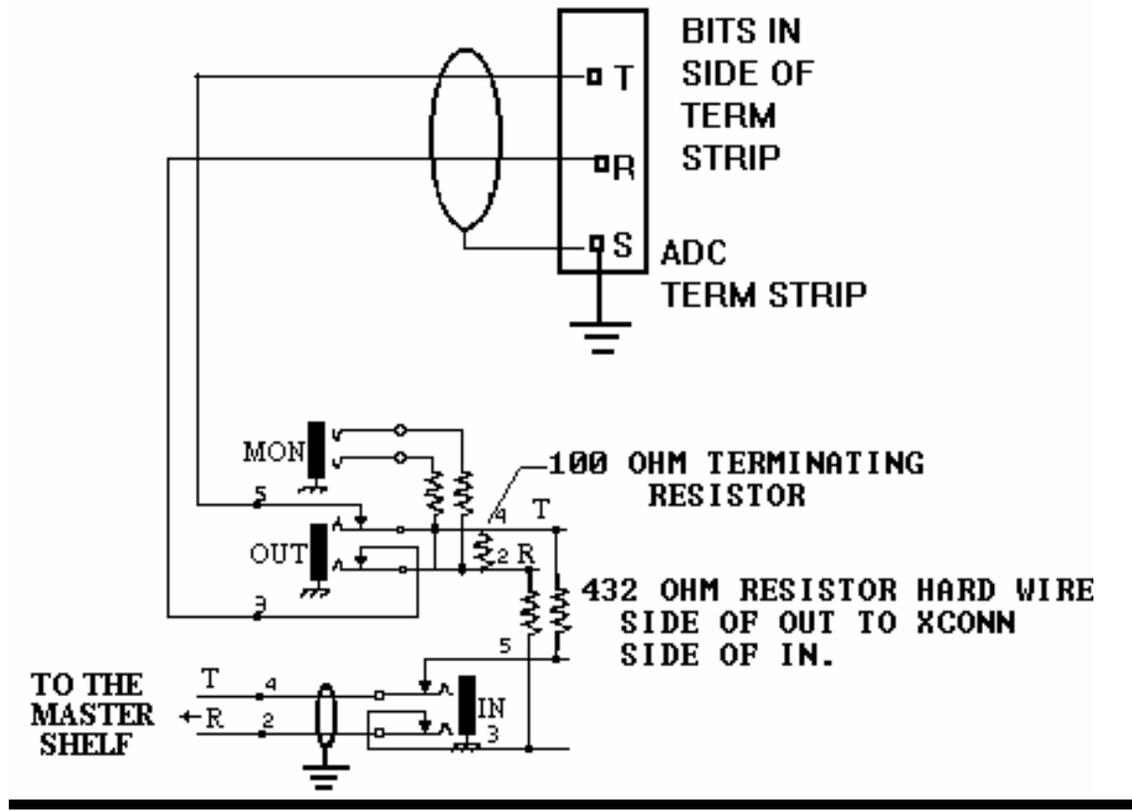


INPUT LEVELS INTO THE DCD SHELF MUST BE LESS THAN .3V FOR BRIDGED INPUT OR MORE THAN 1V FOR TERMINATED INPUT.

VOLTAGES MUST BE MEASURED WITH AN OSCILLOSCOPE

SHIELD TERMINATION FROM DSX TO THE BITS ARE REQUIRED. DCD-523 REFER TO NOTE 55 IN INTERCONNECT DRAWING FOR TERMINATION. DCD-ST2 AND DCD-400 SHELVES REQUIRE AN EXTERNAL GROUND SOURCE.

FIGURE 11-2--SCHEMATIC OF SYNCHRONIZATION JACKS USING SONET REFERENCED SIGNAL

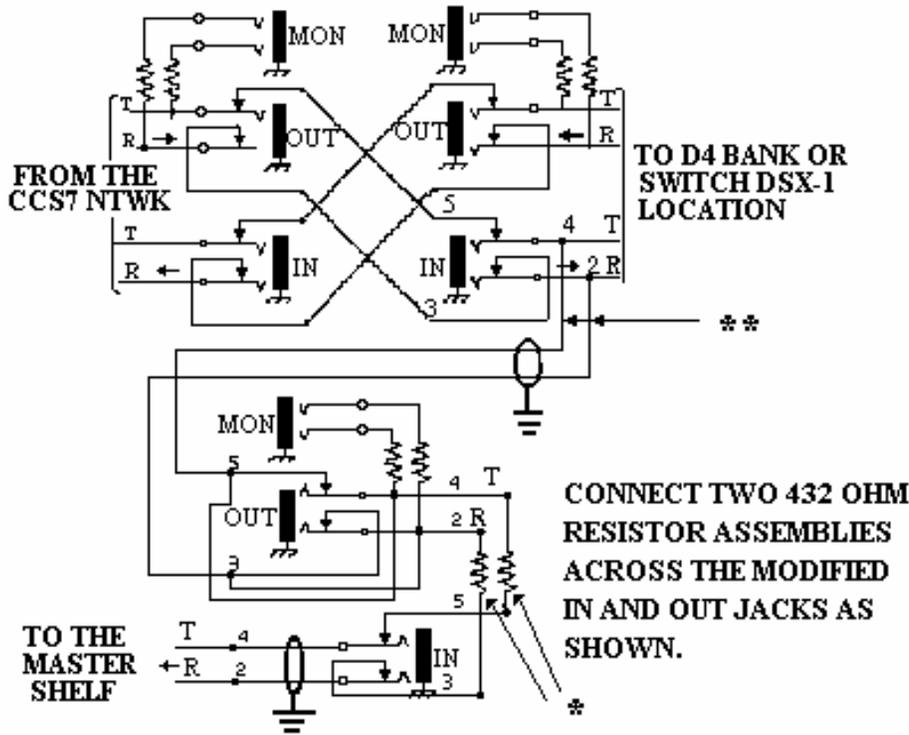


INPUT LEVELS INTO THE DCD SHELF MUST BE LESS THAN .3V FOR BRIDGED INPUT OR MORE THAN 1V FOR TERMINATED INPUT.

VOLTAGES MUST BE MEASURED WITH AN OSCILLOSCOPE

SHIELD TERMINATION FROM DSX TO THE BITS ARE REQUIRED. DCD-523 REFER TO NOTE 55 IN INTERCONNECT DRAWING FOR TERMINATION. DCD-ST2 AND DCD-400 SHELVES REQUIRE AN EXTERNAL GROUND SOURCE.

**FIGURE 11-3--SCHEMATIC OF SYNCHRONIZATION JACKS USING
 CCS7 REFERENCED SIGNAL OR TRAFFIC BEARING T1 SPAN**



* For locations where the DSX line-up is less than 5 bays and the Sync Jack is located in the middle bay. If this condition is not met, these resistors should be replaced with a strap.

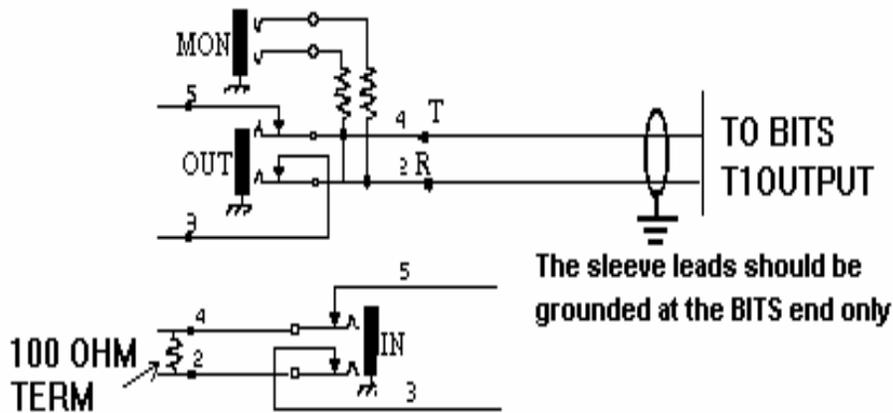
** When the DSX line-up is more than 6 bays or the length of these leads exceed 15 feet, the resistors should be connected between the hardwired side IN jack of the D4 bank jack and the OUT jack of the modified Sync. jack.

INPUT LEVELS INTO THE DCD SHELF MUST BE LESS THAN .3V FOR BRIDGED INPUT OR MORE THAN 1V FOR TERMINATED INPUT.

VOLTAGES MUST BE MEASURED WITH AN OSCILLOSCOPE

SHIELD TERMINATION FROM DSX TO THE BITS ARE REQUIRED. DCD-523 REFER TO NOTE 55 IN INTERCONNECT DRAWING FOR TERMINATION. DCD-ST2 AND DCD-400 SHELVES REQUIRE AN EXTERNAL GROUND SOURCE.

**FIGURE 11-5--SCHEMATIC OF SYNCHRONIZATION JACK
(INPUT TO NETWORK ELEMENT)**



[END OF SECTION]

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1 GENERAL

1.1 Introduction

- 1.1.1 This section covers the general requirements for engineering of battery/rectifiers (AC/DC), converters (DC/DC), inverters (DC/AC), Uninterruptible Power Systems (UPS), power systems monitor/controllers, AC/DC power distribution.
- 1.1.2 The AT&T IS Site Infrastructure Detail Engineer shall ensure that the manufacturer's specifications and documentation (i.e., electrical, mechanical, and maintenance documents, drawings, etc.) are provided with power equipment for turnover to local maintenance forces.
- 1.1.3 The AT&T IS Infrastructure Engineer shall coordinate with the AT&T IS Operations Engineer for the provisioning of the manufacturer's recommended spare parts for each type of power equipment.
- 1.1.4 The AT&T IS Infrastructure Engineer shall provision alarms for all new power equipment in accordance with BSP 801-601-900MP Alarm Standards Technical Manual. As a minimum, see Drawing ATT-P-05010-E.
- 1.1.5 The AT&T IS Infrastructure Engineer shall ensure all floor drains in engine or power rooms are permanently sealed prior to installation of equipment, via a specific installer note in the detail specification.
- 1.1.6 When adding equipment on waterproof floors the AT&T IS Infrastructure Engineer shall determine the method of securing equipment frames to the floor in accordance with BSP 800-000-101MP.
- 1.1.7 Reference BSP-155-002-900MP for standards for tap boxes.

1.2 Definitions and References Specific to Section 12

- 1.2.1 **Power DESP:** The provider of power detail engineering services, including DC power plant, UPS, standby generator engineering service providers.
- 1.2.2 **Listed:** Per the National Electrical Code "Listed" refers to equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that the equipment, material, or services either meets appropriate designated standards or has been tested and found suitable for a specified purpose.

FPN: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. Use of the system employed by the listing organization allows the authority having jurisdiction to identify a listed product.
- 1.2.3 [See Section 1](#) for General Definitions and Glossary
- 1.2.4 **Standard Drawings** are maintained on the Common Systems' web site at <http://mechteam.sbc.com:8080/Power/techpub.html>.

1.3 Compression Connections for DC Power

- 1.3.1 All connectors, including all approved transitional devices, shall be constructed of tin plated copper. Connectors with inspection holes shall be used in all applications except battery posts and connector plates.
- 1.3.2 Transitional devices require a Listed cover and must meet the fire resistance requirements of TP 76200. Covers shall have an oxygen index of 28% or greater and meet UL 94-V1 or better rating. AQUA-SEAL pads are not approved for use in AT&T.
- 1.3.3 In-line reduction (barrel) taps shall be used in preference to H-taps where possible to reduce cable build-up on the cable racks. Through end of year 2006 H-taps may continue to be used in existing POPs. New POPs should use only in-line reduction taps for one to one connections. The manufacturer provided clear heat shrink shall be installed per the manufacturer's instructions to cover the in-line reduction tap.
- 1.3.4 Lead coated connectors shall be used when connecting directly to posts or battery post termination plates of flooded type lead acid batteries. Lead coated connectors shall not be used for any other applications.
- 1.3.5 Manufacturer inspected and sealed battery connection kits (for non-flooded cells) with heat shrink tubing may be provided. These kits may have inspection holes as long as they are covered with heat shrink tubing.
- 1.3.6 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.
- 1.3.7 Valve Regulated Lead Acid (VRLA) batteries shall use connectors specified by the battery manufacturer.
- 1.3.8 NiCad battery connections shall be tin plated copper lugs without inspection holes and nickel plated steel hardware. Connections shall be coated with a thin layer of Nox-Rust X-110.
- 1.3.9 The NiCad battery hardware supplied by Saft® shall be used as standard metric threads are not compatible with the Saft® NiCad battery connections.
- 1.3.10 All connectors shall be the two (2) hole crimp type lugs (#8 stranded and larger) except when connecting to a stud in a power bay or when the equipment specification drawing requires a single hole lug. Single hole lugs require lock washers, except when connected to a fuse stud, in which case two (2) flat washers are required. These washers shall be provided as specified by the equipment manufacturer. (See ATT Drawing ATT-P-05100-E on the electronic file server under ATT CO drawings.
- 1.3.11 Connections made to screw type terminal blocks with #10 to #26 wire gauge shall be specified using the correct color coded insulated ring-type connector, such as the T&B STA-KON ®or Burndy VINYLUG®. The proper size connector shall be used for the wire size being terminated as detailed in the manufacturer's specifications.

