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DC Power Systems Engineering and Installation Standards for Outside Suppliers

AT&T 790-100-669
Issue 5 REV

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About This Document

Purpose

The purpose of this document is to establish minimum standards for the design, installation and acceptance of DC power systems.

Intended Audiences

These standards were prepared for use by engineering and installation service suppliers working on Engineering, Furnish and Install (EF&I) orders, Engineering and Install (E&I) orders, and Engineering Only (EO) orders for AT&T.

This document is intended for use by AT&T Network Packet Optical Network Services (NPONS) Engineering personnel, consultants to AT&T Engineering, and installation personnel.

Reason for Reissue

This document replaces information formerly found in AT&T 790-100-669 issue 1 and BellCore GR-1275-CORE¹, section 17.

The following are changes made from issue 1 by issue number.

Issue 2 Changes

This issue was published to AT&T and Lucent Technologies in September 1998.

General

- Edit some words, titles and sentences to add clarification.
- Transpose information in Chapters 7 and 9.
- Move information in Chapter 12 (issue 1) into Chapter 11 and Chapter 13 information into chapter 12. Chapter 13 has been removed.
- Add information on obtaining this document.

Section 3.02

- Clarify the requirements for INFOBANKTM ² reports at Acceptance.

Section 3.03

- Add INFOBANKTM input requirements.

Section 3.04

- Add tables for INFOBANKTM requirements.

Section 4.01

- Add Tyco 415BTM³ (H569-434) as an approved product.
- Add Tyco GPS 4848TM⁴ and GPS 4824TM⁵ as approved products.
- Add requirements for Power Plant voltage drops.
- Add requirements for Voltage Drops and Minimum Volts Per Cell.
- Add requirements for supplemental battery stand voltage drop.
- Add requirement for proper utilization of voltage drops.

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² INFOBANKTM is a trademark of Lucent Technologies, Inc.

³ Lucent 415BTM is a trademark of Tyco Technologies, Inc.

⁴ TycoGPS 4848TM is a trademark of Tyco Technologies, Inc.

⁵ TycoGPS 4812TM is a trademark of Tyco Technologies, Inc.

- Add requirements on Low Voltage Equipment BDFB.
- Add requirement for standard primary distribution position numbering.
- Add requirements for task lighting.

Section 4.02

- Change requirement for loading of primary distribution panels.
- Add a note to clarify spare controller pack provisioning.

Section 4.03

- Add Tyco GPS™ SR rectifiers as an approved product.
- Add requirement for spare fans for SR rectifiers.

Section 4.04

- Add Tyco KS 15544 battery as approved product.
- Add requirement for dual strings of VR cells.
- Add requirement for wire size from battery post to bus bar based on battery capacity.

Section 4.05

- Add requirement for battery cell number and pilot cell marking.
- Add requirement that supplemental battery stand have bus bars.
- Add requirements on provisioning of lead-acid battery spill-containment.

Section 4.06

- Strengthen statements on the use of insulated tools in power area.
- Change requirement on percentage of current required for milli-volt test.

Section 5.03

- Delete reference to Tyco WP Inverter (Conditional Approved Product).

Section 5.07

- Add requirement for Inverter spares.

Section 6.02

- Add requirements for wire terminals and connections.
- Clarify requirement that lugs and taps be "tinned".
- Clarify position on crimping tools die marking.
- Add requirements concerning "shrink" wrap covering on terminals

Section 6.03.

- Clarify statements on use of tracer cable.
- Clarify and added requirements for DC power racking.
- Add requirements on un-fused cable racks.
- Add requirement to color code drop feeders.

Section 6.05

- Add requirements for bus bars.

Section 6.07

- Clarify cable-tagging requirements during installation.
- Modify requirements for cable tags on battery leads.
- Modify requirements for "Ask Yourself"® tags.

Section 6.08

- Add section for "Building Loads on DC Power Plant".

Section 7.

- Change language from "BDFB" to "Secondary Distribution Bay".

Section 7.01

- Add RELTEC™ Secondary Distribution bay as an approved product.

Section 7.02

- Add requirements for Secondary Distribution Bays.

Section 7.03

- Add requirement for RELTEC™ Secondary Distribution bay.

Section 7.04

⁶ Ask Yourself® is a copyright of AT&T.

- Add requirement that bare wire be "tinned".
 - Allow substitution of Bussmann™⁷ TPN, TPN and TPS fuses for NON and WP fuses.
- Section 7.07
- Modify requirement for Secondary Distribution Bay ABS alarms.
- Section 7.08
- Add requirement for standard fuse or breaker numbering for Secondary Distribution Bays.
- Section 8.07
- Revise section on raised floor grounding to delete automatic grounding by Tyco.
- Section 9.01
- Add requirement for color-coding of AC wires.
- Section 9.05
- Add requirement for standard numbering of PDSC breakers.
 - Add information on AC diversity for DC power plants.
- Section 9.07
- Add requirements for AC task lighting.
- Section 10.02
- Change punching for Rectifier fail alarm on Galaxy SC™⁸ Controller.
 - Change BD and VLV Alarm Threshold for Galaxy SC™ Controller.
- Section 11.01
- Add section on installation per specifications.
- Section 11.06
- Provide an ATT test instruction and form for battery post to battery post measurements.
- Section 11.07
- Added requirement that all cable holes shall be labeled.
- Section 11.11
- Added guidelines for wire/cable removals.
- Section 11.14
- Add reference to ATT "Seed Documents".
 - Remove sample SMOP.
- Section 12.01
- Add size requirement for labeling of power sources.
 - Modify requirements for labeling of power sources.

Issue 3 REV Changes.

This issue was published to all suppliers in March 1999.

General

- Numerous products and services were noted as trademarks.
- Section 1.02
- Reference is made to AT&T 032-385-100, issue 1 "AT&T Approved Burndy®⁹ Connectors".
 - Removed reference to several outdated practices.
- Section 2.02
- Removed the requirement for "GEOCODE" on the order from AT&T.
- Section 3.03
- Added to a note allowing digital cross connect circuits to be "multiplied".
 - Changed the way multiplied loads are entered.
- Section 4.01
- Removed Lucent ECS™ from approved power plant list.

⁷ Bussmann™ is a trademark of Bussmann, Inc.

⁸ Galaxy SC™ is trademark of Tyco Technologies, Inc.

⁹ Burndy® is a registered trademark of Framatone Connectors International.

- Removed Tyco 415A™¹⁰ from approved power plant list.
- Added RELTEC 1231H1™¹¹ Power Plant to approved power plant list.
- Added RELTEC 1231V2 Vortex™¹²Power Plant to approved power plant list.
- Allowed the voltage drop from the battery to the PDB to be .3 instead of .25.
- Added requirement that battery stand is to be cabled for maximum number of battery strings.
- Added section on shunt replacement.
- Added Tyco comcode for T8 lamps.

Section 4.02

- Added requirement for Tyco GPS™ power plant to provide blank panels for un-equipped fuse or breaker panel locations.

Section 4.03

- Added requirement that DC output wires from the rectifiers to the battery stand shall be on dedicated rack. Rectifier racks shall be limited to two layers of wires.

Section 4.04

- Added the following batteries to approved list
- Tyco IR Series II™¹³ VR battery cell
- Tyco Unigy® II™¹⁴ Series VR Battery cell
- Tyco Enhanced VR (EVR)™¹⁵ Series Battery cell
- Removed old VR battery from approved list.

Section 4.05

- Replaced Tyco WP number with Lucent ED number for battery spill containment.
- Added requirement that supplemental bus bar be mounted in the horizontal plane.
- Changed battery standing from "P" to "TR" for reference cell.

Chapter 6

- Rearranged Chapter 6 adding headers for "Tracer Wire", "Securing Wire" and "Cable Taps".

Section 6.03

- Added requirement for lacing of cap tap covers.

Section 6.05

- Clarify Bus Bar separation.
- Added requirements for "back to back" terminations.

Section 6.08

- Added information on the type breaker to be used with building loads.

Section 7.02

- Added requirement for top covers on bottom fed Secondary Distribution Bays.

Section 7.09

- Added a section to Chapter 7 on small fuse panels.

Section 9.01

- Added AC service definitions to chapter 9.

Section 9.04

- Removed reference to AT&T 802-005-180 for armored cable.
- Defined lighting types for network buildings.

¹⁰ Tyco415A™ is a trademark of Tyco Technologies, Inc.

¹¹ RELTEC 1231H1™ is a trademark of RELTEC Corporation.

¹² RELTEC 1231V2 Vortex™ is a trademark of RELTEC Corporation.

¹³ IR Series II™ is a trademark of Tyco Technologies, Inc.

¹⁴ Unigy ® II is a registered trademark of Tyco Technologies, Inc.

¹⁵ Enhanced VR (EVR)™ is a trademark of Tyco Technologies, Inc.

Issue 4 REV. Changes
General

Revised document format to meet AT&T documentation standards. Rearranged chapter format, see table below

Old Chapter	New Chapter
Chapter 4 Battery Plants, Batteries, Rectifiers and Converters	Chapter 4 now covers only Battery Plant items and some grounding issues.
	Chapter 5 now covers Battery and Battery stand equipment
	Chapter 6 now covers Rectifiers and Converters
Chapter 5 Protected AC Power	Chapter 7 Protected AC Power
Chapter 6 DC Power Distribution Requirements	Chapter 8 DC Power Distribution Requirements
Chapter 7 Secondary DC Power Distribution Board Requirements	Chapter 9 Secondary DC Power Distribution Board Requirements
Chapter 8 Framework and Central Office Grounding Requirement	Some requirements have been moved to other chapters, but most of the requirements are found in ATT 803-501-100 or GR-1275-CORE.
Chapter 9 AC Power Distribution Requirements	Chapter 10 AC Power Distribution Requirements
Chapter 10 Alarm Requirements	Chapter 11 Alarm Requirements
Chapter 11 Power Installations- Generic Requirements	Chapter 12 Power Installations- Generic Requirements
Chapter 12 Power Installations- Equipment Labeling	Information combined with old chapter 11 as new chapter 12

The following Chapter references are for issue 3 chapter headings.

Chapter 3

- Revised location for drawing access.
- Allowed substitution of detail specification for INFOBANK “Delta” report.

Chapter 4

- Added criteria for –48V power plants with a MVPC of 1.75.
- Added criteria for up to a 4 volt loop power plant
- Clarified difference between *engineered voltage drop* and *installed voltage drop* for secondary distribution bays.
- Clarified procedure for shunt replacement.
- Added requirement that DC Breakers not alarm when manually operated.
- Added requirements for Tyco GPS4812™ and Marconi Vortex™ power plants.
- Added reference to AT&T 010-160-110, “Spill Clean-up Guidelines Handbook”.
- Added requirement on placement of Tyco’s 10,000-ampere bus bar assembly.
- Added requirement that connectors on battery-connection-bars be tin-plated.
- Added requirement that all wire that attached to a battery string shall be tin-plated.
- Changed requirement to have plated connectors on plated surfaces and lead coated connectors on connections to lead coated devices.
- Added requirement that cell 1 and highest number cell shall not be adjacent for rectangular cells.
- Clarified insulated tool requirements.
- Specified resistance value for battery stand continuity test.

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- Added requirement for a thermometer for each tier and string on a battery stand.
- Specified that manufacturer's requirements for battery installation be used.
- Added requirement for Ohmic testing of VR cell at installation.
- Added requirement that VR cells have ohmic monitoring.
- Allowed supplemental battery stand bus bars to individually be mounted either vertically or horizontally.
- Removed reference to temporary closing of cable holes.
- Added requirement for static discharge connection (ESD) points.
- Added requirement that rectifiers be balanced between AC feeds.

Chapter 6

- Added three types of approved wire.
- Relocated a statement concerning non-halogen wire.
- Allowed un-tinned wire in all but battery applications.
- Added statement concerning the use of long barrel connectors.
- Added conditions when crimping tools of one manufacturer could be used for another's connectors.
- Added restriction on use of No-OX-ID™ Special "A".
- Added note allowing "primary distribution circuits" to be run with wires to secondary distribution bays.
- Removed redundant comment on tap covers.
- Allowed the use of plastic tie wraps to secure tap covers.
- Removed taping as the typical method of insulating taps.
- Relaxed requirement for fiber on certain wire types.
- Added requirement for six-foot separation of Red and Blue BDFB's.
- Added requirement for red and wire to denote "0" and "1" sides of a switch.
- Upgraded "Diversity" to a section in Chapter 6
- Remove temporary cable hole closure instruction.
- Added requirement for both near end and far end information on cable tags.
- Provided additional examples of correct tagging.