- 1.3.12 New power plant installations with ultimate capacity of 4000 amps and above shall use copper bus bars. No new aluminum bars will be used.
- 1.3.13 Non-hardened copper bus bars shall not be tapped for fastening terminal lugs; through-bolts shall be used.
- 1.3.14 For all electrical connections, except for battery post connecting hardware, the Power DESP shall provide zinc plated SAE J429 Grade 5 or ASTM B99 silicon bronze finished bus bar joint, fastening and support bolts, nuts, washers, etc. The hardware shall be American National Course with a Class #2 Fit and Grade 5 or better.
- 1.3.15 When fastening bar to bar, bus bar clamps shall be used. A palnut or locknut shall be provided on each bus bar clamp bolt.
- 1.3.16 Ferrous bolts, screws, nuts, washers, bus bar supports and clips shall be zinc or cadmium plated for non-electrical connections.
- 1.3.17 Only American Standard Unified National Course (UNC) 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).
- 1.3.18 Exposed energized bus bar arrangements located outside of the power equipment areas, shall be protected with insulating (e.g., Lexan®) covers meeting the oxygen index of 28% or greater. In power rooms or in power board lineups containing power exclusively, insulated covers are not required.

2 BATTERY/RECTIFIER (AC/DC)

2.1 General

- 2.1.1 This unit covers requirements for battery/rectifier systems utilized within Information Services Equipment (ISE) facilities and non-regulated/non-utility locations and subject to the rules and requirements as defined in NFPA 70- National Electrical Code (NEC) or Local Electrical Code.
- 2.1.2 AT&T IS will deploy single architecture DC Power Plants with four hours of battery reserve. The DC Plant will provide feeds to single (not dual) BDFBs. Each BDFB will be, at a minimum, dual load and will provide an A&B feed to each DC-powered network element. Refer to [ATT-790-100-656](#), DC Power Distribution, for BDFB engineering.

2.2 Rectifier Plants

- 2.2.1 The major components of the power distribution plant and rectifier plant ([see Figure 12-1](#)) are:
 - a) LOCAL AC POWER DISTRIBUTION - Includes a dedicated Power Distribution Service Cabinet (PDSC) connected to the House Service Board (HSB), conduit, cabling, fasteners, and protective equipment.
 - b) CHARGING EQUIPMENT - Consists of rectifiers and associated equipment to convert AC power to DC power at voltages suitable for AT&T IS applications.
 - c) STORAGE BATTERIES - Provides a source of DC power to the equipment when AC is not available, or until the AC can be restored. They also provide filtering of the rectifier output.

d) DISTRIBUTION CIRCUITS (Primary, Secondary)

- (i) Primary Distribution circuits originate at the power plant and terminate at a secondary distribution point or at specific equipment locations (Protected Circuit). It contains a power board that houses the first over-current protection devices and the downstream power distribution network that feeds the secondary distribution.
- (ii) Secondary Distribution is an intermediate protection network between the primary and the load equipment. It originates at a distribution point (i.e. BDFB, SPDU, or other similar distribution points) and terminates at a specific equipment location (Protected Circuit). All growth and new power plant installations shall include an exclusive fused distribution bay (i.e. BDFB, mini BDFB, micro BDFB, or Intermediate SPDU) for secondary loads (network elements) if one does not exist. This fused distribution bay shall not be located in the traditional power plant footprint. The secondary distribution network contains a bay or panel that houses the over-current protection devices, and the downstream power conductors to the load equipment. Secondary distribution may be located adjacent to the primary distribution power board or remotely on the same or different floors. Secondary distribution (e.g., BDFBs, SPDUs) may also further feed smaller downstream distribution panels following a branch feed style of architecture (i.e., Fuse panels).
- (iii) Primary and secondary circuit protection devices shall be coordinated to prevent premature operation of primary fuses caused by faults on secondary circuits. This coordination allows for circuit protection closest to the network element to activate first, in the event of a failure. When calculating individual circuit design, there should be approximately 20% difference in size between one point of circuit protection to the next.

e) DISTRIBUTION CIRCUIT COMPONENTS

DC distribution systems consist of three basic components:

- Circuit protection device
- Battery and battery return conductors
- Terminating hardware at the circuit's origin and equipment end.

f) CONTROL VOLTAGE – Is the voltage used to operate alarm relays and control circuits in the power plant. The voltage of the primary plant (48 volts, if available) will be the control voltage.

g) FLOAT VOLTAGE/PLANT VOLTAGE – is the voltage read at battery string A. This is the source of the AT&T IS plant voltage as read at the controller.

h) BATTERY DISCONNECT & DC-EPO – Physical interruption of the DC battery connection. Per NEC 645.10, All DC power plants engineered for the exclusive use of the AT&T Internet Services space on raised floor (IT Equipment environment) shall include a means of disconnecting the batteries from its load. Non-raised floor space for AT&T Internet Services does not require EPOs unless specifically required by the local Authority Having Jurisdiction

1. As a first choice, the DC power plants shall be ordered and equipped with battery disconnects for each and every battery string applied in service. Physical disconnection of the batteries at the power plant is considered the optimal choice.

2. If the applied DC Power Plant is not capable of battery disconnection, a stand alone disconnect device may be deployed within the un-fused battery circuit. The battery string disconnect may be

located at the battery stand or in a stand alone rack. Refer to the Approved Products List for appropriate equipment. (Remote disconnect modules are currently under review).

3. All physical battery disconnects shall include the means of local and remote de-activation. The remote feature shall be engineered to collectively bring the sense leads to a common location. The disconnect switch (a.k.a. EPO) shall be placed at principle exit doors and comply with Article 645 of the NEC. Disconnects should be separated as much as practicable from light switches, fire alarm devices, etc.

4. Engineering and installation of the EPO switch shall be considered part of the DC Power Plant.

5. All service de-activation switches (EPO) shall be engineered and installed in a secure method. This includes conduit and appropriate labeling. The remote control leads shall be engineered in approved conduit material. Conduit shall be stenciled to identify itself as "DC EPO" once every 10 feet throughout the conduit run and within the first and last 5 feet of the to and from terminations.

Service De-activation switches (EPO) shall be readily accessible but secure from casual or accidental shut down by including a transparent (Lexan) type face or door. Movement or opening or closing of the transparent door shall not have the ability to accidentally trigger the EPO. The door shall not require a key or any other locking device but shall include a break away tie clasp, pull pin or seal as a security measure. As an additional safety factor, the security door may include a local audible alarm indicating the pre-activation doors have been opened.

The EPO switch shall be Listed.

Furthermore the arrangement of the emergency switching shall be such that its operation does not introduce a further danger or interfere with the complete operation necessary to remove the danger"

The remote EPO switch only serves to disconnect the battery strings and shall not be engineered for reconnection purposes. Testing can occur during initial installation; however, no further testing shall occur once the system is activated.

If an AC EPO switch is part of the facility installation, full segregation between the AC and DC EPOs shall occur. Ganging or co-habitation of the AC and DC EPO's shall not occur.

6. The EPO switch shall be a latching mechanical switch-type and must provide an indicator or lock in place to identify activation when depressed; or operated.

7. Resetting the EPO switch shall not serve to restore the equipment but to simply restore the EPO switch itself. Battery disconnect switches will have to be manually reset using appropriate restoral methods.

2.2.2 Rectifier DC power connections from both supply and return shall utilize crimp type (silver/tin) plated copper connections. Aluminum connectors are not acceptable. Power connectors shall be configured as follows:

a) Within the supplier's equipment, power connections shall be configured to meet the manufacturer's requirements.

b) Between the supplier's equipment in the bay and the top of the bay, connections shall be two-hole crimp with inspection window to verify the connection is fully engaged. Approved connectors can be found on the AT&T Minor Materials list.

2.2.3 AC feeders to rectifiers shall be enclosed in metallic conduit, raceway or bus duct. Vertical runs of Jacketed Metal Clad (JMC) cable or Liquidtite™ conduit shall only be used on the last three feet of the connection to the rectifier.

2.2.4 Metallic conduit (rigid, intermediate metallic conduit (IMC) and electrical metallic tubing (EMT)) is acceptable if it is not installed on cable racks. If EMT is used, steel fittings shall be used.

2.3. Batteries

2.3.1 Flooded lead acid batteries are the AT&T standard. VRLA batteries will be used only as a last choice. With VRLA battery strings, the AT&T IS Infrastructure Engineer shall provide the intercell connectors and associated hardware recommended by the battery manufacturer.

2.3.2 For flooded lead acid batteries the recommended alarm points for the 52.8 float are: Very High Voltage – 54.0V; High Voltage – 53.50V; Low Voltage – 51.25V; Very Low Voltage – 46.50V.

2.3.3 Nickel-Cadmium (NiCad) batteries are a replacement for small capacity battery plants using VRLA batteries or the lower capacity flooded lead acid batteries that have been manufacturer discontinued or unapproved.

2.3.4 The NiCad battery strings for applications contain 38 (1.43V) cells that shall have a string float voltage measured at 54.4V for optimum performance.

2.3.5 The higher than normal NiCad 54.4V float voltage requires that a power plant be entirely supported by NiCad batteries. Strings of other battery types and float requirements such as flooded lead acid batteries shall not be mixed with NiCad battery strings in the same power plant.

2.3.6 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.

2.3.7 NiCad battery racks shall have sliding shelves, and shall meet the seismic rating for the geographical area.

2.3.8 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.

2.3.9 NiCad batteries contain a corrosive alkaline electrolyte solution that shall be neutralized with a special NiCad spill kit (which is labeled in bright orange). The AT&T IS Infrastructure Engineer shall specify a NiCad spill kit for each new installation site. (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.) Spill kits shall be left on-site.

2.3.10 NiCad batteries shall use constant voltage charging to maintain float voltage. Temperature compensated voltage control for VRLA application is not recommended.

2.3.11 Additional details regarding NiCad batteries can be found in ATT Power Drawing – ATT-P-05330-E on the electronic file server site, under ATT CO Power Drawings.

- 2.3.12 Plastic battery stands used for round type lead acid cells shall only be used in seismic zones 2 and below areas and shall be installed with floor mounted corner securing details.
- 2.3.13 When engineering new battery plants the AT&T IS Infrastructure Engineer shall provide approved spill kits. Containment kits shall be provided on a site by site basis according to local code mandates and Fire Marshall directives
- 2.3.14 When engineering battery installations, cells of different manufacturers shall not be placed in the same string. Strings of different manufacturers may be placed in parallel.
- 2.3.15 When engineering the replacement of individual cells in a string, the cells provided will have the same ampere-hour capacity, the same number of plates and will be of the same manufacturer.
- 2.3.16 Measured at floor level, a clear and open aisle of 36 inches shall be maintained between a battery rack, equipment, rigid spill containment, and non-movable obstructions. A single row rack parallel to a wall shall be a minimum of 8 inches from the wall. One end of all other battery stands can be placed perpendicular to the wall within 8 inches.
- 2.3.17 The Power DESP shall provide a thermometer for each flooded lead acid battery string installed which may be included in a battery accessory kit.

2.4. Cable And Bus Bars

- 2.4.1 Whether cables or bus bars are used, each type of conductor shall be sized per Figure 12-2, to prevent heating or exceeding the voltage drop requirement.
- 2.4.2 4/0 flexible type power cable shall be the standard size and type to be used on all cells through 1800AH on battery tier-to-tier or tier-to-termination bar applications. 350kcmil, flexible type power cable, shall be used on 1801AH to 4000AH cells.
- 2.4.3 All bus bars shall be 95% hard drawn copper, bare or tinned.
- 2.4.4 All connections to a bus bar shall be made with a two-hole crimp type connector only. See Drawing ATT-P-05100-E.
- 2.4.5 Cables from the rectifiers to the batteries and from the batteries to the discharge panel shall be on dedicated, non-fused cable racks that are labeled accordingly.

3 AC Distribution (General)

3.1 AC Panels

- 3.1.1 These requirements shall apply when the installation environment is in a non-regulated and non-utility workspace. If there are conflicts between the NEC or Local Electrical Code and the AT&T general requirements listed in this document, the NEC or Local Electrical Code shall prevail. Permits will be required and all applicable local and city codes shall be followed
- 3.1.2 Working Space around all newly placed AC panels and serving equipment shall comply with the NEC, Article 110.26, Spaces About Electrical Equipment.

NOTE: Working clearances vary based on voltage and AC equipment configurations.

3.2 AC Cabling

- 3.2.1 All AC conductors must be enclosed in a Listed conduit, metal raceway or trough. Armored Cable (Type AC) cable may be used only when factory installed within bay or end-guards, and AC outlet extensions between bays, within the base of the bay.
- 3.2.2 For equipment applications where rigid conduit connections are not practical, Liquidtight Flexible Metal Conduit (LFMC) may be used, but shall be limited to three feet or less. Final AC equipment connections with Liquidtight Flexible Metal Conduit (LFMC) (Seal-Tite® or Liquidtite® rated UL 94 V-0) shall not exceed three feet.
- 3.2.3 Final AC lighting fixture connections with Liquidtight Flexible Metal Conduit (LFMC) (Seal-Tite® or Liquidtite® rated UL 94 V-0) shall not exceed six feet.

3.3 AC General Purpose Receptacles in the DC Environment

- 3.3.1 All AC general purpose receptacles are connected to Power Service Cabinets (PSCs) outside the protected load network. These receptacles are engineered and intended to support portable test equipment or portable electrical tools.
- 3.3.2 All wiring and conduit installed in the Non-Regulated/Non-Utility work space shall meet the requirements of the National Electrical Code (NEC), local code and shall be Listed.
- 3.3.3 Circuit breakers shall only be opened with prior authorization by the AT&T Representative.
- 3.3.4 While work is being done on AC circuits, circuit breakers shall be opened whenever it is practical to do so without causing a service interruption.
- 3.3.5 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.
- 3.3.6 All conduit raceways, regardless of the type, shall have an Equipment Grounding Conductor (a.k.a. ACEG) installed with the feeder or branch circuit conductors. Minimum size Equipment Grounding Conductors for raceway and equipment shall comply with Table 250.122 in the NEC.
- 3.3.7 The spacing of general purpose AC receptacles shall be every third bay, not to exceed 10 feet in equipment frames. A single or stand-alone frame shall be engineered to have a general purpose receptacle provided or placed in the base. The circuits shall be designed with no more than 10 duplex outlets per 15 ampere circuit breaker or 13 duplex outlets per 20ampere circuit breaker.
- 3.3.8 AC general purpose receptacles shall be specified to be flush and equipped with a cover plate.
- 3.3.9 The entire length of the metallic raceway, conduit or trough shall be designed to provide a continuous conductive path for grounding.
- 3.3.10 Isolated ground AC receptacles (orange) shall not used or be specified.
- 3.3.11 Wire and cable utilized to distribute AC power shall meet the requirements of the NEC or local electrical code and shall be Listed.
- 3.3.12 All wiring used to distribute AC power shall be copper.

3.4 Conduit

3.4.1 Refer to Section I of TP76301 for information regarding conduit.

3.5 Branch Circuits

3.5.1 The AT&T IS Infrastructure Engineer shall specify a green ACEG lead for all AC lighting fixtures.

3.5.2 When extending an existing circuit, the AT&T IS Operations Engineer working with the AT&T IS Infrastructure Engineer shall confirm that enough capacity on the protection device rating exists for the additional load and the voltage drop allowance for the circuit is not exceeded (NEC, Chapter 9, Table 9).

4 AC REQUIREMENTS – (PROTECTED POWER)

4.1 General Requirements

4.1.1 UPS systems shall be in a dual architecture, identically sized, to meet a five year growth projection or sized identically based on a 50-100 watt per square foot factor. All UPS units will be on-line, double conversion, single module systems containing their own external maintenance bypass switch. On the input side, it is preferable that each UPS unit, "A" and "B", be fed by a separate main distribution panel. On the output side, UPS "A" and UPS "B" shall be wired out to their own distribution panel.

NOTE: As of November 2005 this model is under review by AT&T labs and may change.

4.1.2 Distribution configurations shall be based on load requirements. Dual powered equipment loads shall be directly fed from both UPS A and UPS B PDUs. Single load equipment may be fed from either a UPS A or UPS B PDU, or a Static Transfer Switch (STS) PDU connected to UPS A and UPS B based on the service criticality of the load.

4.1.3 UPS "A" and UPS "B" shall have its own battery back-up. Battery reserve time shall be engineered to 30 minutes based on full load. Flooded cell batteries are first choice but, based on space and loading limitations, VRLA can be the second choice. Batteries may be in attached or detached cabinets or in battery racks as best fits the application. Approved Products shall be used in all applications.

4.1.4 Where space is available it is a preference that batteries be partitioned with appropriate exhaust to the outside.

4.1.5 In installations with VRLA batteries battery monitoring will be included.

4.1.6 In the dual architecture (e.g. two 400kVA units), load must be monitored to insure that either UPS unit can pick up the full load in the event it's counterpart fails or goes down. Neither UPS should be loaded beyond 40% and a load of 35% shall trigger the AT&T IS Infrastructure Engineer to begin the planning and engineering process to relieve the load or upgrade the UPS units.

4.1.7 These requirements shall apply when the installation environment is in a non-regulated and non-utility workspace. If there are conflicts between the NEC or Local Electrical Code and the AT&T general requirements listed in this document, the NEC or Local Electrical Code shall prevail. Permits will be required and all applicable local and city codes shall be followed

- 4.1.8 Where required, the Power DESP may reference the specific requirements for AC equipment connections in accordance with the NEC or Local Electrical Code.
- 4.1.9 All equipment engineering details and instructions shall include language to insure installation technicians and circuits are adequately protected from voltage hazards and service interruptions.
- 4.1.10 Detail engineering instruction shall be written to insure that all electrical circuits, Information Services Equipment (ISE), AC conductors and bus bars are protected any time there is installation activity in the immediate vicinity. See the NEC and Section B of [ATT-TP-76301](#).
- 4.1.11 Working Space around all newly placed AC panels and serving equipment shall comply with the NEC, Article 110.26, Spaces About Electrical Equipment.
- 4.1.12 If an AC load is identified as “protected”, it shall be fed from an inverter plant or Uninterruptible Power System (UPS), as determined by the AT&T Equipment Engineer. These protected loads shall be distributed through Protected Power Service Cabinets (PPSC).
- 4.1.13 All protected AC receptacles shall be engineered to connect to a PPSC within the protected load network. These receptacles are engineered to support protected ISE.
- 4.1.14 Protected Power equipment distribution shall maintain separate and distinct paths from other forms of power distribution.
- 4.1.15 Circuit breakers shall only be opened with prior authorization by the AT&T Representative.
- 4.1.16 While work is being done on AC circuits, circuit breakers shall be opened whenever it is practical to do so without causing a service interruption.
- 4.1.17 If a service interruption is part of the work to be performed, this information shall be duly noted and highlighted on the Installation procedures and approved by the AT&T Representative prior to any work activity.
- 4.1.18 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. This documentation shall be included in the job specification.
- 4.1.19 The entire length of the metallic raceway, conduit or trough shall be designed to provide a continuous conductive path for grounding.
- 4.1.20 Isolated ground AC receptacles (orange) shall not be used or specified.
- 4.1.21 Wire and cable used to distribute AC power shall meet the requirements of the NEC or local code and shall be Listed.
- 4.1.22 All wiring used to distribute AC power shall be copper.
- 4.1.23 As a minimum, AC circuits in this section shall comply with the NEC requirements for *Information Services Equipment* found in Art. 645.

4.2 AC Circuit Protection Devices

- 4.2.1 Thermal breakers are acceptable for most applications and may be used unless indicated by the equipment manufacturer's documentation or specifically instructed by the AT&T Equipment Engineer.
- 4.2.2 For equipment loads having start surges (such as those using capacitors) it is recommended that thermal-magnetic circuit breakers be specified.
- 4.2.3 Circuit design shall not include circuit protection devices engineered in parallel to increase the circuit capacity.
- 4.2.4 Circuit Protection devices shall be engineered based on an 80% rating unless the circuit protector is rated at 100%. Therefore, the continuous load on a circuit breaker should not exceed 80% of its listed capacity. The circuit protection device shall be sized at 125% of the maximum equipment connected load.
- 4.2.5 Circuit protection devices installed in PPSC distribution cabinets shall be specified as bolt-on type rather than the clip-on type. This configuration avoids poor connections, overheating of the circuit and distribution panel, and premature circuit failure.
- 4.2.6 All distribution panel types shall have a nameplate that includes the distribution panel designation, input power source (supply panel designation), supply panel protection device rating, voltage and phases. (Reference TP 76301, Section L)
- 4.2.7 When a new distribution panel is installed in the PPSC architecture, the existing single line drawing shall be modified or created to reflect the changes and provided during the installation/completion of the job. (Reference TP 76301, Section L)

4.3 AC Cabling

- 4.3.1 All cable specified, shall meet current AT&T Standards and the requirements of the NEC or Local Electrical Code for the specific application. Reused cable is not acceptable (excluding whip cables).
- 4.3.2 Conductors used in ISE circuits shall be engineered at no less than 125% of the worst case connected equipment load (see NEC Art. 645.5.) and must include ampacity equal to or greater than the serving protection device.

4.4 AC Conduit, Bus Ducts & Troughs

- 4.4.1 As noted in the NEC Art. 645 there are multiple forms of acceptable conductor ducting including conduit, bus duct, troughs and etc. The following identifies four specific distribution segments that AT&T requires.
 - a) **Primary Power:** Conductors routed from the Main HSB to the UPS. Typically ≤ 480 Vac. Cable and conduit shall meet the applicable sections of the NEC or Local Electrical Code as defined by the equipment type and physical location. Die-cast fittings shall not be used.
 - b) **UPS System Distribution:** Conductors routed from the UPS to the first Distribution Center. Cable and conduit shall meet the applicable sections of the NEC or Local Electrical Code as defined by the equipment type and physical location. Die-cast fittings shall not be used.

- c) **Distribution Center:** Equipment bay/rack ISE circuits shall be distributed from the Distribution Center panel to the equipment cabinet line ups through NEMA 1 level metallic troughs equipped with knockout capability. This may be \leq 240 Vac.
- d) **Cabinet/Bay Protected Power Strip:** Final distribution found at the ISE equipment bay/cabinet. From the aisle trough; the use of ZLHA flexible Liquidtight™ shall be hardwired from the trough to the cabinet equipped Protected Power Strip. This could be a 110 or 208/240 Vac circuit

4.4.2 All primary, secondary distribution troughs, ridged conduits and Liquidtight Flexible Metal Conduit (LFMC) feeding equipment bays shall be installed per the NEC, or Local Electrical Code. This method shall be used in either the raised floor or overhead environments.

4.4.3 AC conduit runs and bus duct (if used) shall be installed per the NEC, or Local Electrical Code requirements.

4.5 Inverters (DC/AC) and Uninterruptible Power Systems (UPS).

4.5.1 If the AC load is identified as “uninterruptible”, it shall be fed from an inverter plant or Uninterruptible Power System (UPS), as determined by the AT&T Equipment Engineer. These protected loads shall be distributed through Protected Power Distribution Service Cabinets (PPSCs).