Chapter 7

- Provided requirements to allow bundling of wire using plastic tie wraps.
- Added requirement that return bars be designated with FIC of secondary distribution bay.
- Added requirement that return bar assemblies have 12 inches of cable space beneath them.

Chapter 9

- EMT allowed up to 2" in diameter.

Chapter 10

- Added comment on Tyco Millennium™ Controller.

Chapter 11

- Removed temporary cable hole closure procedure. -

Chapter 12

- Clarified insulated tool requirements.
- Removed joint testing requirement.

Issue 5 REV. Changes Issued—MARCH 15, 2002

General

- All Lucent Technologies Power Products are now Tyco Electronics Power Products.
- Revised document to meet AT&T documentation standards.

Chapter 1

Section 1.01

- Added a list of references to the following AT&T Practices
 1. 760-200-110—Raised Access Floor Designed Standards For ANS Equipment Locations
 2. 760-200-120---Raised Floor Requirements For All Equipment Locations
 3. 801-006-100---AT&T Cable Management For Common System-Engineering Guidelines
 4. 803-501-100---Grounding and Electrical Protection for AT&T Telecommunications Buildings and Equipment
- Removed information on ATT 201-634-602,DMAS; ATT 751-100-785AC,FICS; and ATT 803-501-100, Grounding.

Chapter 2

Section 2.01

- Added information to Suppliers Requirements.
- Added requirement for local code verification.
- Added Suppliers correction responsibilities in lieu of previous job.
- Added DC power plant necessity for remote alarm test

Chapter 3

Section 3.01

- Add changes to show equipment record, wiring list, office drawing and power maintenance record for DC power are now maintained in IIDI-DC.

Section 3.02

- Information removed and changed.

Section 3.03

- Clarify designations for BDFB's that uses 2 and 4 volt loops.
- Record keeping procedures for power plants and BDFB's.

Section 3.04

- Added statement to locate pwrarch-040 and above in ODMS and INFOSWAP.

Chapter 4

Section 4.03

- Remove .05v loop allowance for supplemental battery stands.
- Added requirement for a .5 volt loop-voltage drop from BDFB to equipment.
- Provide information on voltage drop for supplemental battery stands.
- Added requirement for separate return bars for 2v and 4v BDFB busses.

Section 4.04

- Added requirement to replace shunt at 80% of rating.

Section 4.05

- Allowed bottom growth Primary Distribution bays to be numbered starting at bottom left panel.

Section 4.06

- Changed requirement for task lighting from 10 to 35 foot-candles

Section 4.08

- Added information to clarify disposition of controller updates and spares parts kit.
- Added note “2” to clarify shunt monitoring of various breaker size.

Section 4.13

- Added requirements for “A” string battery sensing lead for Marconi Power Plants.
- Provided for bottom up numbering on Primary Distribution bays.

Chapter 5

Section 5.01

- Added GNB Absolyte (XL, II, IIP) to the approved flooded cell list
- Added VRLA cells and criteria for which they shall be used.
- Clarify battery connection coating requirement.

Section 5.02

- Added location for where FIC code should be placed on battery stands.

Section 5.03

- Add note describing what materials are to be used for battery spills.
- Added requirement for micro-ohm test on all battery installation.
- Added record requirements for micro-ohm test.

Chapter 6

Section 6.01

- Added requirement for N+2 rectifiers on power plant with “MD” rectifiers.

Chapter 7

Section 7.03

- Removed “MD” Marconi Inverter from approved equipment list.

Section 7.08

- Prohibited the use of orange colored outlets for protected-AC.

Chapter 8

Section 8.01

- Added suppliers to approved wire product list.
- Added AT&T color-code for DC-wires.
- Added rating for wire per NEC 2002™

Section 8.03

- Clarified and removed duplicated information on shrink-wrap.

Section 8.04

- Clarify note under general information concerning equipment powered directly from power plants.
- Added subsection for cable racking and cable protection requirements.
- Made 7” rule applicable to horizontal racks.
- Added note requiring the use of NEC 2002™ to determine wire ampacity.

- Added note concerning drop-feeder not approved by AT&T.
- Removed requirement to fiber KS24194 wire on vertical runs.
- Added requirement for tracer on all gray, blue and red wires 8AWG and larger.
- Limited the use of plastic tie wraps to under floor areas.
- In under floor area allow taps on the vertical if properly supported.
- Added requirement for tags on taps made 10 feet beyond the connection point.

Section 8.05

- Clarified the use of plastic tie wraps in secondary distributions areas

Section 8.06

- Clarified when to test alarms in generic fuse/breaker application.

Section 8.09

- Clarified near-end cable identification tag application at equipment bays.
- Added tag requirements for cable taps located 10 feet beyond the connection point.

Chapter 9

Section 9.02

- Clarified return feeds for BDFB's with 2 and 4-volt loops.

Section 9.03

- Removed approval of high capacity fuse blocks.

Section 9.04

- Added requirement to verify issue of pwrarch.
- Added requirement for numbering return bars.
- Added requirement for numbering on return bars.
- Added requirement for spike protection on fuses over 70 amperes.

Section 9.06

- Added requirement for a .5 volt loop-voltage drop from BDFB to equipment.

Section 9.08

- Updated table 9-1 for 12-position panel indication.

Chapter 11

Table 11.5

- Added -48 volt values for VRLA cells

Chapter 12

Section 12.02

- Removed requirement for OSWF name on pre-conditioning tags.

Section 12.06

- Defined "suppliers checklist".
- Deleted requirement for milli-volt test.
- Added requirement for micro-ohm test.
- Added documentation requirements for micro-ohm test.

Section 12.07

- Removed reference to temporary cable hole closure.

Section 12.09

- Added information on test sets used for cable locating.

Section 12.10

- Added requirement that when two circuits are paralleled, the voltage difference shall not be more than .25 volt.

Section 12.13

- Allowed flexibility in bolt alignment.
- Added information the use of corrosion inhibitors.

How to Use This Document

This document provides the information needed to establish the minimum DC power distribution system design, installation and acceptance criteria. The subjects in each chapter are broken down as follows:

Chapter 1 - General Requirements — provides general information about supplier requirements and Quality Assurance.

Chapter 2 - Pre-Engineering and Job Planning — covers criteria for building infrastructure verification and basic installation order information.

Chapter 3 - Engineering Records and Documentation — covers criteria for update of engineering drawings and records, including INFOBANK™ requirements.

Chapter 4 - DC Power Plant Requirements — covers general and detailed engineering and installation requirements for DC Power Plant installations, and includes Batteries, Rectifiers, System Controllers, and Power Board Distribution.

Chapter 5 – Battery and Battery Stand Requirements--- covers general and detailed engineering and installation requirements for DC Power Plant installations of battery equipment.

Chapter 6 – Rectifiers and Converters ---- covers general and detailed engineering and installation requirements for DC Power Plant installations of rectifiers and converters.

Chapter 7 - Protected AC Power Requirements — covers criteria, which apply to installations requiring protected, “no-break” power.

Chapter 8 - DC Power Distribution Requirements — covers general requirements for the engineering and installation of DC Power distribution cables and includes cable-sizing requirements.

Chapter 9 - Secondary DC Power Distribution Board Requirements — covers specific requirements for downstream distribution equipment (BDFB, PDF, etc.).

Chapter 10 - AC Power Distribution Requirements — covers criteria, which apply to AC Power distribution feeding DC Power Plants, including cable, connectors and PDSCs.

Chapter 11 - Alarm Requirements — covers criteria for alarming of DC power equipment.

Chapter 12 - Power Installation – Generic Requirements — covers miscellaneous topics such as “Ask Yourself”©, fire safety, equipment labeling and SMOP.

Standards and Conventions

The following standards and conventions are used consistently throughout this document:
Tables and figures are located as closely as practical to the point in the text where they are referenced

Important Reminders

Following are items, which should be read and understood before performing any work or procedures on the AC and DC power systems.

- Ask Yourself©
- Power Awareness

Related Documentation and Drawings

Please refer all requests for any sub-documents and/or drawings listed in this document to your AT&T contact. Documents and drawings referred to in this document may not be available to all suppliers. Suppliers who have signed a non-disclosure agreement with that manufacturer may in some cases obtain manufacturer's drawings and specifications.

Admonishments

Admonishments are reminders that are used to assure the safety of personnel and to minimize service interruptions; loss of data; and damage to equipment, products, and software. There are three types of admonishments used in this document.

The three types are identified and defined below in descending order of priority:

- **DANGER** indicates the presence of a hazard that will cause death or severe personal injury if the hazard is not avoided.
- **WARNING** indicates the presence of a hazard that can cause death or severe personal injury if the hazard is not avoided.
- **CAUTION** indicates the presence of a hazard that will or can cause minor personal injury or property damage if the hazard is not avoided.

Training

For information about any training courses related to power systems, call NOET (Network Operation Education & Training) at 1-404-728-6100.

To register for a power course, contact your local training coordinator or call 1-800-NETRAIN (638-7246).

How to Order Documentation

External AT&T suppliers may obtain a copy of this document by accessing AT&T's Supplier Information web site (InfoSWAP) at <https://www.infoswap.att.com/>. This site requires an id and password that can be obtained through AT&T Supplier Management.

Internal AT&T customers may obtain an electronic copy of this standard in Portable Document Format (PDF) or in a Word Document format (DOC), by accessing the NOE Document Management System (ODMS) at <http://www.qms.att.com/odms/>. Search for this document using 790-100-669 or MLID 9583.

How to Comment on This Document

To report errors or suggest changes to this document, contact the document owner. Address to document owner is found at the ODMS site. <http://www.qms.att.com/odms/>

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Chapter 1- General Requirements

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General Requirements

1.01 General

These requirements have been prepared to provide telecommunications equipment engineering and installation service suppliers with general engineering and installation requirements for performing work within AT&T Network Packet Optical Network Services.

These requirements are necessary to insure that new installations meet AT&T power and grounding quality requirements and design parameters, and to make certain the equipment is installed in a safe and efficient manner.

NOTE:

AT&T reserves the right to revise this document for any reason. Liability to anyone arising out of use or reliance upon any information set forth herein is expressly disclaimed, and no representation or warranties, expressed or implied, are made with respect to the accuracy or utility of any information set forth herein.

This document is not to be construed as a suggestion to any manufacturer to modify or change any of its products, nor does this publication represent any commitment by AT&T to purchase any specific products. Further, conformance to this document does not constitute a guarantee of a given supplier's equipment and/or its associated documentation.

This document is not intended to be all-inclusive, and shall make reference to other AT&T practices when necessary. Additional engineering guidance may be required to engineer and install a specific piece of equipment, or to meet additional requirements established by contract or by AT&T.

1.02 Other Documentation

The following documents and AT&T practices were used in the development of this practice, and will provide the supplier with more detailed information on certain subjects. If the supplier needs copies of the documents listed below; they can be obtained from INFOSWAP web site.

AT&T Practices:

010-515-170, AT&T "Ask Yourself"© Handbook
032-385-100, "AT&T Approved Burndy® Connectors"
154-001-050, Power and Infrastructure Standards Manual
154-103-101, AT&T Alarm Standards Manual
760-200-110, Raised Access Floor Design Standards For ANS Equipment Locations
760-200-120, AT&T Practices-Raised Floor Requirements For All Network Equipment Locations
770-350-100 REV, Fire Stopping of Penetrations

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800-610-155, Earthquake and Disaster Bracing for Central Office Equipment
801-006-100, AT&T Cable Management For Common System-Engineering Design Guidelines
803-501-100, Grounding And Electrical Protection For AT&T Telecommunications Buildings And Equipment

1.03 Outside Supplier General Requirements

The supplier is required to ensure that AT&T's engineering, installation, architecture, and interconnection requirements are met.

The supplier shall ensure that engineering and installation accomplished for AT&T is done in accordance with Federal, State and Local requirements, codes, laws and regulations.

The supplier must obtain the required documentation in order to engineer the order. This may require cooperation with other companies.

The supplier shall ensure all licenses, copyrights, or permits are available if an equipment supplier requires them in the course of engineering or installation.

The supplier shall ensure all AT&T engineering documentation and records are updated and accurate at the completion of the work.

The supplier is responsible for opening and closing cable holes, as required, during the performance of services. Cable holes shall remain closed when cable work is not in progress.