4.5.2 The use of inverters shall be considered for planned loads of 60kVA and below as the first choice. Loads greater than 60kVA shall be served via UPS equipment. Current approved Inverter technology is sized in systems of 21kVA, and up to 3 systems can be installed. However, all systems shall require independent dedicated PPSCs as the current inverter systems cannot be paralleled.

4.5.3 An AC maintenance bypass switch from a separate commercial AC power source to the inverter/UPS output PPSC shall be provided to allow maintenance or removal of the uninterruptible AC element on UPS and inverter systems larger than 10KVA inverters.

4.6 UPS Apparatus Considerations

4.6.1 AC wiring shall be sized to meet manufacturer’s specifications, NEC or Local Electrical Code requirements, whichever is more stringent. Rigid metallic conduit shall be used in areas where activity could jeopardize the integrity of the system.

4.6.2 Grounding of the UPS shall be in accordance with the manufacturer’s specifications, NEC, Local Electrical Code or Section 13 of ATT-TP-76401, whichever is more stringent.

4.6.3 Circuit breakers shall be sized and coordinated with system components to ensure proper isolation of feeders due to faults or overloads. Breakers shall be sized to allow all charge units to operate at full output during battery recharge. Additionally, all circuit design shall include adequate circuit coordination as listed in NEC Art. 240 Overcurrent Protection.

4.6.4 DC supply wiring used in Inverter Systems shall be sized to meet manufacturers' specifications for ampacity and loop voltage loss between the battery and the charger or inverter. These leads shall be run on open cable racks or trays from the serving DC Power Plant. However, conduit may be used if both the positive and negative leads are run in the same conduit. Conduit should be used only if other means are not available due to space requirements.

4.7 UPS Battery DC Cabling.

4.7.1 Battery cabling within the string shall be black non-braided or gray braided insulated flex cable. Gray braided flex cable shall be used from the battery string to the disconnect switch

4.7.2 Inter-cell straps shall meet manufacturer requirements and shall be attached with stainless steel hardware.

4.7.3 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.

4.8 UPS Battery Disconnect Switch.

4.8.1 UPS battery disconnect switch cabling to the UPS shall be either supplied by the manufacturer or shall be cotton braided/flex cabling.

4.8.2 UPS battery disconnect switches (one per string) shall be located within the battery area. The local AHJ may dictate the specific location.

4.9 UPS Battery Applications

4.9.1 Flooded batteries are considered the first choice in any UPS application, however floor space limitations may dictate the use of Valve Regulated Lead Acid batteries (VRLA).

4.9.2 UPS Batteries approved for use are listed on the AT&T Common Systems Power Approved Products list. Additionally AT&T standardizes on low specific gravity batteries to further life expectancy.

4.10 UPS Battery Stands/Cabinets

4.10.1 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>

4.10.2 VRLA battery cabinets shall be Listed.

4.11 UPS EPO Switches

4.11.1 Where require, 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.

4.12 Protected Power Service Cabinets (PPSC)

- 4.12.1 On a going forward basis the term PPSC will be included in the labeled identification of all AC Protected Distribution Panel cabinets located on the load distribution side of any UPS
- 4.12.2 Only bolt-on type distribution circuit breakers (no clip-on type) shall be specified for all Protected Power Service Cabinets. This configuration avoids poor connections, overheating of the circuit and distribution panel, and premature circuit failure.

4.13 Protected Power Strips

- 4.13.1 Protected Power Strips serve as the final point of AC distribution typically found in the ISE cabinet/bay.
- 4.13.2 The AT&T IS Infrastructure Engineer shall specify Protected Power Strips that are approved for use by AT&T. Power strips in the protected power architecture shall be equipped with the following features:
 - 4.13.3 Protected Power strips shall be hardwired between the strip and the adjoining cable trough by a flexible conduit. (a.k.a. whip). The whip shall be comprised of a ZHFL rated Liquidtite™ flexible conduit. The conduit will be mechanically attached at both ends using standard electrical connection hardware.
 - 4.13.4 The Protected power strip shall be bolted and permanently affixed to the cabinet/bay structure.
 - 4.13.5 Depending on the ISE configuration the protected power strip may be specified as horizontal or vertical mounting.
 - 4.13.6 The ISE configuration shall include separate protected power strips to support the A & B loads independently.
 - 4.13.7 Each Protected Power Strips shall be engineered with a dedicated supply circuit and load managed (monitored), not to exceed 80% of the supply circuit breaker.
 - 4.13.8 The protected power strip shall not include local fusing or a cut off switch.
 - 4.13.9 Surge protection is not required and shall not be included in the protected power strip.
 - 4.13.10 The protected power strip shall be Listed.

5 RING VOLTAGE

5.1 Voltage other than -48v DC

Equipment requiring voltage other than -48v DC or ring cadence of any type should be generated within the equipment.

6 DC POWER DISTRIBUTION

6.1 Power Distribution Sources

- 6.1.1 Fuses are preferred for primary distribution equipment.
- 6.1.2 Equipment being engineered with multiple loads (i.e. "A", "B", "C", etc.):

- a) Shall be assigned to different load supplies on the BDFB.
 - b) Shall maintain separate primary fuse integrity throughout the circuit
- 6.1.3 Primary battery and battery return leads shall be run on unpanned dedicated power cable rack. Secondary power leads shall be run on existing, dedicated secondary power cable racks, whenever possible. If dedicated cable rack is not available, secondary power leads shall be run on existing non-dedicated cable rack.
- 6.1.4 A separate battery return lead shall be paired with each distribution or source lead. A and B battery return leads may be connected to the same battery return bus bar position.
- 6.1.5 The Power DESP shall provide 145P (tag) or approved equivalent tags for both ends of every battery and battery return lead, except secondary power leads internal to a rack.
- 6.1.6 Preferred fuse panels for BDFBs are telecommunications power-style (e.g. TELPOWER®), which accommodate fuse sizes from 1 to 150 amps.
- 6.1.7 The maximum fusing for a supply to a single or multiple bays BDFB shall be sized to the bus distribution, not to exceed 800 amps per load, unless prohibited by state or local codes.
- 6.1.8 On a going forward basis, the Power DESP shall provide a work item to stencil the manufacturer's maximum BDFB bus capacity on the front of the BDFB. This labeling shall be located near other specifications at the BDFB meter panel.
- 6.1.9 The largest fuse to be used in a BDFB shall be 150 amps.
- 6.1.10 In a BDFB, a single panel shall not have multiple feeds connected to it.
- 6.1.11 Only factory manufactured 45 or 90 degree lugs shall be used to minimize cable congestion within the BDFB.
- 6.1.12 Any secondary distribution equipment located on one floor shall not be used to supply equipment located on another floor, except in those cases where requirements state that equipment units must be supplied from the same secondary distribution equipment and the equipment units are located on different floors.
- 6.1.13 For new BDFBs configured with external battery return bus bars, the bars shall be mounted as close as possible to the BDFB without impeding the access to the BDFB or associated cable racks. The preferred placement for the external return bar is at the rear of the BDFB at the cable rack level or higher; however, it can also be placed to the side of the BDFB, at the cable rack level or higher, based on space availability. ([See figure 12-3](#) in this section for BDFB external battery return bar placement, and [ATT-TP-76401, Section 8](#) figures for common systems cabling and rack details.)
- 6.1.14 Secondary Distribution is defined as any distribution circuit between the primary power distribution source and the final distribution element at the equipment load. Secondary distribution devices are listed:
- a) A Battery Distribution Fuse Bay (BDFB) - 7' full bay BDFB, at least 2 separate loads providing a minimum of 96 positions.
 - b) A Mini-Battery Distribution Fuse Bay (BDFB) – Typically half the physical size of a full size BDFB with approximately 48 fuse positions. Only available in two load.

- c) A Micro-Battery Distribution Fuse Bay (BDFB) - Approximately 1 quarter the size of a full size BDFB. Only available in two loads with approximately 24-36 fuse positions.
 - d) An Intermediate Secondary Power Distribution Unit (SPDU) – Approximately 1 eighth the size of a full size BDFB. Only available in two loads with approximately 8-16 fuse positions.
 - e) A Secondary Power Distribution Unit (SPDU) Dual A/B loads with approximately 10-20 GMT or 70-type fuse positions. GMT type fuse panels are limited by the manufacturers rating, but typically can support between 10-20 amp fuse requirements.
- 6.1.15 In some limited applications, a standard SPDU can feed another SPDU or PDU as long as the appropriate fuse coordination and voltage drop limitation can be achieved.
- 6.1.16 A Power Distribution Unit (PDU) is the final form of distribution used to directly feed the network element. PDUs may serve network elements outside the bay in which the fuse panel resides as long as it is within a close proximity of the fuse panel, and does not exceed the engineered limitation of the largest output cable the panel can accommodate. Exact distances will vary from panel to panel and overall shall not be outside a line-of-sight. Distances shall be calculated by determining the largest conductor physically attachable to the panel (tapping a larger cable to increase the distance is not acceptable), appropriate voltage drop, and List 2 DC amperage value to be used per fuse position.
- 6.1.17 SPDUs shall be fused at their source (Power Board or BDFB) with a fuse size not to exceed the maximum rating of the fuse panel using a single fuse and set of power cables per load.
- 6.1.18 Fuse panels shall not be "daisy chained" to the same source (sharing the same cable or fuse).

6.2. DC Equipment Loads

- 6.2.1 The nominal voltage levels for standard telecommunications equipment is -48Vdc. Although nominal voltages are standardized, the limits permitted on individual equipment assemblies are more variable. Voltage requirements are:
- a) HIGH VOLTAGE LIMIT - Above this supply voltage, equipment damage may occur.
 - b) LOW VOLTAGE LIMIT - Below this supply voltage, equipment does not operate properly.
 - c) ELECTRONIC NOISE IMMUNITY - The power supply shall not exceed manufacturer's requirements and in no case exceed 35 dBmC.
- 6.2.2 The maximum allowable one way voltage drop from batteries to the served equipment via a BDFB/SPDU shall be 1.0 volt per ATT-P-05410-E drawing.
- 6.2.3 The Power DESP shall assure that the maximum allowable voltage drop from the battery to the served equipment is not exceeded. This voltage drop is an engineered value, based on the minimum volts per cell (MVPC) used in calculating battery requirements. Refer to the BDFB CO records in TAB/db & PowerPro for the engineered voltage drop values of each BDFB.

6.3. DC Protector And Cable Sizing

- 6.3.1 Overcurrent protection (fuses) and secondary distribution cables are sized using List 2 current drain. List 2 current drain represents the peak current for a circuit under worst-case operating conditions. Worst case could be a constant power load requiring maximum current at minimum operating voltage. These values may be obtained from the equipment manufacturer.

- 6.3.2 The Power DESP shall determine the cable path and length, and then size the cable for the load at the maximum allowable voltage drop. The following formula applies:

$$CM = (11.1 \times L \times \text{Feet}) / V$$

Where:

CM = Circular Mil area of the cable
L = List 2 Drain
Feet = One-way length of cable in feet
V = Allowable voltage drop one way

See reference drawing ATT-P-05410-E

- 6.3.3 Fuse size shall be larger than the load on the cable. Multiply the List 2 load by 1.25 (125%) to determine the minimum protector size. **Caution:** This does not apply to protectors at BDFB/SPDU or Power Board which supply miscellaneous fuse panels as described previously under Power Distribution Sources. Once the protector is sized, assure the ampacity of the cable exceeds the rating of the protector. The cable size may be increased as necessary to meet the requirements for ampacity. The current capacity of the cable is usually only an issue with very short runs, since cables are sized first on voltage drop, then current capacity.
- 6.3.4 When adding circuit breakers to an existing BDFB/SPDU/PDU, the circuit breaker shall be, thermal-magnetic and 100% DC rated, Listed, and the trip-free type. Contacts shall not be able to be held closed during an over-current condition by holding the lever in the closed position. Circuit breakers approved for use are listed on the Minor Material List.
- 6.3.5 A circuit breaker with a 100% rating can be loaded to the List 2 drain.
- 6.3.6 Circuit breakers not rated at 100% shall be larger than the load on the cable. Multiply the List 2 load by 1.25 (125%) to determine the minimum protector size.
- 6.3.7 To obtain a degree of fault coordination, primary and secondary circuit protection devices shall be coordinated to prevent premature operation of primary fuses caused by faults on secondary circuits. The differential shall be approximately 20% per protection level.
- 6.3.8 Circuit breakers shall not be protected by fuses as circuit breakers typically have slower interrupt ratings. The exceptions are:
- If the network element rack comes pre-assembled;
 - Where the circuit breaker is used as an on/off switch at the equipment
- 6.3.9 If paralleling of conductors or reinforcement of existing, overloaded conductors is required, they shall be electrically joined at both ends to form a single conductor. Paralleled conductors shall meet the following:
- Be the same length;
 - Have the same conductor material;
 - Be the same size in circular mils area;
 - Have the same insulation type;
 - Be terminated in the same manner and area;
 - Follow the same path.

- 6.3.10 All cartridge type fuses shall be DC rated, telecommunications power-style (e.g. TELPOWER®) for new installations and replacements, unless another type of fuse is specified in the applicable AT&TIS Equipment or Power Drawing. Approved telecommunications power-style fuses are listed on the Minor Materials List and shall be used
- 6.3.11 All non-cartridge type fuses shall be AC rated for AC circuits and DC rated for DC circuits. AC and DC rated fuses shall not be mixed.
- 6.3.12 Alarm pilot fuse applications shall be 0.18 amps.
- 6.3.13 All DC fuses shall be provided with a blown fuse indicator connected to a remote alarm circuit and indicating lamp at the bay level.
- 6.3.14 DC circuit breakers shall be of the thermal-magnetic and must be Listed. They shall be trip-free type. Contacts shall not be able to be held closed during an over-current condition, by holding the lever in the closed position.
- 6.3.15 Dummy fuses shall be provided at all exposed vacant fuse positions. (This includes GMT type and 70-type). It is not necessary to provide dummy fuses for enclosed cartridge type fuse blocks, unless required to maintain spring tension to keep the cap in place. .
- 6.3.16 The AT&T IS Operations Engineer shall provide 10% spare fuses (minimum 1) of each size and type ordered up to 100 amps, and 25% spare fuses (minimum 1) of each size and type from 100 to 600 amps.
- 6.3.17 Only manufacturer approved fuse reducers may be used for exposed face fuse positions. In all other cases fuse reducers shall not be used.

FIGURE 12-1--POWER SYSTEM

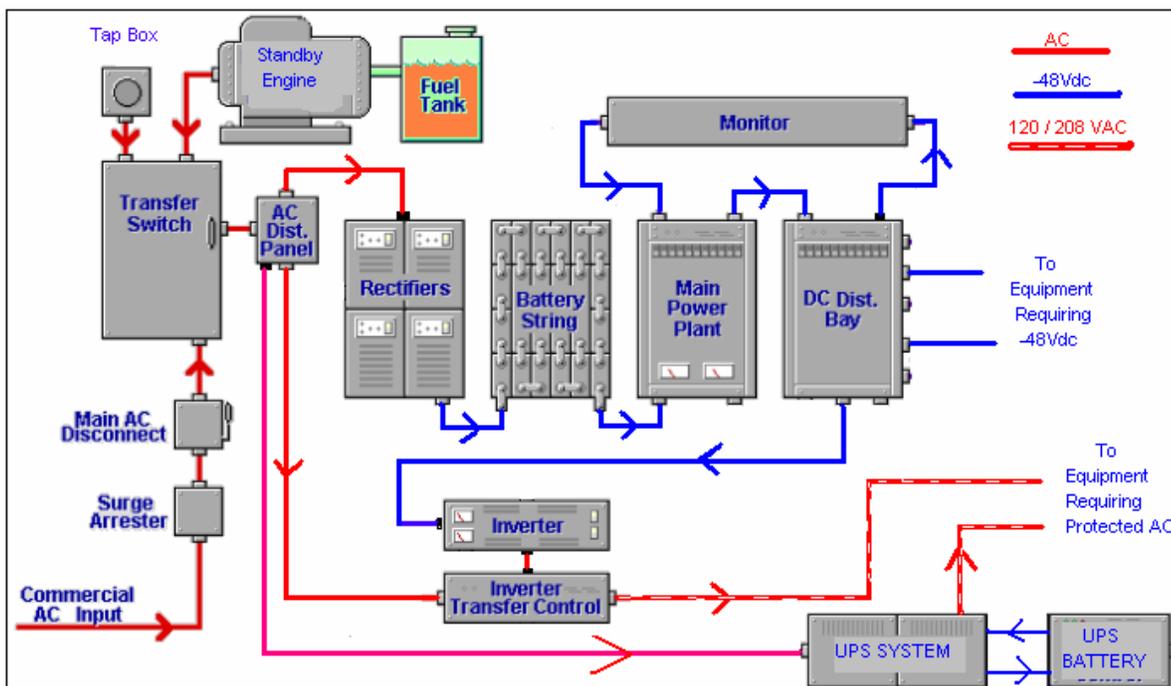


Table 12 -1 Busbar sizing chart

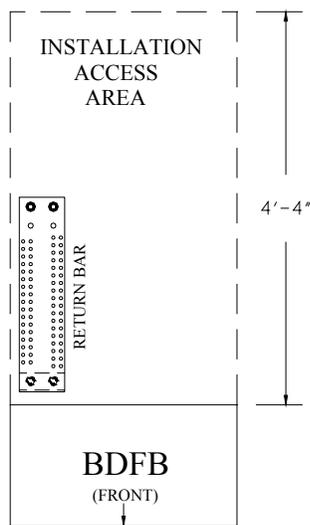
# OF BARS	THICKNESS OF BARS	WIDTH OF BARS	AREA IN CM	ALUMINUM				COPPER			
	IN INCHES			AMPACITY	LBS PER FT.	Microhms Per Foot. @ 70 C	AMPACITY	LBS. PER FT.	Microhms Per Foot. @ 70 C		
1	1/8	1/2	29.60	114	112	0.07	271.6	154	152	0.242	159.49
1	1/8	3/4	119.4	159	157	0.11	180.9	215	212	0.362	106.32
1	1/8	1	159.2	203	200	0.15	135.8	275	271	0.483	79.74
1	1/8	1 & 1/2	238.7	287	283	0.22	90.54	390	385	0.725	53.16
1	1/8	2	318.3	370	364	0.29	67.91	503	496	0.966	39.87
1	1/4	1/2	159.2	177	174	0.15	135.8	238	234	0.483	79.74
1	1/4	1	318.3	302	297	0.29	67.91	409	403	0.966	39.87
1	1/4	1 & 1/2	477.5	471	415	0.44	45.27	572	564	1.45	26.58
1	1/4	2	636.6	537	529	0.59	33.95	731	721	1.93	19.94
1	1/4	2 & 1/2	795.8	651	636	0.73	27.16	887	869	2.42	15.95
1	1/4	3	954.9	762	746	0.88	22.63	1040	1019	2.9	13.29
1	1/4	3 & 1/2	1,114.00	873	841	1.03	19.4	1192	1152	3.38	11.39
1	1/4	4	1,273.00	982	946	1.17	16.98	1342	1298	3.86	9.97
1	1/4	6	1,910.00	1408	1320	1.76	11.32	1931	1820	5.8	6.65
1	1/4	8	2,546.00	1823	1649	2.34	8.49	2506	2292	7.73	4.98
1	3/8	1	477.5	387	381	0.44	45.27	524	517	1.45	26.58
1	3/8	1 & 1/2	716.2	533	525	0.66	30.18	724	714	2.17	17.72
1	3/8	2	954.9	675	665	0.88	22.63	919	906	2.9	13.29
1	3/8	2 & 1/2	1,194.00	814	796	1.1	18.11	1110	1087	3.62	10.63
1	3/8	3	1,452.00	951	960	1.32	15.09	1298	1272	4.35	8.85
1	3/8	4	1,910.00	1219	1175	1.76	11.32	1667	1612	5.8	6.65
1	3/8	6	2,865.00	1740	1629	2.64	7.55	2388	250	8.69	4.43
1	3/8	8	3,820.00	2248	2035	3.52	5.66	3092	2828	11.59	3.32
1	1/2	1	636.6	466	459	0.59	33.95	632	622	1.93	19.94
1	1/2	1 & 1/2	954.9	636	626	0.88	22.63	863	851	2.9	13.29
1	1/2	2	1,273.00	800	788	1.17	16.98	1088	1073	3.86	9.97
1	1/2	3	1,910.00	1118	1093	1.76	11.32	1525	1494	5.8	6.64
1	1/2	4	2,546.00	1427	1376	0.34	8.49	1951	1887	7.73	4.98
1	1/2	6	3,820.00	2029	1899	3.52	5.66	2783	2623	11.59	3.32
1	1/2	8	5,093.00	2615	2366	4.69	4.25	3596	3289	15.46	2.49
2	1/4	2	1,273.00	969	935	1.18	16.98	1301	1259	3.86	9.97
2	1/4	3	1,910.00	1363	1285	1.76	11.32	1834	1735	5.8	6.65
2	1/4	4	2,546.00	1745	1596	2.34	8.49	2350	2163	7.72	4.98
2	1/4	6	3,820.00	2483	2152	3.52	5.66	3352	2937	11.6	3.32
2	1/4	8	5,093.00	3198	2605	4.68	4.25	4325	3583	15.46	2.49
2	1/2	2	2,546.00	1458	1411	2.34	8.49	1961	1902	7.72	4.98
2	1/2	3	3,820.00	2015	1906	3.52	5.66	2715	2577	11.6	3.22
2	1/2	4	5,093.00	2555	2346	4.68	4.24	3445	3182	15.46	2.49
2	1/2	6	7,639.00	3597	3131	7.04	2.83	4861	4275	23.2	1.66

2	1/2	8	10,186.00	4608	3770	9.38	2.12	6236	5189	31.92	1.25
3	1/4	2	1,910.00	1397	1336	1.77	11.32	1865	1787	5.79	6.65
3	1/4	3	2,865.00	1957	1813	2.64	7.54	2616	2432	8.7	4.43
3	1/4	4	3,820.00	2496	2226	3.51	5.66	342	296	11.58	3.32
3	1/4	6	5,730.00	3543	2947	5.28	3.77	4745	3992	17.4	2.22
3	1/4	8	7,640.00	4552	3495	7.02	2.83	6105	4770	23.19	1.66
3	1/2	4	7,640.00	3670	3291	7.02	2.83	4918	437	23.19	1.66
3	1/2	6	11,460.00	5146	4311	10.56	1.88	6902	5848	34.77	1.11
3	1/2	8	15,280.00	6572	5083	14.07	1.42	8824	6950	46.38	0.831
4	1/4	2	2,546.00	1823	1735	2.16	8.49	2426	2313	7.72	4.89
4	1/4	3	3,820.00	2549	2337	3.52	5.66	3394	3123	11.6	3.32
4	1/4	4	5,093.00	3249	2850	4.58	4.25	4328	3819	15.44	2.49
4	1/4	6	7,639.00	4598	3728	7.04	2.83	6130	5026	23.2	1.66
4	1/4	8	10,186.00	5899	4354	9.16	2.12	7872	5916	30.92	1.24
4	1/2	4	10,186.00	4782	4228	9.36	2.12	6384	5679	30.92	1.25
4	1/2	6	15,280.00	6688	5473	14.08	1.42	8933	7392	46.36	0.831
4	1/2	8	20,372.00	8527	6362	18.76	1.06	1139	8659	61.84	0.623
								5			
5	1/4	4	6,365.00	3999	3471	5.85	3.4	5312	4637	19.3	1.99
5	1/4	6	9,550.00	5650	4502	8.8	2.26	7512	6048	29	1.33
5	1/4	8	12,730.00	7242	5202	11.75	1.7	9634	7041	38.65	0.99
5	1/2	4	12,730.00	5892	5161	11.7	1.69	7847	6915	38.65	0.997
5	1/2	6	19,10.0	8227	6626	17.6	1.13	1096	8921	57.95	0.665
								0			
5	1/2	8	25,460.00	1047	7624	23.45	0.849	1396	1034	77.3	0.498
				5				0	0		
6	1/4	4	7,640.00	4748	4090	7.04	2.83	6295	5452	23.16	1.66
6	1/4	6	11,460.00	6702	5273	10.6	1.89	8891	7064	34.8	1.11
6	1/4	8	15,380.00	8585	6043	14.15	1.42	1139	8154	46.38	0.83
								5			
6	1/2	4	15,280.00	7002	6092	14.04	1.42	9309	8148	46.38	0.831
6	1/2	6	22,920.00	9765	7775	21.12	0.943	1298	1044	69.54	0.554
								0	5		
6	1/2	8	30,560.00	1242	8876	28.14	0.707	1652	1200	92.76	0.415
				5				0	5		
7	1/4	6	13,370.00	7753	6041	12.32	1.62	1027	8076	40.6	0.95
								0			
7	1/4	8	17,822.00	9926	6878	16.38	1.21	1315	9259	54.11	0.71
								0			
7	1/2	6	26,740.00	1130	8921	24.64	0.808	1500	1186	81.13	0.475
								0	0		
7	1/2	8	35,644.00	1434	1012	32.83	0.606	1908	1366	108.2	0.356
				5	0			0	0		
8	1/4	6	15,280.00	8804	6808	14.08	1.42	1164	9086	46.4	0.83
								5			
8	1/4	8	20,372.00	1126	7711	18.72	1.06	1490	1076	61.84	0.62
				5				5	0		
8	1/2	6	30,560.00	1284	1006	28.16	0.707	1702	1347	92.72	0.415