The supplier shall be knowledgeable and meet all requirements of isolated and integrated ground planes, which may exist in the installation area.

Detailed Method Of Procedures (MOPs) and Service Method Of Procedures (SMOPs) must be developed and approved per requirements in the following:

- **"Ask Yourself"© Handbook, AT&T 010-515-170**
- **Service Method of Procedure, AT&T 790-100-421**

1.04 Quality Assurance

Acceptance of the engineering and installation performed by the supplier shall be in accordance with the General Procurement Agreement, General Services Agreement, Network Supplier Guidelines, and any written agreement negotiated with the supplier by AT&T.

Power and grounding engineering services, deliverables, and installation shall also be subjected to an engineering acceptance audit conducted by AT&T in accordance with requirements in ATT 800-614-105, the Installation, Test and Acceptance (ITA) checklist and this document.

- Audit results will be shared with the supplier and are expected to result in continuous improvement.
- The supplier at no cost to AT&T will remedy discrepancies identified, as a result the acceptance audit procedure, immediately
- Unsatisfactory audit results and unsatisfactory management commitment to improve those results may lead to de-certification and elimination of the supplier from consideration for future contract awards.

1.05 DC Power System Major Components

1. COMMERCIAL AC POWER DISTRIBUTION - This is the input to the DC power system and includes the power distribution cabinet (PDSC or PCCD), which feeds rectifiers as well as protective devices (breakers/fuses), conduit, cable, and connectors.
2. CHARGING EQUIPMENT - Consists of rectifiers and associated equipment to convert AC power to DC power at voltages suitable for AT&T applications.
3. STORAGE BATTERIES - Provides a source of DC power to the equipment when AC power is not present. This power is provided until AC power can be restored or the batteries are depleted. Storage batteries also provide filtering of the rectifier output. Lead acid wet cells are connected in series (battery strings) to obtain the proper voltages. Battery strings are connected in parallel to provide adequate current capacity.
4. INITIAL CONTROL AND PRIMARY DISTRIBUTION BAY - Provides operational and control logic and plant monitoring features for the DC plant. Also functions as a primary DC power distribution source through protective devices to secondary distribution equipment (BDFB's PDF's PDFB's, etc.).
5. SUPPLEMENTAL PRIMARY DISTRIBUTION BAYS - Provides primary DC power distribution, through protective devices, to secondary DC distribution equipment (BDFBs, PDFs, PDFBs, etc.). Supplemental Primary Distribution bays may also provide DC distribution directly to equipment loads.
6. SECONDARY DISTRIBUTION EQUIPMENT - Provides DC power distribution, through protective devices, directly to equipment loads. Secondary Distribution equipment may include Battery Distribution Fuse Bays (BDFB), Power Distribution Fuse Bays (PDFB), Power Distribution Frames (PDF), Area Bus Centers (ABC), or miscellaneous fuse and distribution panels.
7. CONVERTER - Provides DC/DC voltage conversion to enable a single power plant to serve telecommunications equipment requiring an input voltage other than the voltage of the power plant.
8. INVERTER – Converts a DC voltage into an AC voltage. Inverters are used to provide protected AC power.

1.06 Code Requirements

Power equipment shall be engineered and installed per appropriate codes governing the equipment and the jurisdiction in which the equipment is installed.

The furnishing supplier (engineering and/or installation) shall guarantee code compliance. This code compliance shall include any laws or ordinances enacted by legal bodies having jurisdiction over a specific office or offices. If specific codes do not exist, NFPA 70, "National Electric Code®¹⁶" published by the National Fire Protection Association shall be the minimum standard applied. The supplier shall notify the appropriate AT&T Engineering Representative of any special code requirements that will impact costs. This notification shall occur prior to issuing detail specifications.

¹⁶ National Electric Code® is a registered trademark of National Fire Protection Association.

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Chapter 2- Pre-Engineering and Job Planning

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Pre-Engineering and Job Planning

2.01 Building Infrastructure Verification

During the pre-engineering process a preliminary evaluation shall be performed by the consultants and supplier, if known, assisted by AT&T representatives (Building Engineering, Central Office Planning, Power Engineering, Facility Engineering, etc.), all of whom may be involved in the overall planning and implementation of the project. Participants will determine the possible effect of the proposed work on the capacity of building power and infrastructure support systems. A clear understanding of the complete project scope, schedule, and overall responsibilities shall be the purpose of this meeting. The meeting may be held at the AT&T engineering location, at the location where the work is planned, or at any other location that is acceptable to AT&T. For major power work, an on site visit is strongly recommended. A site visit by the consultants (prior to start of detailed engineering) and suppliers (prior to proposal submittal) to the actual work location may be required to verify office conditions. Systems to be evaluated shall include, but are not limited to the following.

- Chiller Capacity
- Cooling Fans
- Building Structure, including Seismic Requirements
- Security Systems
- Fire Protection and Detection Systems
- Emergency Lighting Systems
- Standby Engine Alternator Capacity
- DC Power Plant Capacity
- Inverter Capacity
- AC Power Distribution System Capacity
- Emergency Egress
- Infrastructure Alarm System

The supplier, in most cases, may not know the answer to these questions, but is required to ask these questions to the operating AT&T designated personnel or group.

The installation of the planned equipment may affect the ability of these infrastructure systems to adequately support the building or the existing telecommunications equipment within the building. If the proposed work will negatively impact the existing or planned equipment within the building, the team shall contact the impacted engineering group for resolution of any conflict.

During the pre-engineering walk-through the supplier and AT&T, shall verify the following:

- Verify that -48 V DC power or protected AC power (if required) capacity is readily available in the area. Secondary Distribution Bay and DC power board distribution should be verified against the engineering records for accuracy at this time. Any discrepancies shall be marked and corrected as part of the work to be done.
- Verify that adequate floor space is available for the initial installation and future growth per the preliminary floor plan. If the floor space is not clear and equipment removal is necessary, identify how and when the removal work will be completed in order to meet the installation start date.
- Verify that the floor will support the weight of equipment being added.
- Verify that essential AC power, if required, is readily available in the area.
- Verify that emergency/egress lighting is adequate in the area during the installation and after the installation is complete. Overhead cable racking, air plenums, etc., which are to be installed may block existing lighting fixtures, thus requiring additional lighting to meet egress code requirements.
- Verify that building environmental systems (cooling, air handling, and heating) are adequate to support the operation of the proposed power equipment.
- Verify compliance with special environmental or safety codes if batteries are being installed.
- Verify that there is adequate ceiling height to accommodate the installation, and that the cable racking system can be supported from the ceiling, if required.
- Verify that an adequate office alarm system exists to accommodate the installation work proposed.
NOTE: DC power plants cannot be turned up and accepted as complete unless remote alarms are operated and have been verified.
- Verify that in a raised floor environment, the under floor cabling area is not being used as an air plenum and that a water detection system is planned for under the floor if the installation is below grade or packaged A/C units are used.
- Verify that the area is free from building obstructions, which may interfere with the installation, or the delivery and/or removal of the equipment. This includes but is not limited to the following:
 - Are there areas of build-up around the building columns?
 - Are there fluid (water, wastewater, or gas) pipes in the area?
 - Are there air plenums crossing the area?
 - Are there cable racks crossing the area?

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- Are there AC or DC bus ducts crossing the area?

AC Power Verification

The engineering team should consider the following issues.

- If existing essential AC task lighting exists, is it adequate to allow installation to start?
- Is adequate essential AC power available for the power equipment being installed?
- Can the essential AC power for DC plants be obtained from two separate sources?
(Critical offices only)
- What is the AC power available fault current? This must be determined prior to engineering and ordering AC power distribution equipment.
- Is the standby AC plant capable of handling the planned additional load?

DC Power Cabling Verification

The engineering team should consider the following issues.

- Is the equipment to be installed on a raised floor with under floor cabling or will the equipment is slab mounted with overhead racking?
- Are existing cable racks or cable paths available?
- Are there 'choke points' or areas of excessive cable build up on existing racks?
- Will building problems and obstructions create long cable runs?
- Will cable paths pass through administrative areas or areas belonging to other companies?
- Will cable paths pass through areas above false ceilings or under raised floors that may be considered plenums?
- If cabling between floors is required, will additional cable holes be required?
- Do local codes require battery acid spill containment?

Grounding Verification

The engineering team should consider the following issues.

- Will a ground plate need to be added for the new equipment?
- Is there a Central Office (CO) ground system with existing ground bars?
- Will all equipment bays be within 100 feet of the CO ground riser and within 200 feet actual cable length?
- Is the equipment being powered within an isolated ground plane area?

- If a raised floor is utilized, how will it be grounded and by whom?

Code Verification

The engineering team should consider the following issues:

Supplier shall insure that all local codes are met by the installation crew. This includes permits and inspections as required by the local governing authority. Codes that may be involved include, but are not limited to building, electrical, seismic and water quality.

2.02 Required Order Input

The following information, based on work covered, shall be provided to the supplier and will be included in the Telephone Equipment Order (TEO) from AT&T.

- Location - office name, street address, CLLI® code¹⁷
- Required ship, start, and complete dates
- Coordinating order numbers
- General description of work and major equipment required
- Floor locations

Note:

This information shall be in the form of a Frame Identification Code (FIC) for each bay of equipment.

- DC input/output requirements for converters and inverters.
- AC input/output requirements for inverters and rectifiers.
- Information on AC feeds provided by other suppliers.
- Busy-hour reserve (BHR) requirements.
- Battery plant-shunts size.
- Office temperature for battery calculations.
- A brief description of the type of equipment that the power plant will feed.
- The type and location of the local alarm system used.
- The type and location of the remote alarm system used.
- Special spare component parts or plug-in requirements.
- Seismic zone where applicable (order must designate "0" if none is required).
- Material source for material provided by AT&T.
- Material source for material provided by an outside supplier
- An assessment of risk to the AT&T network
- Fuse and breaker assignments (if reserved by AT&T)
- Any special requirements not covered in this practice.

¹⁷ CLLI® is a registered trademark of Bellcore, Inc.

2.03 Order Sequencing and Coordination

Sequencing of work within a single order is the responsibility of the supplier. All work must conform to SMOP guidelines and approval process.

Sequencing of work between related orders shall be specified in the description field of the AT&T EQUIPMENT ORDER. The order number of any related order shall be listed in the description field of the equipment order. AT&T Engineering shall list a contact for information on sequencing of the orders within the note section of the equipment order. The supplier's engineering and installation team shall then be responsible for sequencing the work between the orders. The supplier's engineering representative shall initiate a conference call with the AT&T Engineering Representative. The purpose of this call shall be to provide information on the sequencing requirements.

Sequencing of an order may be required either by an AT&T order from other than the Power Engineering group or to facilitate the supplier's engineering. In these cases, the supplier's engineer shall notify the appropriate person in AT&T's Power Engineering group of the need for sequencing. The supplier's engineering and installation team shall then be responsible for sequencing the work between orders.

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Chapter 3- Engineering Records and Documentation

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Engineering Records and Documentation

3.01 Engineering Records and Drawings

A complete set of office engineering records is required. AT&T shall furnish source documents relating to the work to be performed to the supplier prior to the start of detailed engineering. The supplier may obtain information concerning AT&T documents, records and drawings from AT&T Supplier Management. Records shall include, but are not limited to, the following documents.

- Central Office Development Plan (obtain from Central Office Planner)
- Detailed Building Drawings
- Grounding Drawings
- Cable Running List
- Cable Racking Plan
- Front Equipment Drawings or IIDI-DC records
- Wiring Lists and Block Schematics or IIDI-DC records
- Secondary Distribution Assignment Drawings or IIDI-DC records
- Power Plant Distribution Assignment Drawings or IIDI-DC records
- Alarm drawings or IIDI-DC records. During the detailed engineering process the supplier will be responsible for the updating of existing engineering records or the creation of new drawings and records to reflect the work being performed.

NOTE:

For any work the suppliers shall obtain the required drawings from AT&T's INFOSWAP web site or IIDI database.

3.03 IIDI-DC Input Requirements

General Requirements

The following are requirements for data input for AT&T projects into the IIDI database system. Refer any questions to the Manager for DC Documentation in the Infrastructure Process District.

ALL IIDI-DC records shall be completed by the main equipment ship date for power equipment additions. For equipment fuse or breaker assignments, records must be complete at the specification release date.

The IIDI-DC records must accurately reflect the office conditions plus any engineered additions, modifications or removals.

All fields that apply to any added circuit record must be populated.

Example: The "FS/CB" section of the "BDFB Load" screen record shall be populated and must agree with the information populated in the PPLT record.

Do not enter "V" as a unit in fields requiring voltage entries.

Do not enter "A" as a unit in fields requiring amperage entries.

The load designation used in the PPLT record shall match the load designation used in the BDFB record.

Example: If the PPLT record shows a breaker feeding a BDFB load "AA", the BDFB record shall show that load as "AA", not "A" or "1".

All drawings shall be entered without a space between the beginning alpha character and the first numeric, i.e., enter Tyco "J85568D-1" not Tyco "J 85568D-1" or Tyco "KS23836" not Tyco "KS 23836".

When notes are added to the record, a blank line shall be inserted between notes.

Each power plant controller shall be identified as to the equipment served. For example, a controller on a blue -48 V plant serving the Lucent 4ESS™¹⁸ would have "-48V 4ESS BLUE" in it's "DESIG" field. The area served field for this power plant would be "4ESS".

When a BDFB or PD is added to the record, the installed voltage drop data shall be entered in the bay record. The value entered must be the actual (installed) voltage drop. See the section entitled, "Proper Utilization of Secondary Distribution Voltage Drops" in Chapter 4 of this document.

Small fuse panels shall have a major user listed in the "Functional Designation" field.

Example: A fuse panel installed for DMACS™ shall have "DMACS FS PNL" in the "Functional Designation" field.

Diversity fields shall be populated with "RED", "BLUE" or "GRAY". This entry applies to both the BDFB load record and the PPLT record. In those cases where "RED" and "BLUE" BDFBs have been cabled to a GRAY power plant, the BDFB record shall indicate the BDFB color, not the power plant color.

If return cables use wire with a "tracer", the color of the wire shall be entered as "REDT" or "BLUET".

Battery Capacity and hours shall match the Battery Reserve Requirement (BHR) for the power plant in IIDI. For example, power plants with an IIDI required BHR of 5 hours shall have 226/5 not 301/3. This assumes MVPC of 1.86 volts and one string of Tyco KS20472 L1S battery cells.

¹⁸ Lucent 4ESS™ is a trademark of Lucent Technologies, Inc.

In the power plant record (PPLT), the power plant capacity shall be entered based on the bus bar capacity of the power plant.

The software version and the manufacturer's part number (comcode) for the software used on the controller software shall be entered in the Equipment wiring list when upgrades occur. The initial installation of a controller shall have the ship date (month, year) of the unit if the version is unknown.

Example: For a Galaxy SC™ controller, the entry shall be:

Circuit Name: SFTWR VER. 5.30 (or the ship date (1199))

Quantity: 1

Equipment Dwg.#: 000000000*

*Manufacturer's number (comcode)

Fuse Reservation Requirements

The AT&T Engineering Group may provide the assignments for added equipment. This information must be identified in the order to the supplier and also entered into the IIDI-DC system. The assignments shall have an equipment identifier and "RSVD" in the functional designation field. "RSVD" is used to indicate that the assignment is "reserved". AT&T shall populate the equipment load, fuse size and the List 2(X) drain fields for the assignment. The supplier or others as designated by AT&T shall complete the IIDI-DC information as part of the detail engineering. The supplier may make changes to assignments, with concurrence from AT&T Power Engineering. Contacting the AT&T Engineering Representative is not required unless, based on the List 2 drain, an overload condition is created or if insufficient positions are available.

In most cases, the supplier shall make the fuse assignment in IIDI. Until the information is placed in IIDI as "RSVD or ACTUAL" assignments, the positions are available to any supplier.

Frame Identification Requirements

A Frame Identification Code (FIC) shall consist of six-digits, a decimal and three additional digits with the last position an optional letter (FL-LINE.XXO). They shall agree with the FIC provided in the EQUIPMENT ORDER and the AT&T development plan unless additional documentation is provided i.e., email message.

Note: Frame codes for former LNS offices may vary from this convention, these FIC shall maintain their existing numbering pattern

If a circuit is re-cabled, the new record shall conform to the new FIC requirement.

This will require a conversion based on the tables found on the floor plans or developmental plans. If sufficient character spaces are available, the old FIC may be placed in the Functional Designation field, for future reference. If a conversion table does not exist please contact AT&T Central office Planner (COLD) for the information and request that the drawing be corrected.

Example: A DDM 1000 load "A" is re-cabled. The old FIC was 0333.03 and the conversion on the floor plan says that the 0333 line becomes the 030033 line. The new FIC for the "A" load shall be 030033.03. The old FIC 0333.03 shall become part of the entry in the Functional Designation field, i.e. "DDM 1000 0333.03".

If any equipment load is re-cabled and the records indicate the old type FIC in the "Relay Rack" field, ALL load records for that bay shall be updated to the new type FIC (FL-LINE.XXO).

Example: For the DDM 1000 in the item above, the IIDI-DC record for the "B" load would also be changed from 0333.03 to 030033.03. The "Function Designation" field shall be changed from "DDM 1000" to "DDM 1000 0333.03"

The FIC shall be used to identify a secondary distribution bay in both the BDFB and PPLT record. In the BDFB record, the "Bay" record shall have the FIC entered in the "Bay Designation Field". In the PPLT record, the assignment record shall have the FIC entered in the "Relay Rack" field.

All equipment bays must have a FIC entry in the "Relay Rack" field. Some bays may be known as PD-0 or other system designation. The system designation shall be placed in the "Functional Designation" field, but the FIC must be placed in the "Relay Rack" field.

In the BDFB Load record, the section named "FS/CB" provides detail information on the protection device feeding the BDFB or PDF. In this section the field named "location" shall be populated with the FIC of the Power Board on which the protection device feeding the BDFB/PDF bus is mounted. Do not use the term "PBD" or other descriptive term in this field.

Secondary Distribution Bus Requirements

Load shall not be added to a Secondary Distribution Bays (BDFB or PDF) bus, beyond the cabled List 2 drain, unless authorized by AT&T in writing. The List 2 drain shall not exceed the breaker size. This authorization may be in the form of an email message or fax.

Example: If a circuit has a 400-ampere breaker and is cabled for 320 amperes (400 X .80). The maximum List 2 drain allowed is 320 amperes. Additional drain up to 400 amperes (L-2) may be added, but only if approved and documented by an AT&T power representative. These List 2 drain values must include all circuits attached to the BDFB bus regardless of status.

The equipment load is not required to be entered in the "Functional Designation" field unless the circuit feeds power to more than two loads, or two loads each designated by more than one letter, i.e., AA and AB. If a fuse or breaker powers two equipment loads, the two loads shall be entered in the "RR-Ld" field and separated by a comma.

Example: An "A" load and an "E" load would be entered as "A, E".

If the circuit powers more than two loads, the first load followed by "-" shall be entered in the "RR-Ld" field. All loads powered shall be entered in the "Functional Designation" field.

Example: Loads A, B, C, and D shall be entered in the "Functional Designation" field and "A-" shall be entered in the "RR-Ld" field.

NOTE:

In the past, a single power circuit was sometime used to provide power to several bays of equipment or for two or more buses in a distribution bay. These circuits were referred to as "multiplied" circuits. Equipment multiples shall not be used to power AT&T equipment bays without specific written instructions to do so. Digital cross-connect alarm and signal circuits may continue to be "multiplied". If taps are used for multiplied circuits, cable tags shall be used on all wires at the tapped point.

If two BDFB or PDF buses are tied to a common protection device, the capacity of the circuit shall be split between the two buses. I.e., if a circuit is cabled for 100 amps and two buses attached, each bus has a List 2 capacity of 50 amperes or one bus may have 60 amperes and the other 40 amperes. **In no case shall the capacity of the buss be exceeded.**

If two BDFB or PDF buses, which use two character identifiers (A0 or AA), are tied to a common protection device, the "EQ Ld" field of the circuit in the PPLT record shall show the BDFB or PD load that is connected closest to the power board. The other load shall be shown in the "Equipment Multiples" field. The Functional Designation field shall contain both load bus designations.

Example: PD-0 has the B0 and B6 buses fed from a common breaker.

"Functional Designation" = "PD-0 LD B0 and B6"

"Relay rack" = "020010.12"

"Eq Ld" = "B0"

If busses on secondary distribution bays have different voltage drops, each bus shall have its voltage drop entered in the BDFB record. If a circuit uses the four-volt-loop as detailed in chapter 4 of this document and the BDFB has been installed as a two-volt-loop; the *circuit* shall have (4VL) entered in the functional designation field for the circuit. Also, a bus that has both 2V-loop and 4V-loop equipment installed shall be designated as (2v/4v) in the records.

Special Indicator Requirements

The "WO" field shall not be populated except for true preconditioned equipment. Spare, Future or RIP equipment shall not use this field. "WO" shall not be entered in the "Functional Designation" field as a designation for preconditioned equipment.

Pre-assigned positions shall have "(FUT)" entered in the "Functional Designation" field. The fuse size must be entered and 0.01 shall be entered in the 'Drain' field.

When pre-assigned equipment is installed, the "(FUT)" is to be removed from the "Functional Designation" field and the 0.01 in the "Drain" field replaced with the proper List 2 drain.

NOTE:

The term "pre-assigned" refers to breaker or fuse positions for systems or projects that assign positions for the ultimate requirement, but do have a project in progress to install all of the equipment. These positions are usually standard for all Secondary Distribution bays (BDFBs or PDs) installed within a system.

Reserved positions shall have "RSVD" entered in the "Functional Designation" field. This is in addition to the equipment information. The fuse size and the List 2 drain shall be entered in the record. Once the detail engineering and cable running information has been added to the record, the "RSVD" shall be removed from the 'Functional Designation' field.

NOTE:

The term "Reserved" refers to a circuit for which a project has been written. The circuit will either be installed in the near future or the reservation removed. These circuits do not normally appear in the same position in a bay for all locations.

Equipment that is in place and cabled but is to be de-fused shall have "(SP)" or "RIP" added to the Functional Designation field. The fuse "Size" and the List 2 "Drain" shall remain in the record.

The only time the List 2 drain shall be removed from the record is when the cables have been removed from the distribution bay. At that time the marking on the bay shall be removed and the record returned to "unassigned" status.

V-TYPE and VTY Field Requirements

The "V-type" or "VTY" field for BDFB records shall be populated with the following, based on the main usage (amperage of loads) of the BDFB or power plant:

"4ESS™", "5ESS®¹⁹", "POI", "CPA", "NCP", "STP", "OSPS", "FIBER", "DACS", "DCO", "DCS™²⁰", "PSS", LCONN, ALTEL, BLDG, DCOLV

NOTE: The database will not allow the ® or ™ symbols to be entered.

¹⁹ 5ESS® is a registered trademark of Lucent Technologies, Inc.

²⁰ DCS™ is a trademark of Lucent Technologies, Inc.

NOTE:

This is not a complete list of technologies. Contact the AT&T Power Engineering if a technology being installed is not on this list.

NOTE:

The Vty or V-type does not necessarily mean a BDFB is dedicated only to that technology.

When a BDFB is designated as dedicated to a certain technology, the VTYPE for that BDFB shall be shown as that equipment type. A note shall be added to the IIDI "BDFB" record stating that the BDFB is dedicated to that service.

If a Secondary Distribution Bay (BDFB, PD) is installed with buses equipped but not wired to a power plant, the BDFB buses shall be entered as normal (A, A0) but the "V-type" or "Vty" field shall be entered as "NOTCA". In addition, the "BDFB LOADS" field "IN CB/FS SIZE" shall have "FUT" and the "FS/CB LOCATION" field shall have "NOT CABLED". In addition, the fuse position fields for these buses shall not be populated.

Each power plant (PPLT) record shall have an entry in the V-Type field. If the power plant is dedicated to a technology, that technology code shall be used. 4ESS™, 5ESS®, CPA or NCP are examples of dedicated type plant. Plants that are used for Digital Central Offices or common equipment shall use "DCO". "BLDG" shall be used for DC plants that serve only building loads (DC lights, switchgear).

3.04 Equipment Specific Examples

The following are the minimum requirements for entries in the "Functional Designation" fields for specific equipment:

(Power Archs starting with PwrArch-040 have this information in the power arch. These PwrArchs may be found in ODMS and INFOSWAP).