				0	5			0	5		
8	1/2	8	40,744.00	1632 0	1136 5	37.52	0.53	2163 5	1531 0	123.7	0.313
9	1/4	6	17,190.00	9854	7575	15.84	1.26	1302 0	1009 5	52.2	0.74
9	1/4	8	22,914.00	1260 5	8541	21.06	0.94	1666 0	1145 5	69.57	0.55
9	1/2	6	34,380.00	1437 5	1120 5	31.68	0.629	1904 0	1498 5	104.3	0.369
9	1/2	8	45,828.00	1826 5	1260 5	42.21	0.472	2419 0	1695 5	139.1	0.277
10	1/4	6	19,100.00	1090 5	8338	17.6	1.13	1440 0	1110 0	58	0.67
10	1/4	8	25,460.00	1394 5	9369	23.4	0.85	1841 5	1254 5	77.3	49
10	1/2	6	38,200.00	1591 0	1235 0	35.2	0.566	2106 0	1649 5	115.9	0.332
10	1/2	8	5,920.00	2021 0	1384 0	46.9	0.424	2674 5	1860 0	154.6	0.248
11	1/4	6	21,010.00	1195 5	9102	19.36	1.03	1577 5	1210 5	63.8	0.6
11	1/4	8	28,006.00	1528 5	1019 5	25.74	0.77	2017 0	1364 0	85.03	0.45
12	1/4	6	22,920.00	1300 5	9866	21.12	0.94	1715 0	1311 0	69.86	0.55
12	1/4	8	30,560.00	1662 5	1102 5	28.08	0.71	2192 5	1472 5	92.86	0.41

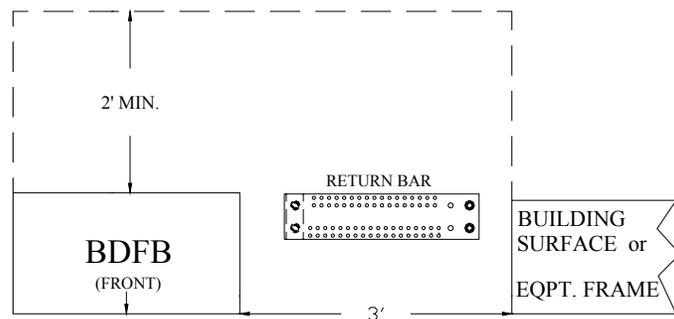
FIGURE 12- 3 – BDFB EXTERNAL BATTERY RETURN BAR PREFERRED PLACEMENT (TOP)

PREFERRED LOCATION



EXTERNAL RETURN BAR - REAR MOUNT

OPTIONAL LOCATION



EXTERNAL RETURN BAR - SIDE MOUNT

TABLE 12 - 2 – SUMMARY OF CHANGES IN SECTION 12

Change	Number	Item in This Issue
Revised 4/4/06	2.2.1 (h)	
Deleted		
Added		

[END OF SECTION]

SECTION 13--GROUNDING AND BONDING

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1. GENERAL

1.1. Introduction

1.1.1 This section identifies the requirements for the grounding and bonding of network equipment engineered for the AT&T .

1.1.2 Changes in this issue of Section 13 are summarized in Table 13-1.

1.1.3 Proper engineering and installation of grounding and bonding infrastructure are critically important to the safety of installation and operations personnel, the protection of equipment and the provision of reliable services.

2. requirements

2.1. ATT-TP-76403

2.1.1 Instructions for ordering a copy of ATT-TP-76403 are in Section 1, of ATT-TP-76401.

2.1.2 The IS design engineer shall engineer to the applicable bonding and grounding requirements of ATT-TP-76403, Grounding and Bonding Requirements for Network Facilities. For convenience, the sub sections of ATT-TP-76403 are outlined below:

AT&T Sub Section

- 1 Definitions, General and Material Requirements
 - 2 Office Ground Electrodes, Vertical and Horizontal Equalizers, AC Service and Distribution System
 - 3 Power Plants and Equipment, Transport and Miscellaneous Equipment
 - 4 Isolated Bonding Networks for Internet Services and Operational Support Systems Equipment
 - 5 Customer Premises Equipment
 - 6 Video Sites and Equipment
- Annex A – Reference Documents and Information
- Annex B – Revisions to Text and Information

Annex C – Index to Figures and Tables

2.2. Specification Notes

- 2.2.1 The building IS design engineer shall provide specification notes requiring the building installation supplier to provide documentation of placement and composition of an earth electrode system.
- 2.2.2 When an earth electrode system is provided, the building IS design engineer shall provide specification notes requiring the building installation supplier to provide advance notification to AT&T for inspection and testing prior to back fill.
- 2.2.3 The IS design engineer shall provide a specification note requiring the existing grounding convention be followed.

TABLE 13-1 – SUMMARY OF CHANGES IN SECTION 13

Change	Item in This Issue	Item in This Issue
Revised		
Deleted		
Added		

[END OF SECTION]

SECTION 15--CABLE ENTRANCE FACILITY

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1. GENERAL

1.1. Introduction

- 1.1.1 This section covers the grounding requirements in the cable vault and Cable Entrance Facility (CEF). Note: Non-Central Office locations will need to meet the requirements of the National Electrical Code; Fiber Cable – Article 770 Copper Cable – Article 800.
- 1.1.2 Changes in this issue of Section 15 are summarized in Table 15-1.
- 1.1.3 The CEF is the interface linking the outside plant cables to the termination frame in the IS office. These outside plant cables are feeder and trunk cables that may be paired-conductor, coaxial, or optical. The paired cables that leave the CEF and attach to the connectors on the termination frame.
- 1.1.4 A below ground CEF is sometimes called a cable vault.

1.2. Requirements – All CEFs

- 1.2.1 The protection measures should be applied to the cables in a designated area of the CEF that promotes uniform methods and facilitates inspections; this area is identified as the cable protection area. It is located between the entrance conduit and the splice frame in a horizontal-entry CEF; it traverses the entire CEF in a vertical-entry system.
- 1.2.2 All of the ground bars located in the cable vault shall be bonded to the 1/0 AWG conductor connected to the CO ground system or building ground system, via the OPGP or ground bar. The bonding conductor shall be run on the top horizontal and secured every 18 inches with cable ties or sewing twine.
- 1.2.3 A 1/0 AWG conductor is required between the CEF and the ACEG.
- 1.2.4 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.
- 1.2.5 Each lineup of cable rack in the cable vault shall be equipped with an insulated ground bar near each CEF. (See Figure 15-1)
- 1.2.6 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.

- 1.2.7 Each lineup of cable rack in the cable vault shall be bonded to the cable vault ground bar with a #6 AWG bonding conductor using a two (2) hole crimp type connector.

1.3. Requirements – Non-Insulating Joint CEFs

- 1.3.1 Each ST 21 Peth (polyethylene) sheath entrance cable shall be bonded to the ground bar nearest its CEF. Stacking ground connectors is not acceptable. 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.
- 1.3.2 Foil-lined or metallic air pipes shall also be bonded to the nearest CEF ground bar using #6 AWG bonding conductors. Air pipe fittings are available for this purpose.
- 1.3.3 Connections to the cable vault ground bar shall be made using two (2) hole crimp type connectors.
- 1.3.4 In a CO or IS location without a cable vault, an insulated ground bar shall be mounted near the CEF.
- 1.3.5 If Cable Rearrangement Facility (CRF) cabinets are in the CEFs, a 1/0 AWG dedicated conductor shall be run from the CRF cabinet/panel to the ground bar.
- 1.3.6 Tip cables (or stub cables) extend from the cable entrance facility to the termination frame. The metallic sheaths of these cables are bonded to the OSP cable sheaths and to the termination frame ground bar using a #6 AWG

1.4. Requirements – Insulating Joint CEFS

- 1.4.1 IS offices may be located in areas where stray DC currents are present in the earth from external sources such as dc powered public transportation systems, cathodic protection rectifiers or large welding establishments. The low earthing resistance of the IS office grounding electrode system picks up a portion of these stray currents from the earth and conducts it to the CEF, where it exists on the metallic shields of outside plant cables. At a location outside the IS office, where bare metallic components of the outside plant are in direct contact with the earth, the stray DC current leaves the plant and re-enters the earth, returning to its source. This discharge of DC current causes corrosion of outside plant components at that remote location.
- 1.4.2 Conduction of stray DC currents to the outside plant cable shields can be prevented by installing insulating joints in all cable shields and other metallic components entering the CEF. An insulating joint is an opening in the outside plant cable or air pipe that breaks the continuity of the sheath, shield, metallic strength member and moisture barriers, which interrupts the flow of DC currents that may cause corrosion.
- 1.4.3 Cable corrosion protection in the CEF shall be provided by creating a minimum $\frac{3}{4}$ inch air gap in the metallic shields of composite-sheath cable, the metallic components of an optical fiber cable and the metallic components of air pipes.
- 1.4.4 The metallic cable shield and other metallic components on the field side of the insulating joint shall be connected to a #6 AWG copper conductor insulated from the framing structure. This conductor shall be joined to a common # 6 AWG minimum isolation bonding conductor which is also insulated from the framing structure. This conductor shall terminate on an insulated bus bar located at the top of the cable rack. See Figure 15-2.

- 1.4.5 Outside plant entry cables shall be isolated from the CEF framing structure by either hardwood insulating members placed between the cable racks and framing structure or by insulators placed between the cables and cable hooks or cable support arms.
- 1.4.6 The metallic cable shield on the IS office side of the insulating joint shall be connected to the IS office grounding system following the requirements for a Non-Insulating Joint CEF except no bond is made between the OSP cable sheath and the tip cable sheath. See drawing 15-2.
- 1.4.7 To maintain a path to ground for lightning and ac voltages, the insulating joint shall be bridged with a bridging capacitor.

1.5. Interbonding

For Cable Entrance Facility requirements see [ATT-TP-76416](#).

1.6 Fiber Optic cable

Any Fiber Optic cable containing a metallic shield shall be bonded to the CEF.