Table 3-1 Sonet Transmission Manager (STM) (PWR ARCH-001)

Equipment type	Entry in functional designation field	Load field
STM-18 Cab 1	STM-18 FR 1	A, B
STM-18 Cab 2	STM-18 FR 2	A, B
STM-18 Cab 3	STM-18 FR 3	A, B

Table 3-2 Voice Recognition Call Processing (VRCP) (PWR ARCH-002)

Equipment type	Entry in functional designation field	Load field
VRCP Bay 0 Fuse Panel	VRCP CSS/AP BAY 0	A, B

Table 3-3 Lucent Digital Access & Cross Connect System IV™²¹ (DACS IV), 256 Port System (PWR ARCH-003)*

Equipment type	Entry in functional designation field	Load field
Digital Access & Cross Connect IV™	DACS IV (256)	A, B, C, D

*See table 3-17 for DACS IV, 512 port System

Table 3-4 Call Detail Recording Platform System (CDRP) (PWR ARCH-004)

Equipment type	Entry in functional designation field	Load field
CDRP Star Server SSFT R3000 CO System Cabinet	CDRF SSFT R3000	A, B
CDRF MSC/DTC Cabinet	CDRF MSC/DTC	A, B

Table 3-5 Lucent Digital Access & Cross Connect System III™²² (DACS III 2000) (PWR ARCH-005)

Equipment type	Entry in functional designation field	Load field
DACS III 2000 1024 System	DACS III (SM)	A, B, C, D, E
DACS III 2000 2064 System	DACS III (LG)	A, B, C, D, E, F, G, H, J

²¹ Digital Access & Cross Connect System IV™ is a trademark of Lucent Technologies, Inc.

²² Digital Access & Cross Connect III™ is a trademark of Lucent Technologies, Inc.

Table 3-6 Lucent FT Series G^{TM23} Lightguide (PWR ARCH-006)

Equipment type	Entry in functional designation field	Load field
FT-G 417 Dual Terminal Muldem (Lucent J987464C)	DTMB 417	A, B
FT-G 1.7 Dual Terminal Muldem (Lucent J987464C)	DTMB 1.7	A, B
FT-G 417 Terminating Muldem (Lucent J987464B)	TMB 417	No entry
FT-G 1.7 Terminating Muldem (Lucent J987464B)	TMB 1.7	No entry
FT-G Telemetry Channel Controller (Lucent J987464T)	TCC	No entry
FT-G Embedded Telemetry System (Lucent J987464E)	ETS	No entry
FT-G Line Repeater (Lucent J987464R or Lucent J987464S)	LRB	No entry

Table 3-7 Lucent 4ESSTM Service Circuit System (SCS)(PWRARCH-007)

Equipment type	Entry in functional designation field	Load field
Service Circuit Controller (Lucent J4A024A-1)	SCS SCC CMPX (#) 'A' or 'B'	J0, J1, J2, J3, J4, J5
Service Circuit Unit (Lucent J4A024B-1)	SCS CMPX (#) SCU CAB (##)	J0, J1, J2, J3, J4, J5
Custom Data Services PHASE 1 (Lucent J4A024C-1)	SCS CDS CMPX (###) PH1	J0, J1, J2, J3, J4
Custom Data Services PHASE 2 (Lucent J4A024C-1)	SCS CDS CMPX (###) PH2	J0, J1, J2, J3, J4
Announcement Administrative Processor	SCS AAP CMPX (###)	A,B

(#) A total of eight (8) complexes (CMPX) are possible. They will be numbered from 0 to 7.
Example: SCS SCC CMPX 0 or SCS SCC CMPX 7

(##) A total of four (4) SCU per complex is possible. They will be numbered from 0 to 3.
Example: SCS CMPX 0 SCU CAB 0 or SCS CMPX 7 CAB 3.

(###) One CDS can be equipped per SCC complex. The CMPX number here is the number of the corresponding SCC complex.
Example: SCS CDS CMPX 0

Table 3-8 Alternate Signaling Interface System (ASI) (PWRARCH-008)

Equipment type	Entry in functional designation field	Load field
Lucent ED 3F402-01 PD Cab	ASI PD CAB	A1, A2, B1, B2

²³ FT Series GTM is a trademark of Lucent Technologies, Inc.

Table 3-9 DTMS/FASTAR® (PWRARCH-009)

Equipment type	Entry in functional designation field	Load field
Inverter	FASTAR INVR (DEDICATED)	No entry

Table 3-10 Worldspan Access Cabinet (PWRARCH-010)

Equipment type	Entry in functional designation field	Load field
Access A	WORLDSPAN ACCESS A	No entry
Access B	WORLDSPAN ACCESS B CAB (#)	A, B, C
Backbone A	WORLDSPAN BACKBONE A	A, B
Backbone B	WORLDSPAN BACKBONE B	A, B

(#) A total of four (4) expansion (B) cabinets are possible. They will be numbered 1,2,3 and 4.

Table 3-11 Lucent GlobeView-2000®²⁴ Asynchronous (ATM™²⁵) Cell Switch (PWRARCH-011)

Equipment type	Entry in functional designation field	Load field
Control Cabinet		
CIRCUIT 1 ASNCP SIDE 0	ATM CONTROL ASNCP 0	1
CIRCUIT 2 ASNCP SIDE 1	ATM CONTROL ASNCP1	2
CIRCUIT 3 ISS SIDE 0	ATM CONTROL ISS 0	3
CIRCUIT 4 ISS SIDE 1	ATM CONTROL ISS 1	4
CIRCUIT 5 COOLING SIDE 0	ATM CONT COOLING 0	5
CIRCUIT 6 COOLING SIDE 1	ATM CONT COOLING 1	6
Fabric Cabinet		
CIRCUIT 1 ATMIS SIDE 0	ATM FABRIC ATMIS 0	1
CIRCUIT 2 ATMIS SIDE 1	ATM FABRIC ATMIS 1	2
CIRCUIT 3 ISS EXP SIDE 0	ATM FABRIC ISS EXP 0	3
CIRCUIT 4 ISS EXP SIDE 1	ATM FABRIC ISS EXP 1	4
CIRCUIT 5 COOLING SIDE 0	ATM FABRIC COOLING 0	5
CIRCUIT 6 COOLING SIDE 1	ATM FABRIC COOLING 1	6
ISS Cabinet (up to 3 provided)		
CIRCUIT 1 ISS SIDE 0	ATM ISS (#) SIDE 0	1
CIRCUIT 2 ISS SIDE 1	ATM ISS (#) SIDE 1	2
CIRCUIT 3 ISS EXP SIDE 0	ATM ISS (#) EXP SIDE 0	3
CIRCUIT 4 ISS EXP SIDE 1	ATM ISS (#) EXP SIDE 1	4
CIRCUIT 5 COOLING SIDE 0	ATM ISS (#) COOLING SIDE 0	5
CIRCUIT 6 COOLING SIDE 1	ATM ISS (#) COOLING SIDE 1	6

²⁴ Lucent GlobeView-2000® is a registered trademark of Lucent Technologies, Inc.

²⁵ ATM™ is a trademark of Lucent Technologies, Inc.

Table 3-12 Post Answer Call Redirection™²⁶ (PACR™) (PWRARCH-012)

Equipment type	Entry in functional designation field	Load field
Summa 4 SDS™ ²⁷ -1000 Switch #1 Main Cabinet	PACR SUMMA 4 #1 MC-MPS	A1
Summa 4 SDS™-1000 Switch #1 Expansion Cabinet	PACR SUMMA 4 #1 EXP-MPS	A2
Summa 4 SDS™-1000 Switch #2 Main Cabinet	PACR SUMMA 4 #2 MC-MPS	B1
Summa 4 SDS™-1000 Switch #2 Main Cabinet	PACR SUMMA 4 #2 EXP-MPS	B2
Summa 4 SDS™-1000 Switch #3 Main Cabinet	PACR SUMMA 4 #3 MC-MPS	A1
Summa 4 SDS™-1000 Switch #3 Expansion Cabinet	PACR SUMMA 4 #3 EXP-MPS	A2
NCR Starserver FT Processor	PACR STARSERVER	A,B

Table 3-13 Individual Per-Call Control System (IPCC™²⁸) (PWRARCH-013)

Equipment type	Entry in functional designation field	Load field
IPCC™ Gateway Sun Station	IPCC Gateway	A,B

Table 3-14 Digital Cross Connect 3/1 System (DCS™ 3/1) (PWRARCH-014)

Equipment type	Entry in functional designation field	Load field
Administrative Processor Bay	DCS 3/1 ADMIN PROC	A, B
Center Stage Bay Copy 0	DCS 3/1 CTR STG COPY 0	A, B
Center Stage Bay Copy 1	DCS 3/1 CTR STG COPY 1	A, B
End Stage Bay 1 Copy 0	DCS 3/1 END STG 1 COPY 0	A, B
End Stage Bay 1 Copy 1	DCS 3/1 END STG 1 COPY 1	A, B
End Stage Bay 2 Copy 0	DCS 3/1 END STG 2 COPY 0	A, B
End Stage Bay 2 Copy 1	DCS 3/1 END STG 2 COPY 1	A, B
End Stage Bay 3 Copy 0	DCS 3/1 END STG 3 COPY 0	A, B
End Stage Bay 3 Copy 1	DCS 3/1 END STG 3 COPY 1	A, B
End Stage Bay 4 Copy 0	DCS 3/1 END STG 4 COPY 0	A, B
End Stage Bay 4 Copy 1	DCS 3/1 END STG 4 COPY 1	A, B
I/O Bay 1 Shelf 1 and 2	DCS 3/1 I/O-1 SHLF 1,2	A, B
I/O Bay 2 Shelf 3 and 4	DCS 3/1 I/O-2 SHLF 3,4	A, B
Continue I/O bay pattern for up to 16 bays (shelf 31 and 32)		

²⁶ Post Answer Call Redirection™ and PACR™ are trademarks of Lucent Technologies, Inc.

²⁷ SDS™ is a trademark of Lucent Technologies, Inc.

²⁸ IPCC™ is a trademark of Lucent Technologies, Inc.

Table 3-15 AT&T Interspan Data Communications Services Information Access System (AIS) (PWRARCH-015)

Equipment type	Entry in functional designation field	Load field
AIS Primary Access System	IAS PRIMARY ACCESS	No entry
AIS Telematic S4500 PAD	IAS S4500 PAD (#)	No entry

Table 3-16 Interspan Data Communications Services (Frame Relay) (IAS) (PWRARCH-016)

Equipment type	Entry in functional designation field	Load field
Stratacom Cabinet	IAS STRATACOMM FS PNL	No entry
Verilink Cabinet	IAS VERILINK FS PNL	A, B
Dial Back-up Cabinet Commsphere 3000 (#)	IAS DBC COMSPHE (#)	A, B

Six (6) units may be equipped. They will be numbered as 1,2,3,4,5, and 6.

Table 3-17 Lucent Digital Access & Cross Connect IV-2000™²⁹ (512) (DACS IV) (PWRARCH-017)

Equipment type	Entry in functional designation field	Load field
DACS IV 2000 Switch Bay #1	DACS IV 2000 SW 1	AA, AB, AC, AD
DACS IV 2000 Switch Bay #2	DACS IV 2000 SW 2	BA, BB, BC, BD
DACS IV 2000 Fuse and Alarm Bay #1	DACS IV 2000 F/ALM 1	AA, AB, AC, AD, BA, BB, BC, BD
DACS IV 2000 Fuse and Alarm Bay #2	DACS IV 2000 F/ALM 2	AA, AB, AC, AD, BA, BB, BC, BD

Table 3-18 Multi-application Platform-2000 (MAP 2000) (PWRARCH-018)

Equipment type	Entry in functional designation field	Load field
Provisioning & Maintenance Frame	MAP 2000 PROV/MAIN	A, B
Call Processing Frame (#)	MAP 2000 CALL PROC FR (#)	A, B

(#) Frame numbers 1,2,3,4,5,6,7,8,9 and 10 may be equipped.

Table 3-19 AT&T Network Connect Services (ANCS) (PWRARCH-019)

Equipment type	Entry in functional designation field	Load field
Common Equipment Cabinet	ANCS COM. EQUIP	A, B
Netware Connect Cabinet	ANCS NET CONNECT	A, B
Hub Cabinet	ANCS HUB	A, B
Router Cabinet	ANCS ROUTER (#)	A, B

(#) Several router cabinets may be installed. They are designated as A, B...N.

²⁹ Digital Access & Cross Connect System IV 2000™ is a trademark of Lucent Technologies, Inc.

Table 3-20 Lucent Digital Access & Cross Connect II™³⁰ (Lucent J98774) (DACS II) (PWRARCH-020)

Equipment type	Entry in functional designation field	Load field
DACS II 640 (Lucent J98774A)	DACS II (640)	A, B, C, D
DACS II 160 (Lucent J98774B)	DACS II (160)	A, B, C, D
DACS II CEF (Lucent J98774C)	DACS II CEF	A, B, C, D

Table 3-21 DDM 1000 (Lucent J98769A) (PWRARCH-021)

Equipment type	Entry in functional designation field	Load field
DDM 1000 (single shelf)	DDM 1000 SYS (#)	A, B
DDM 1000 (Fuse Panel)	DDM 1000 FS PNL	A, B

The system number or other identifying label for the DDM 1000 shelf.

Table 3-22 Lucent FT-2000 OC-48 Lightwave System™³¹ (PWRARCH-023)

Equipment type	Entry in functional designation field	Load field
FT-2000 OC-48 Optical Amplifier	FT 2000 OC-48 OA	A, B
FT-2000 OC-48 Large Capacity Terminal Initial Interface Bay (Lucent J68974L-1 List 1)	FT 2000 OC-48 LCT-IN	A, B
FT-2000 OC-48 Large Capacity Terminal Initial Switch Bay (Lucent J68974L-1 List 1)	FT 2000 OC-48 LCT-SW	A, B
FT-2000 OC-48 Large Capacity Terminal First Terminating Growth Bay (Lucent J68974L-1 List 2)	FT 2000 OC-48 LCT-G1	A, B
FT-2000 OC-48 Large Capacity Terminal Second Terminating Growth Bay (Lucent J68974L-1 List 3)	FT 2000 OC-48 LCT-G2	A, B
FT-2000 OC-48 Add/Drop Rings Terminal (Lucent J68974E-1 List 5)	FT 2000 OC-48 ADD/DRP	A, B
FT-2000 OC-48 1X1 End Terminal (Lucent J68974E-1 List 6)	FT 2000 OL-48 END TERM	A, B
FT-2000 OC-48 Repeater (Lucent J68982R-1)	FT 2000 OL-48 RPT	A, B
FT-2000 OLS End Terminal (Lucent J68982C-1 List 101)	FT 2000 OLS END TERM	A, B
FT-2000 OLS Dual End Terminal (Lucent J68982C-1 List 103)	FT 2000 OLS DUAL ET	A, B
FT-2000 OLS Repeater (Lucent J68982C-1 List 102)	FT 2000 OLS RPT	A, B
FT-2000 OLS Dual Repeater (Lucent J68982C-1 List 104)	FT 2000 OLS DUAL RPT	A, B
FT-2000 OLS Combination End Terminal/ Repeater (Lucent J68982C-1 List 105)	FT 2000 OLS ET/RPT	A, B

³⁰ Digital Access & Cross Connect II™ is a trademark of Lucent Technologies, Inc.

³¹ FT-2000 OC-48 Lightwave System™ is a trademark of Lucent Technologies, Inc.

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Table 3-23 Universal Echo Canceller System (PWRARCH-025)

Equipment type	Entry in functional designation field	Load field
USEC Enhanced Platform (Lucent J98781A-1)	USEC (ENHANCED)	No entry
USEC RUBY Platform (Lucent J98803A-1)	USEC (RUBY)	No entry
USEC QuiteHear System (Lucent J98803B-1)	USEC (QUITEHEAR)	No entry
USEC Diamond Platform (Lucent J98803C-1)	USEC (DIAMOND)	No entry

Table 3-24 Buckeye AV1 Lightguide System (PWRARCH-026)

Equipment type	Entry in functional designation field	Load field
Buckeye AVI 1610 Optical Line Amplifier	BUCKEYE AVI OC48 OA	A, B
Buckeye LPR/DCD-525 SYNC Bay	BUCKEYE LPR/DCD-525 SYNC	A, B
Buckeye 1648 SM 1538/1558 Optics Dual HD Regen Bay	BUCKEYE 1648 SM Dual HD	A, B

Table 3-25 Segmentation Directory (SD) (PWRARCH-027)

Equipment type	Entry in functional designation field	Load field
Encryptor / Decryptor Bay per Lucent J3F062A-1	SD SYS (#)CED(X)	A, B
CISCO™ ³² 7507 ROUTER	SD CAB (Y) CISCO ROUTER	A, B
M8PSM-EDC Switching Hub	SD CAB (Y) M8PSM-EDC HUB	A, B
PAGODA CABINET E/W 2 3160 DSU	SD CAB (Y) DSU FUSE PNL	A, B

(#) SD SYS NUMBER 1 OR 2, (X) CED BAY NUMBER 0,1,2 OR 3, (Y) Pagoda cabinet 0 or 1

³² Cisco™ is a trademark of Cisco Corp.

Table 3-26 AT&T WorldNet™³³ Common Backbone (WorldNet CB) (PWRARCH-028)

Equipment type	Entry in functional designation field	Load field
Internet Gateway Router Cabinet CSU Fuse panel	W-NET GATEWAY CSU FP (#)	A, B
Internet Gateway Router Cabinet Cisco™ 7513 Router	W-NET GATEWAY ROUTER (#)	A, B
Backbone Router Cabinet CSU Fuse Panel	W-NET BACKBONE CSU FP (#)	A, B
Backbone Router Cabinet Cisco™ 7513 Router	W-NET BACKBONE ROUTER (#)	A, B
Access Router Cabinet CSU Fuse Panel	W-NET ACCESS FP (#)	A, B
Access Router Cabinet Cisco™ 7513 Router	W-NET ACCESS ROUTER (#)	A, B
CSU Cabinet	W-NET CSU CAB	A, B
Network Management Cabinet (type 1)	W-NET MGMT CAB TYPE 1	A, B
Network Management Cabinet (type 2)	W-NET MGMT CAB TYPE 2	A, B
Network Management Cabinet (type 3)	W-NET MGMT CAB TYPE 3	A, B
Cascade B-STDX 9000 Switch Cabinet	W-NET B-STDX-9000 SW CAB	A, B
Cascade 500 Switch Cabinet	W-NET 500 SW CAB (#)	A, B

(#) CABINET NUMBER

Table 3-27 AT&T WorldNet™ Dial Platform (W-NET Dial) (PWRARCH-029)

Equipment type	Entry in functional designation field	Load field
Digital Access (Modem) Cabinet	W-NET DIAL MODEM CAB (#)	A1, A2, B1, B2
Type 4 BNC Router Cabinet Fuse Panel	W-NET DIAL FP BNC ROUTER	A, B
Type 4 BNC ROUTER Cabinet BNC ROUTER BAY NETWORKS	W-NET DIAL ROUTER BAY NTWK	A, B

(#) Cabinet number (0) to (10)

Table 3-28 NEC™³⁴RC-48DX (RC-48DX) (PWRARCH-030)

Equipment type	Entry in functional designation field	Load field
NEC™ RC-48DF Digital Multiplex	NEC RC-48DF (#)	A, B
NEC™ RC-48DX Digital Multiplex	NEC RC-48DX (#)	A, B

If an individual shelf is mounted provide system or bay position for the shelf.

³³ AT&T WorldNet is a trademark of AT&T.

³⁴ NEC™ is a trademark of NEC Corp.

Table 3-29 AT&T HomePlace Services (HomePlace) (PWRARCH-031)

Equipment type	Entry in functional designation field	Load field
BTI Core Equipment Cabinet	HOMEPLACE BTI CEC1	A, B
BTI Applications Processing Cabinet	HOMEPLACE BTI APC CAB (#)	A, B
Digital Access Cabinet	HOMEPLACE DAC1	A, B
Router Cabinet Fuse Panel	HOMEPLACE ROUTER FP	A, B
Router Cabinet Bay Networks 5000 Hub	HOMEPLACE BAY NTWKS HUB	A, B
Router Cabinet Cisco™ 7505 Router (Kansas City & Chicago)	HOMEPLACE CISCO ROUTER (A) or (B)	A, B
DSU/CSU Cabinet	HOMEPLACE DSU/CSU	A, B
ISP Cabinet	HOMEPLACE ISP (#)	

(#) APC or ISP Cabinet number (0) to (4)

Table 3-30 Fastar® Equipment per NJ04096B-1 (PWRARCH-032)

Equipment type	Entry in Functional designation field	Load field
Fastar NJ04096B-1 Fuse PANEL for X.25 switch	FASTAR NJ04096B-1 FS PNL	Not required
Fastar NJ04096B-1 RNC-2000 computer	FASTAR RNC-2000	Not Required

Table 3-31 Digital Clock Distributor (DCD-LPR/DCD-523) (PWRARCH-033)

Equipment type	Entry in functional designation field	Load field
DCD-LPR/DCD-523 Master	DCD-LPR/DCD-523	A, B
DCD-523 Remote	DCD-523 REMOTE	A, B

Table 3-32 Unified Global Network (UGN) (PWRARCH-034)

Equipment type	Entry in functional designation field	Load field
UGN Cabinet 1-13	UGN CAB. (#) FS PNL	A, B

Note: (#) denotes identifies which cabinet from 1 to 13.

Table 3-33 1 800 CALL ATT® ³⁵ Service (PWRARCH-035)

Equipment type	Entry in functional designation field	Load field
1 800 CALL ATT® Fuse Panel	1-800-CALLATT FS PNL	A, B

Table 3-34 DDM-2000 OC-3 and OC-12 (PWRARCH-036)

³⁵ 1 800 CALL ATT is a registered trademark of AT&T.

Equipment type	Entry in functional designation field	Load field
DDM-2000 OC-3 Add/Drop Multiplexer Bay (6 DDM-2000 shelves)	DDM-2000 OC-3 MUX BAY	A, B
DDM-2000 OC-3/OC-12 Combo Multiplexer Bay (4 DDM-2000-OC-3 and 1 DDM2000-OC-12)	DDM-2000 OC3/OC12 MUX BAY	A, B
DDM-2000 OC-12 Mutiplexer Bay 3 (3 OC-12 DDM-2000)	DDM-2000 OC-12 MUX BAY	A, B

Table 3-35 Usage Management System (UMS) (PWRARCH-037)

Equipment type	Entry in functional designation field	Load field
UMS Encryptor/Decryptor Bay per Lucent J3F062A-1 System 1	UMS BAY CED-0 (SYS 1)	A, B
UMS Encryptor/Decryptor Bay per Lucent J3F062A-1 System 2	UMS BAY CED-1 (SYS 2)	A, B

Note: Loads 1 and 3 are fed from the "A" protection device and loads 2 and 4 are fed from the "B" protection device.

Table 3-36 CIENA™³⁶ MultiWave Sentry Lightwave System (CIENA) (PWRARCH-038)

Equipment type	Entry in functional designation field	Load field
CIENA™ OTS End Terminal Cabinet/Frame	CIENA OTS END TERM	A, B
CIENA™ OTS Repeater Cabinet/Frame	CIENA OTS RPTR	A, B
CIENA™ OTS Repeater Cabinet/Frame equipped with miscellaneous shelves	CIENA OTS RPTR/MISC	A, B

Table 3-37 NEC™ SONET OC-48 ADD/DROP Mutiplexer (ADM) Intelligent Transporter System (ITS-2400A) (PWRARCH-039)

Equipment type	Entry in functional designation field	Load field
NEC™ SONET OC-48 ITS-2400A ADM Sys. 1	NEC OC-48 ITS-2400A SYS 1	A, B
NEC™ SONET OC-48 ITS-2400A ADM Sys. 2	NEC OC-48 ITS-2400A SYS 2	A, B

Table 3-38 Equipment not currently in PWR Arch's.

³⁶ CIENA is a trademark of Ciena Corp.