TABLE 15-1 – SUMMARY OF CHANGES IN SECTION 15

Change	Item in Issue	Item in This Issue
Revised		
Deleted		
Added		

FIGURE 15-1 -- CABLE VAULT GROUNDING

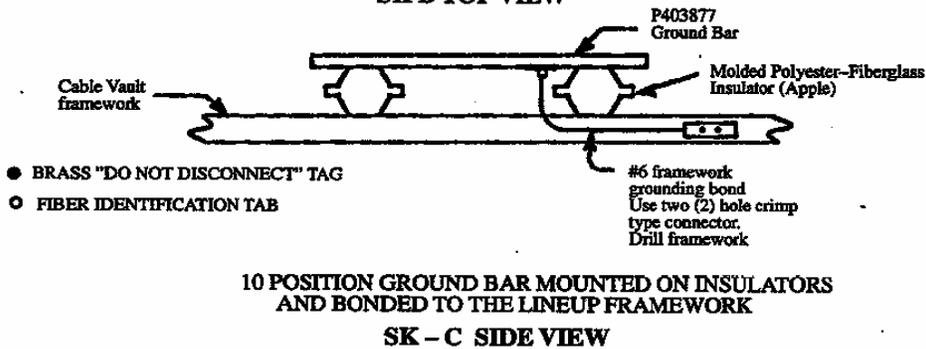
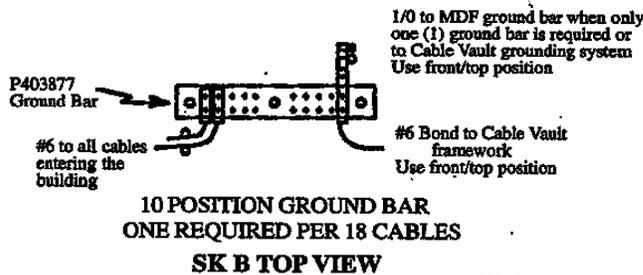
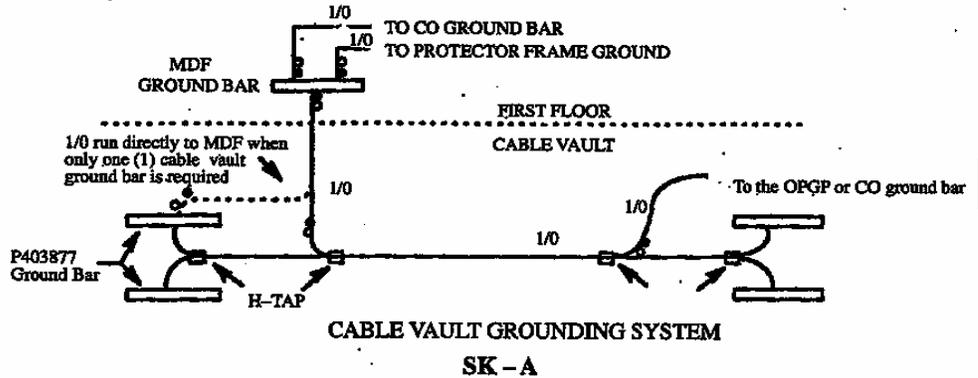
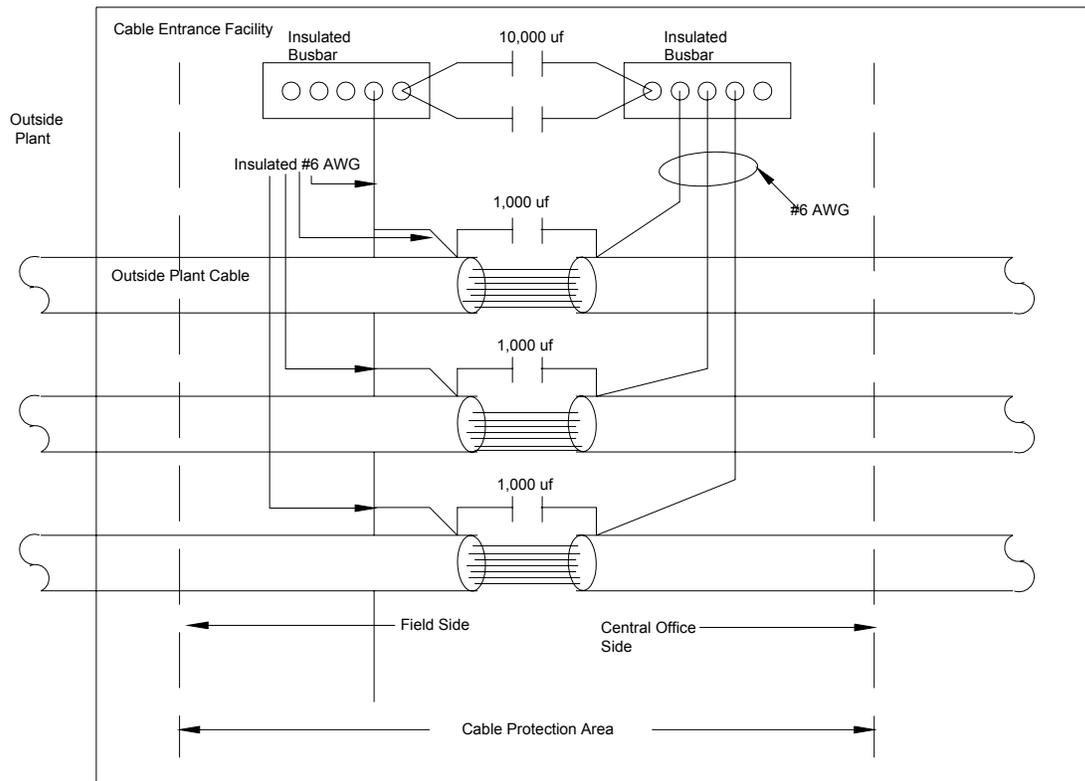


FIGURE 15-2 -- INSULATING JOINT CEF



[END OF SECTION]

SECTION 16 - STANDBY ENGINE/ALTERNATORS

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1. GENERAL

1.1. Introduction

- 1.1.1 This section covers the engineering requirements for standby engine/alternators.
- 1.1.2 Changes in this issue of this section are summarized in Table 16-1.

2. REQUIREMENTS

2.1. General

- 2.1.1 This document contains Standard Specification for Engine Alternator Sets and requirements for all standby AC systems and equipment including engine/alternators with automatic transfer equipment.
- 2.1.2 Terminology commonly used for AC power plants is defined in ATT-790-100-659
- 2.1.3 As of 4/1/2006 all engines shall meet a minimum of Tier 1 EPA requirements and shall meet all local and state emission requirements, whichever is more stringent.

2.2. Engine Requirements

- 2.2.1 The AT&T Equipment Engineer will select the standby engine to be used.
- 2.2.2 The use of diesel fuel engines shall be the first choice and is to be used for any installation going forward. The current use of natural gas is considered an isolated case, and any future installations shall be determined by the AT&T Power Equipment Engineer.
- 2.2.3 See BSP-790-100-658MP for Generator/Alternator test and acceptance requirements.
- 2.2.4 Engine critical building interface systems (intake louvers, fuel transfers, etc.) shall be sourced either directly on the engine or on the standby buss (as directed by the AT&T Equipment Engineer) and shall not be controlled by any building environmental control system. These systems shall be under the exclusive control of the engine alternator. The determination of relevance of any area subject to dispute in the above requirements shall be made by the AT&T Equipment Engineer
- 2.2.5 House service control panels or other controls will not override generator OEM operation controls (fuel, air intake, air exhaust, network load, etc.). Load shedding controllers shall only control building load shedding, not network load (see Section 2.9)
- 2.2.6 Tap boxes shall be provisioned as required for the connection of portable standby engines.

2.3. Fuel Systems

- 2.3.1 The rate of fuel supply to the engine's injection system shall be as required to prevent stalling, over-speed, or over temperature under any steady state or transient loading conditions. This shall be true when the engine/alternator set operates within its rating and proper environmental limits (temperature, altitude, and humidity) as stated in TP 76200. The fuel system shall be designed so that the engine/alternator set draws necessary fuel. Fuel shall not be fed to the set.
- 2.3.2 Petroleum storage tanks shall be installed in accordance with Environmental Protection Agency (EPA), NFPA, UFC, state and local laws and regulations.
- 2.3.3 There are two basic types of petroleum storage tanks used by AT&T
 - a) Underground Storage Tank – shall be doublewall with annular space monitoring and all bungs (openings) into the tank shall have a watertight collar and sump around them. Tanks shall be UL approved fiberglass reinforced plastic or composite construction. Composite tanks shall be used in high seismic zones.
 - b) Aboveground Storage Tank – shall be doublewall. All tanks shall have annular space monitoring, overfill protection and spill bucket. Tanks greater than 660 gallons or an accumulated value of more than 1320 gallons shall have a Spill Prevention Control and Countermeasures (SPCC) Plan. Tanks installed outside the building shall be UL 2085 approved. Sub base tanks (belly tanks) and other tanks installed inside a structure shall be double walled UL 142 approved. Day tanks shall be equipped with a Rupture Basin.
- 2.3.4 Tanks are to be installed in a location as near as possible to the engine alternator, to minimize piping runs in accordance with local code restrictions. Variance from local codes should be obtained in special circumstances.
- 2.3.5 All new petroleum storage tanks shall be equipped with release detection with a continuous monitoring system.

- 2.3.6 All return fuel shall be pumped back to the main petroleum storage tank unless otherwise specified by the AT&T Equipment Engineer.
- 2.3.7 Return fuel line capacity shall be greater than the supply line capacity.
- 2.3.8 A leak detection sensor shall be installed in the rupture basin of the day tank, when present, and installed near the engine when no day tank is present.
- 2.3.9 Double solenoid shut off devices shall be installed before the day tank or main petroleum storage tank to prevent catastrophic fuel spills in the following situations:
 - a) When any petroleum storage tank (day tank or main tank) is installed at a higher elevation than the engine/alternator;
 - b) Any piping system under pressure greater than atmospheric pressure.
- 2.3.10 Underground petroleum storage tank piping shall be double wall UL approved flexible pipe originating inside a fiberglass secondary containment sump. UL approved double wall fiberglass piping may be used in low seismic risk zones. Aboveground piping shall be single wall schedule 40 black steel pipe. Any flexible section of piping aboveground shall be UL approved for aboveground use. Fuel return lines shall not be equipped with any valves and must be larger in diameter than the supply lines. Long runs of piping inside a building shall be welded black iron. Fuel return lines shall not be equipped with any valves
- 2.3.11 Copper or galvanized steel pipe or pipe fittings shall not be used for fuel lines.
- 2.3.12 Fuel level indicators on the day tank shall be provided.

2.4. Exhaust Systems

- 2.4.1 Exhaust pipes shall comply with applicable codes. The minimum requirements are as follows:
 - a) Pipes shall be wrought iron or steel and strong enough to withstand the service. All externally exposed pipes will be stainless steel.
 - b) Pipes shall not be supported by engine or silencer;
 - c) Exhaust plumbing shall have a stainless steel flexible bellow type section installed within 12 inches of the engine manifold;
 - d) Pipes shall have a clearance of at least 9 inches from combustible materials and terminate outside the building;
 - e) Pipes shall be guarded and/or insulated to prevent burn injuries to personnel and excessive heat in the engine room;
 - f) All connections shall be bolted flange (with gaskets) or welded. No automotive type exhaust pipe clamps are permitted;
 - g) The outlet of the exhaust pipe shall be a 90 degree horizontal bend, designed for minimum back pressure, with the end of the pipe cut at a 45 degree angle (scarfed), with expanded metal over the open end. If a rain cap is not installed, a suitable exhaust drain tap shall be supplied;

- h) The surface temperature of the muffler and all indoor exhaust piping shall not exceed 130° F. The insulation shall be installed so that it does not cover or interfere with the functioning of the flexible exhaust fitting. A protective shield shall be provided around the flexible section;
- i) Exhaust piping shall be of sufficient length to allow for proper exhaust flow and configured to meet manufacturer EPA requirements.

2.4.2 A Critical Grade exhaust silencer(s), sized in accordance with the manufacturer's recommendations, shall be provided for each engine. Silencer(s) shall comply with the acoustic requirements of Section 6 of TP 76401.

2.5. Starting Systems

2.5.1 The engine starting battery shall be sized per AT&T drawing ATT-P-05332-E or in accordance with the engine manufacturer's requirements.

2.5.2 The engine start batteries shall be located so the cells will not be exposed to excessive engine heat.

2.5.3 The engine start and control batteries shall be AT&T approved Lead Acid or NiCad type.

2.5.4 An engine start battery rectifier shall be mounted either in the control cabinet or mounted on a wall near the start battery stand. Engine driven alternators shall not be used as the sole source for maintaining charge on start batteries.

2.5.5 The engine starting battery rectifier shall be a regulated type and capable of recharging the start battery to a serviceable condition within 30 minutes after a drain of three successive starts. The rectifier output capacity shall be a minimum of 5 amperes, and the rectifier shall have an output voltmeter and ammeter. The battery rectifier shall be compatible with the battery application.

2.5.6 The starting battery rectifier shall be powered from the protected AC bus.

2.6. Cold Starting Aids

2.6.1 All water-cooled diesel engine alternator sets shall be provided with thermostatically-controlled heaters, designed to maintain jacket water temperatures not lower than 90° F and not higher than 120° F.