Equipment type	Entry in functional designation field	Load field
Digital Access & Cross Connect I™ ³⁷ (Lucent J98735A)	DACS I	A, B, C, D, E, F
DDM 2000 single shelf (Lucent ED8C724-30) OC-3	DDM 2000 OC-3	A,B
DDM 2000 single shelf (Lucent ED8C727-30) OC-12	DDM 2000 OC-12	A,B
DMACS™ Alarm System Fuse Panel	DMACS FS PNL (#)	As required
NCOE (Tau-Tron™ ³⁸)	NCOE SYS (#)	A, B
Advanced Switch able Signaling and Echo Canceling Terminal III	ASSET III	A, B

Provide system or shelf number

Table 3-39. The following PWRARCH are available at the ODMS web site (<http://www.qms.att.com/odms/>) or on INFOSWAP (<https://www.infoswap.att.com/>) web site. Information and proper IIDI entries are contained within these documents

PWRARCH	Equipment Covered
PWRARCH-040	Power Distribution Architecture For Network Service Adjunct Platform (NSAP)
PWRARCH-041	Power Distribution For Digital Conference Bridge 2000 (DCB 2000)
PWRARCH-042	CISCO ONS 15454 (Aggregator) MSP Power Standard
PWRARCH-043	NEC SpectraWave DWDM Lightwave System Power Standard
PWRARCH-044	Lucent OLS 400G WaveStar DWDM Lightwave Power Standard
PWRARCH-045	ALCATEL 1680 OGX (Optical Gateway Cross Connect DC Power Standard
PWRARCH-046	NEC 160 Spectral Wave Power Standard
PWRARCH-047	Ciena CoreDirector Intelligent Core Switch Power Standard
PWRARCH-048	Lucent DMX -MSP Power Standard

³⁷ Digital Access & Cross Connect I™ is a trademark of Lucent Technologies, Inc.

³⁸ Tau-Tron™ is a trademark of Tau-Tron, Inc. (General Signal Corp.)

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Chapter 4- DC Power Plant Requirements

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4

DC Power Plant Requirements

4.01 Approved Power Plants

Approved Products and Suppliers

The following equipment has been authorized for use in the AT&T network.

*Please note that **Tyco** power products were formerly **Lucent** power products*

Use of any other equipment requires written permission of the AT&T Engineering department and the AT&T Infrastructure Process District.

Tyco J85500K-1 Lineage 2000 FPS™ Power Plant

Tyco H569-429 415B™ Power Plant

Tyco H569-434 GPS4848™ Power Plant

Tyco J85582B-1 GPS™ Power Plant

Tyco J85582C-1 GPS™ Power Plant

Tyco H569-436 GPS4812™ Power Plant

Marconi 1231H1™³⁹ Power Plant

Marconi 1231V1 Vortex™⁴⁰ Power Plant

Marconi 1231V2 Vortex™⁴¹ Power Plant

Tentatively Approved Power Plants

These power plants have been approved by AT&T–NTD but are not approved for core office applications. Contact the NCP&D DC SME for authorization to use these power plants.

Astec Power Plants

4.02 Minimum Volts per Cell

The choice of a Minimum Volts Per Cell (MVPC) for a DC power plant involves a balancing of distribution (copper) costs and battery costs. In locations where space and floor loading are not issues, higher MVPC shall be utilized. The MVPC shall be agreed upon with the AT&T DC Power Engineering prior to issuance of detail engineering.

The use of a MVPC of 1.75 for –48 volt power plants shall be restricted to power plants meeting the following criteria.

- A maximum 2.0-volt loop voltage drop is used for all circuits.
- All equipment to be powered from the power plant shall operated down to –40.0 v DC or less. For example, equipment with a cutoff voltage of –37 volts would qualify.

³⁹ 1231H1™ is a trademark of Marconi Corporation.

⁴⁰ Vortex™ is a trademark of Marconi Corporation.

⁴¹ Vortex™ is a trademark of Marconi Corporation.

- ALL records shall contain the following note and this information shall be marked on the main power board and all secondary distribution bays fed from the power plant.

Note: All equipment powered from this (PDB, BDFB, PD) must be capable of normal operation down to -40 VDC.

4.03 DC Power System Voltage Drops

Overall Voltage Drops

Unless specified in the equipment order, the maximum voltage drop allowed from the battery post on the "A" string (positive and negative end of the battery string) to the equipment input power connection shall be up to 4.00 volts loop based on table 4.1. However, in most cases, the protection device sizing will only allow a 3.5-volt drop to be achieved. **Plants dedicated to systems that specify voltage drops in the system documentation shall use the system voltage drops.**

Table 4-1 Power Plant Voltage Drops

Recommended Application	Minimum Volts Per Cell	Minimum Voltage At Battery String	Total Allowable Loop Voltage drop	Internal Power Plant Loop Voltage Drop	Loop Voltage Drop for -42.75 Volt Equipment	Loop Voltage for -40 Volt Equipment
Dedicated solely to Equipment with a Low Operating Voltage less than 40 VDC	1.75	42.00	2.0	.25	Can Not Be Used	1.75
Available for use if required	1.78	42.72	2.5	.25	Can Not Be Used	2.25 -2.0
Dedicated to a switch with a Low Operating voltage of -40 VDC or sites with less than 1,000 sq. ft of space	1.80	43.2	3.5	.25 - .50	.20 – Can only be used with .25 v internal power plant drop	2.95 – 2.70
Available for use if required	1.82	43.68	3.5	.25 -.50	.68 - .43	3.43 – 3.18
Recommended for DCO power plants or with switches that have a Low Operating voltage of -42.75/-40	1.84	44.16	4.0	.25 -.50	1.16 - .91	3.91 – 3.66
Available for use if required	1.86	44.64	4.0	.25- .50	1.64 – 1.39.	4.0 – 4.0*
Recommended for power plants with long distances between Main distribution bays	1.88	45.12	4.0	.50 -.75	1.87 – 1.62	4.0 –4.0*

The loop voltage drop from the battery posts from any battery string to the Main Distribution Board (breaker panel) shall not exceed .5 volt (loop). Included in this loop are the wires connected from the

Power Plant Bus Bar to the battery post on both ends of the "A" battery string. See Figure 4-1 for a summary of voltage drop allowances.

All voltage drops that are placed in the office records shall be actual voltages not engineered. See the discussion on voltage drops under "Proper Utilization of Secondary Distribution Voltage Drops".

All general-purpose (DCO) secondary distribution bays shall be installed with a minimum .5 loop voltage from the secondary distribution bay to the equipment. A waiver from the AT&T Power Element Manager may be granted prior to the start of installation, if office conditions preclude using a .5 loop. In no case shall the loop voltage from a secondary distribution bay to the equipment be less than .25 loop.

Loop Voltage Drops

Unless instructed by ATT, all new power plants for DCO shall be utilize the 4-volt-loop model. Switching power plants shall utilize the voltage drop plans required by the switch manufacturer unless specified otherwise by ATT. All DCO equipment that operates down to -40 volts or lower (-37) shall utilize the 4-volt-loop model. See Figures 4.2 and 4.3 for typical arrangements.

CAUTION:

In all DC circuits, the ampacity of the main feeder (a single or the smallest wire in a set of parallel wires) in the circuit shall not be less than the Ampere rating of the protection device. The ampacity shall be the value in the 75° column in table 310-16 of the National Electric Code 2002™. The 90° column may be used provided that the wire, connectors and the equipment being connected all are rated for 90 degree operation.

Table 4-2 Examples:

Protection Device Size	Wire size (Ampacity)
30	10 AWG
70	6 AWG
300	350 kcmil
400	750 kcmil
600	2-350 kcmil *

* A single 750 kcmil is not adequate.

For existing plants, all new secondary distribution bays shall utilize the 4-volt-loop, unless the majority of the equipment being installed has a higher low operating voltage (-42.75 or -42.5) point. Small additions of equipment utilizing a higher low voltage operating point (-42.5 to -42.75) shall be powered directly from the power plant if only 4-volt-loop secondary distribution bays are available.

Equipment that operates down to -40 volts may be assigned to secondary distribution bays that are set up using the 2-volt-loop model. In this case, the total voltage drop shall not exceed the 4-volt-loop and the wire shall not have an ampacity less than the protection device. The detail engineer shall review the existing circuits on the bus and determine if the entire bus is to be identified as a 4-volt-loop bus or if only the circuit is to be identified as a 4-volt-loop (4VL) circuit in the functional designation field of the office record.

If the bus is to be identified as a 4-volt-loop bus, the records and bus shall be marked as required in "Mixed Voltage Drop Secondary Distribution Bases".

Mixed Voltage Drop Secondary Distribution Buses

It is permissible to mix 4-volt-loop buses and 2-volt-loop buses in the same secondary distribution bay. The office drawings shall be clearly indicated the loop voltage that bus uses. In addition, the low voltage buses in the bay shall be marked with the following warning. "Only equipment that operates down to -40 volts or lower may be assigned to this bus." This marking shall meet the same standards, as the labeling required in Chapter 12 of this document. Caution 4-volt and 2-volt buses shall utilize separate return buses at the BDFB.

Cabling conditions for typical arrangements (Fig 4.2 and 4.3)

Minimum Volts per Cell (MVPC) is 1.86.

Total voltage drop allowed for -42.75 equipment is 1.89 ($44.64 - 42.75 = 1.89$)

Total voltage drop for -40.0 volt equipment is set at 4 volts ($44.64 - 40.0 = 4.64$)

Primary Breakers are 600-ampere devices and are cabled for 480 amperes load.

Distance from primary board to BDFB is 200 feet one way (400-foot loop).

Distance from BDFB to equipment is 100 feet (200 feet loop).

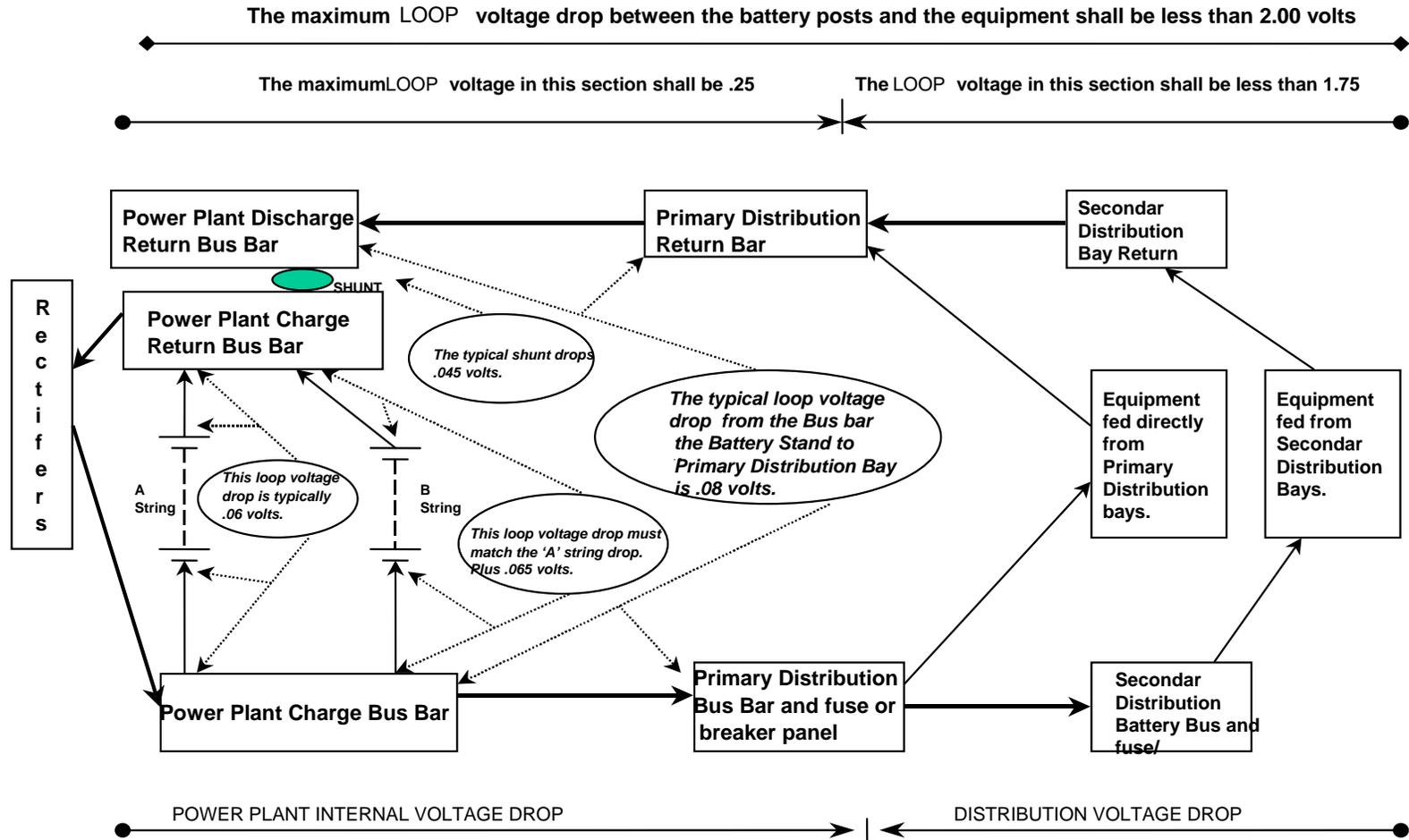
Equipment drain estimated as 50 amperes per load.