2.6.2 For all engine alternator sets to be installed where ambient temperatures will fall below 40° F, optional arrangements shall be provided for maintaining the start and control battery between 50° F and 80° F in low ambient temperatures.

2.7. Acoustic Noise

2.7.1 Sound levels within the building housing the standby plant and outdoor sound levels resulting from operation of this equipment shall meet the requirements specified in TP 76200 or local codes, whichever is more stringent.

2.7.2 Where the engine alternator set is equipped with a sound attenuating enclosure, the enclosure shall be designed to allow adequate cooling of the engine alternator set. The enclosure shall be designed to allow adequate intake and exhaust airflow per the genset manufacturer.

2.7.3 Sound-attenuating enclosures, where employed, shall provide hinged doors or latched panels to allow access for normal maintenance and repair operations, including:

- a) Removal and replacement of fuel and lubricating filters;

- b) Replacement or cleaning of air filters; and
- c) Performance of all other normal maintenance operations specified by the manufacturer.

2.7.4 Where the engine alternator set is equipped with a sound-attenuating enclosure, the enclosure cooling requirements shall be met without booster fans or other accessory devices.

2.7.5 Acoustical materials, such as acoustically absorbent liners, shall be non-capillary, non-hygroscopic and free from perceptible odors. They shall maintain their acoustic attenuating properties under the conditions of temperature, mechanical vibration, and exposure to petroleum products to which they may be subjected under normal operation. Elastomeric material used in sealing the acoustic enclosure shall remain flexible and resist cracking in the environment to which they are exposed in normal use.

2.8. Cooling System

2.8.1 Some installations require the radiator and fan to be mounted separately from the engine alternator. If so, the following requirements shall be met:

- a) When the engine driven water pump produces water flow, total piping pressure drop shall not exceed the engine manufacturer's recommendation. If an auxiliary pump assists water flow, piping pressure drop shall be matched to pump capacity at desired water flow, as determined by the manufacturer;
- b) Remote radiators are designed for installations where no external airflow restrictions occur. A remote radiator that ventilates a room or has any ducting, shall not be located where its airflow is reduced or opposed by prevailing winds.
- c) A remote radiator fan requires an electric motor compatible with the standby power source. The voltage, frequency and horsepower of the required motor shall be specified on its rating tag. The fan can be direct or belt drive. If belts are used, multiple belts shall be employed to ensure reliability. An indicator lamp shall be on the engine control panel, indicating proper operation of the fan and an alarm to indicate fan failure;
- d) Heat exchangers shall be utilized when the engine manufacturer's specified maximum head pressure is exceeded. If a heat exchanger is required, an auxiliary pump shall be used in the system;
- e) For external engine cooling, a remotely mounted radiator or an engine based-mounted heat exchanger and an expansion tank, of a type and capacity recommended by the engine manufacturer for the application, shall be provided. Two manual shutoff valves shall be furnished and installed. The valves shall be mounted on the cooling water supply and return sides. In addition, a remote shutdown switch shall be provided for the engine-cooling fan. Flexible water line connectors shall be supplied for heat exchanger inlet and outlet ports;
- f) The engine cooling system shall be pre-treated by the engine supplier for the inhibition of internal corrosion.

2.8.2 The engine radiator exhaust duct shall be equipped with a re-circulation inspection door.

2.8.3 Combustion and cooling air louvers shall open upon loss of commercial AC power. These louvers shall be spring loaded to open mechanically (electrically held closed).

2.9. Alternator Technical Requirements

2.9.1 Alternators shall meet the following requirements:

- a) Lead Termination - The alternator leads shall terminate on the line side of the circuit breaker. Ring terminal compression connectors shall be used to terminate the alternator's leads. A means will be provided to prevent connectors from turning when mounted on breaker studs;
- b) Vibration Isolation - Each engine alternator set shall be mounted on vibration isolators, either internal or external to the skid base of the set.

2.9.2 To minimize potential loose connections or trouble spots in the control circuitry, all interconnections of control circuitry wiring shall be terminated with ring terminals securely fastened to terminating points with a machine screw. Only one termination shall be provided per screw.

2.9.3 All connections between the remote control cabinet and the set cabinet shall be run in conduit. These leads may be run along with the alarm leads.

2.9.4 Connect the neutral of the set to the neutral of the commercial power at the house service entrance.

2.10. Load Prioritization

2.10.1 Genset loads shall include all self sustaining equipment. For instance, fuel pumps, air control servos, and battery chargers shall be electrically supported by the specific generator served, co-dependency is not allowed.

2.10.2 Generator control systems may include load prioritization. In those cases, network and network supporting loads shall never be staged and shall be the first loads(s) to transfer to the generator.

2.10.3 Building control systems may be employed to load and shed only non-network (administrative) supported loads. These type loads shall be the last loads added to the generator and the first loads to be removed.

2.11. Automatic Transfer Switch Systems.

2.11.1 Each Automatic Transfer Switch (ATS) shall be mechanically held on both the standby and normal side, and be rated for continuous duty in an unventilated enclosure. The ATS shall have three possible positions:

- a) Closed to Commercial, Open to Engine;
- b) Closed to Engine, Open to Commercial;
- c) Open to Engine and Open to Commercial.

2.11.2 An ATS shall have a minimum open time of six to ten seconds depending on the load configuration. The mechanical components of the transfer system can be either circuit breakers or a switch. There shall be no provision to unload the engine automatically (load shedding), except in the very large offices where multiple transfer points are available.

2.11.3 Each ATS shall be a solenoid operated mechanism, momentarily energized from the source to which the load is being transferred. The open circuit interval during transfer shall be long enough

to allow stored energy in the powered equipment to decay, thus preventing a possible phase mismatch and power overload during the switch transition.

- 2.11.4 Each ATS used shall meet UL 1008 requirements. All main contacts and control assemblies shall provide repetitive load transfer service. Inspection and replacement of all main and arcing contacts shall be possible from the front of the ATS enclosure without disassembly of operating linkage or disconnection of power conductors.
- 2.11.5 Each ATS shall include a separate control panel. The switch shall be mounted on the inside surface of the enclosure door. The ATS shall be in a secured area. For large or high voltage (over 400v) systems, the switch may be outside the engine/alternator room. A protective cover shall be provided. The capability to manually bypass the ATS shall be provided. If a wiring harness plug is used, it shall be secured with machine screws to prevent accidental disconnection. The following shall also be provided:
- a) Engine starting contacts to provide for engine/alternator starting of each unit, independent of the other;
 - b) Three-phase relays shall be field adjustable, close differential type with 92-95 percent pick-up and 82-85 percent dropout. Relays are to be connected across live lines;
 - c) Test switch to simulate normal source failure;
 - d) Independent voltage and frequency sensing of the emergency source, factory preset to pick up at 90 percent voltage and 58 Hz;
 - e) Adjustable time delays for start, transfer, retransfer and engine cool-off;
 - f) Two auxiliary contacts rated at 10 amperes, 480v AC, one closed on normal, one closed on emergency;
 - g) Pilot light(s) to indicate switch position;
 - h) The ATS shall have a manual operation option.
- 2.11.6 Transfer system enclosures are usually NEMA 1 type as a manufacturing standard. However, job conditions may dictate a choice of the following:
- NEMA 1A, Dust Tight, Indoor
 - NEMA 3, Dust Tight/Rain - Sleet Resistant
 - NEMA 3R, Rain Proof/Sleet Resistant
 - NEMA 4, Water Tight or Dust Tight
 - NEMA 12, Industrial Oil Tight, Indoor
- 2.11.7 The transfer system shall be arranged to use DC trip to open and AC closure. The DC trip signal shall be supplied from an external source. This arrangement will provide the protection necessary in the event of any unacceptable commercial power source conditions such as complete power failure, high or low voltage, high or low frequency and single phasing. The AC closure shall be obtained from the power source that will be active after the transfer.
- 2.11.8 The manufacturer shall supply interconnection information for connecting the engine alternator with an Automatic Transfer System.
- 2.11.9 For automatic transfer, the system shall be capable of the following:

- a) Recognizing the occurrence of a power failure;
- b) Opening the commercial power source;
- c) Starting the engine alternator set;
- d) Closing the alternator circuit breaker;
- e) Automatically controlling the loading of the standby bus;
- f) Recognizing the return of commercial power;
- g) Transferring all loads from the standby power source to the commercial power source;
- h) Engine cool down and shutting down the engine alternator.

2.11.10 For automatic paralleling of multiple engines, the system shall be capable of performing the following operations:

- a) Recognize the occurrence of a power failure;
- b) Open the commercial power source;
- c) Initiate the Start signal to all engines simultaneously;
- d) The first engine to reach proper voltage and frequency closes its on-set breaker initiating closure of the engine transfer breaker powering the static loads;
- e) As additional engine alternators are paralleled to the essential bus, the Load Management Controller shall connect these loads on a priority basis;
- f) Recognize the return of commercial power;
- g) Transfer all loads from the standby power source to the commercial power source after the Holdover Timer has operated;
- h) Engine cool down and shut down of the engine alternator(s).

2.12. Outdoor Enclosures

2.12.1 When the engine/alternator is to be enclosed, it will be necessary to provide access for maintenance purposes. The enclosure shall be designed to allow sufficient air flow for combustion and cooling of the engine/alternator set, during normal operation, and any negative air pressure shall not hamper easy opening and closing of the enclosure door. Any acoustical material or thermal insulation shall be non-capillary, non-hygroscopic, free from perceptible odors, fire retardant, and capable of holding its acoustical characteristics without deterioration. Exhaust piping shall be of sufficient length to allow for proper exhaust flow.

2.13. Safety

2.13.1 The engine alternator set shall be designed and constructed so that personnel hazards are minimized. Component parts shall be suitably arranged and/or guards shall be employed to minimize the possibility of accidental contact with hazardous voltages, rotating parts, excessively sharp edges, and/or high temperature surfaces.

2.13.2 Exposed surfaces with temperatures greater than 115°F shall be marked with warning labels. Surfaces with temperatures greater than 130° F shall be guarded as well as marked with warning labels.

- 2.13.3 Insulation and/or ventilated guards shall be provided to protect the operator from coming in accidental contact with the high-temperature external surfaces of diesel engine exhaust system parts and piping and any other components with surface temperatures higher than 130° F.
- 2.13.4 Suitable guards shall be provided for all fans, blowers, rotating parts of alternators, and any other rotating parts associated with the engine alternator plant to which the operator might otherwise be exposed.
- a) Guards shall be of substantial construction, removable but securely fastened in place, and of such design and arrangement that any part of the operator's body cannot project through, over, around or underneath the guard.
 - b) All set screws, projecting bolts, keys, and key ways shall either be suitably guarded or of a safety type without hazardous projections or sharp edges.
 - c) All in-running gears and sprockets otherwise exposed to personnel contact shall be completely enclosed or be provided with band guards around the face of the gear or sprocket. Side flanges on the band guard shall extend inward beyond the root of gear teeth.
- 2.13.5 The design engineer shall ensure that suitable warning labels for automatic start are provided.

2.14. Hazardous Voltages

- 2.14.1 Energized components with voltages at or above 150 Volts DC or 50 Volts rms AC shall be enclosed or covered. Warning labels shall also be provided and conspicuously displayed with guards either in place or removed.

3. MAIN LINE AC CIRCUIT BREAKERS

3.1. General

- 3.1.1 When the AC transfer system is a circuit breaker type, and the circuit breaker is located within 25 feet of the standby engine/alternator, a separate main line AC circuit breaker is not required. Otherwise, a second AC circuit breaker shall be placed within 25 feet of the standby engine/alternator and sized to the output of the alternator as a load circuit interrupting and protection device. It shall operate both manually for normal switching functions and automatically during overload and short circuit conditions.
- 3.1.2 The trip unit for each post shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection.
- 3.1.3 The AC circuit breaker shall have a battery voltage operated shunt, trip wired to the safety shut down to open the breaker in the event of engine failure. This AC circuit breaker shall have a dry alarm contact.
- 3.1.4 The emergency shutdown switch for the engine shall be labeled and covered to prevent accidental activation.

TABLE 16-1 – SUMMARY OF CHANGES IN SECTION 16

Change	Item in Issue	Item in This Issue
Revised		
Deleted		
Added		

[END OF SECTION]