The red and blue lettering shown on this drawing denote -40 volt equipment versus -42.75 and have nothing to do with diversity requirements.

Note:

If a larger wire is required either to meet breaker size or due to wire sizes available the actual voltage drop is shown in ().

Figure 4-1. DC Power System Voltage Drops - Typical 48 V Power Plant using a 2.0-volt loop



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NOTE 1:

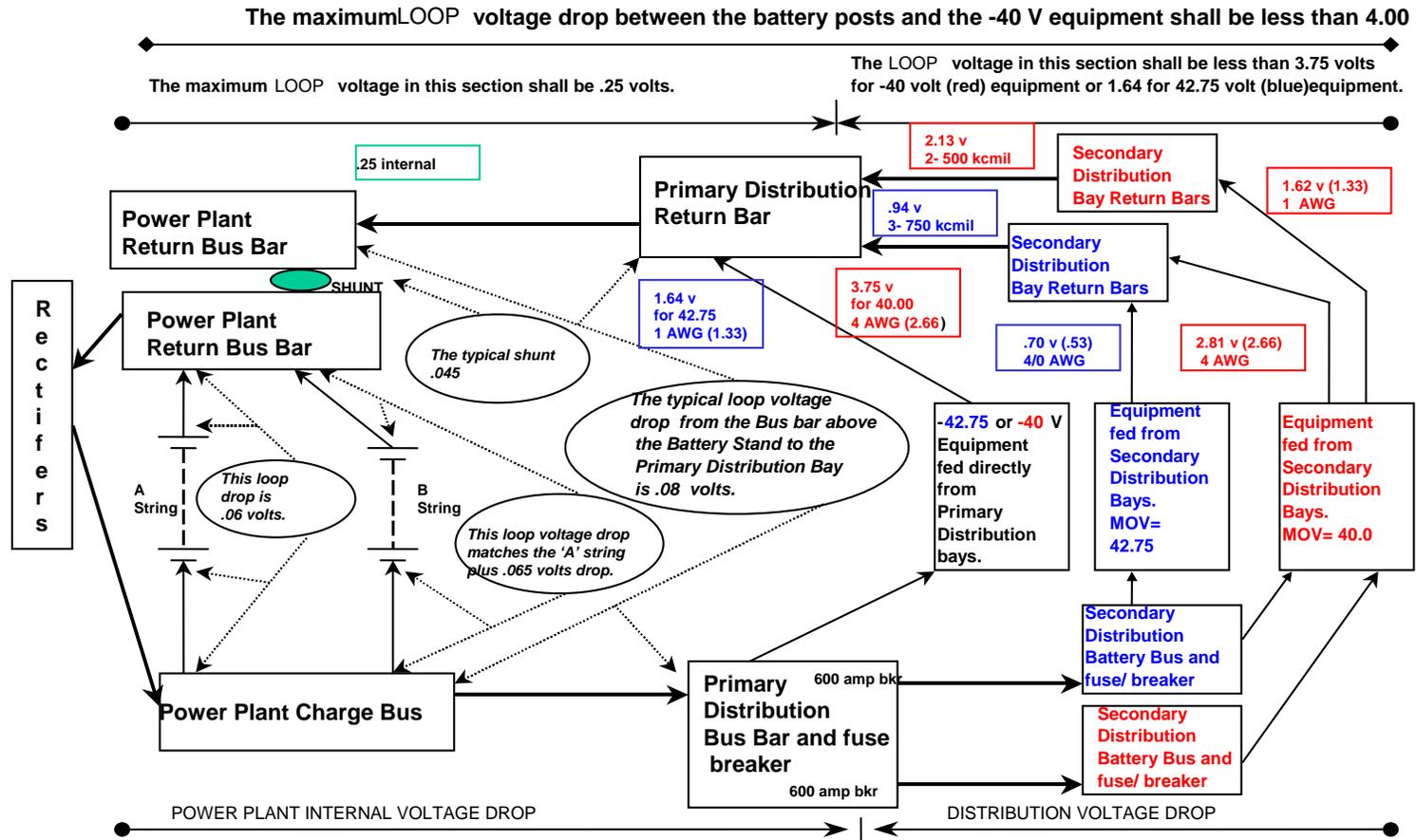
Note 1.

For a plant with a 1.75 MVPC and equipment with a low operating voltage of -40 volts

The loop voltage shall be 2.00 volts.

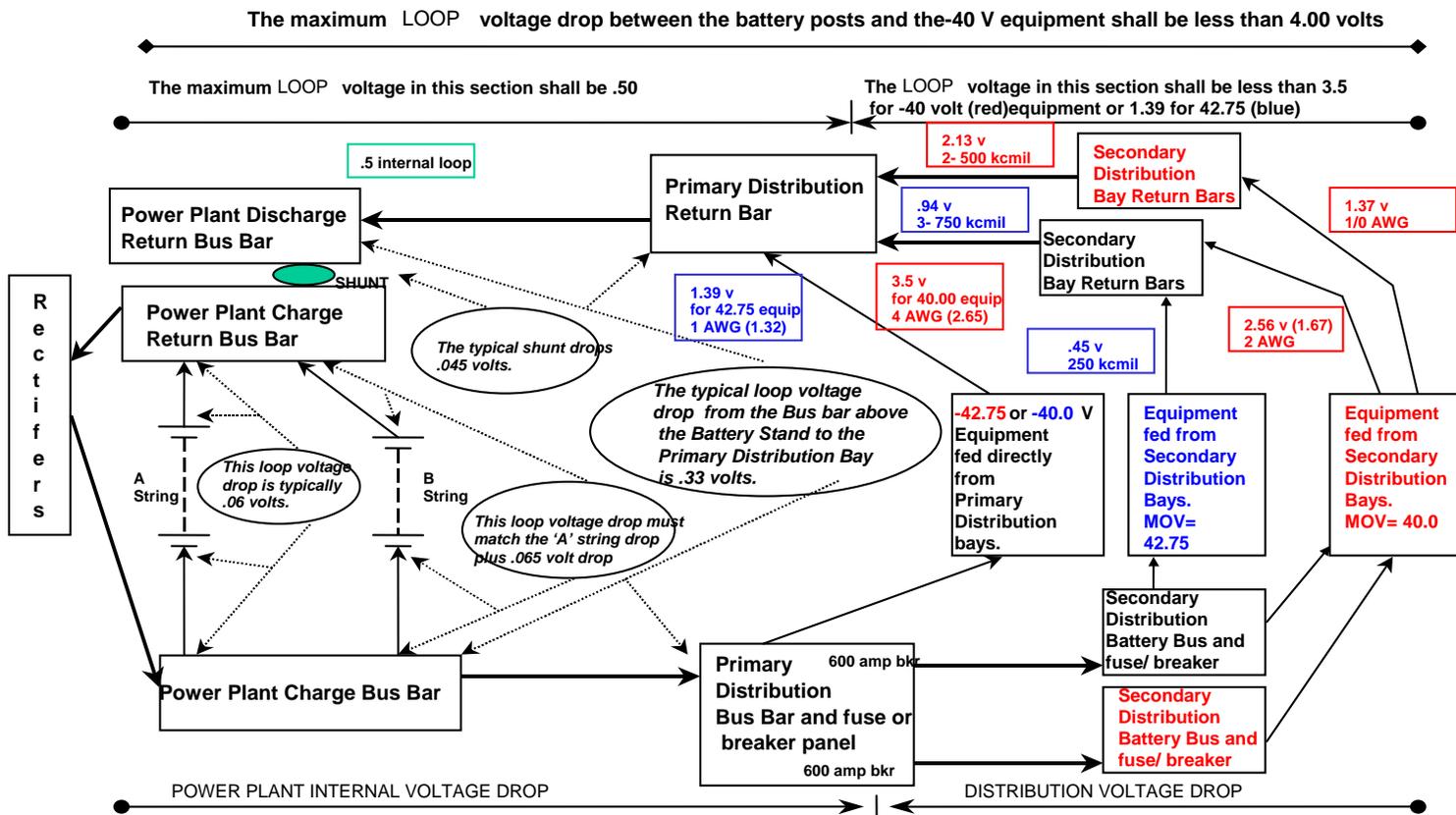
$(24)(1.75) = (-42.0) - (-40.0) = 2.05 \text{ Vd} - .30 \text{ Vd} = 1.75 \text{ Vd}$ allowed in Distribution Loop.

Figure 4-2. System Voltage Drops - 48 V Power Plant using a 4.0-volt Loop with .25 Power Plant Loop



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Figure 4-3. System Voltage Drops - Typical 48 V Power Plant using a 4.0-volt Loop and a .5 Power Plant Loop



Supplemental Battery Stands

For wire runs to supplemental battery stands less than twenty (20) feet (loop), the same wire size used on the first string may be used. For distance greater than twenty (20) feet, the leads wire sizes must be calculated. The voltage drop allowed from the supplemental battery stand to the Charge/Discharge bar is .065 volts.

Note: The engineer may choose to add additional wire from the battery post to the supplemental battery stand bus bar. For example, if the "A" string is equipped with four 4/0 wires, the engineer may choose to run six 4/0 wires for the supplemental strings. In no case should the battery manufacturer's recommendation on the number of terminations on the battery post or the weight on the battery posts be exceeded. Any voltage drop gained may then be applied to the run back to the discharge bar.

The voltage drop budget is based on a .25 loop voltage drop in the power plant.

Battery post to supplemental bar =	.06 volt
Battery supplemental bar to main discharge bar =	.065 volt
Shunt voltage drop =	.045 volt
Main Bar to Primary Distribution bay =	.08 volt
Total drop =	.25 volt

Note: If a bus bar assembly is used to connect to the primary distribution bay, the voltage drop of the bar shall be calculated and the other voltage drops adjusted according. This information shall be placed in the IIDI record.

The wires to a battery stand shall be sized for the maximum number of battery strings that the stand will accommodate. Exceptions must be documented in the office drawings and in correspondence between the AT&T Power Representative and the supplier.

The voltage drop from the Power Plant Bus bars to the battery post is determined by the length of the cables, the expected rate of discharge and the ampere hour capacity of the cells. For cells rated at 1680 ampere-hours, the expected current during a five (5) hour discharge to 1.86 volts per cell is 226 ampere. The calculation for the voltage drop, using the typical four 0000 wires provided is:

$$Vd = \frac{(11.1) (\text{length}) (\text{amperes})}{\text{cmil of cable}} = \frac{11.1(20)(226)}{4 (211,600)} = \frac{50,172}{846,400} = .0593 = .06$$

Notice that as the battery ampere-hour rating increases, the size of the cable must also increase. A cell with a rating of 3500 ampere-hours would have a five-hour discharge to 1.86 volts per cell of 533 amperes. Either four 350,000 cmil or six (6) 0000 wires should be provided with this cell. The formula becomes:

$$Vd = \frac{(11.1) (\text{length}) (\text{amperes})}{\text{cmil of cable}} = \frac{11.1(20)(533)}{4 (350,000)} = \frac{118,326}{1,400,000} = .0845$$

$$Vd = \frac{(11.1) (\text{length}) (\text{amperes})}{\text{cmil of cable}} = \frac{11.1(20)(533)}{6 (211,600)} = \frac{118,326}{1,269,600} = .09$$

Because the total voltage drop is so small, additional circular mil will be required for supplemental battery stands over ten (10) feet away (20 foot loop). The voltage drop and the distances require careful engineering of the battery racking. This is especially important as the distances increase.

For each supplemental battery stand, only eight wires shall be connected to the power plant bus bar for each battery string equipped. This is four on the battery bar and four on the return bar. If more than eight wires are required, the additional wires required should be tapped to the wires that are connected to the bars.

For example, a battery stand located 60 feet away (120 foot loop), with a single string of 1680 ampere hour cells and a five hour discharge rate would require 14 each 750,000 cmil wires (7 battery leads, 7 return leads).

$$\text{cmil required} = \frac{(11.1) (\text{length}) (\text{amperes})}{Vd} = \frac{11.1(120)(226)}{.065} = \frac{301,032}{.065} = 4,631,262$$

$$\# \text{ of } 750,000 \text{ cables} = \frac{4,631,262}{750,000} = 6.18 = 7$$

If this same battery stand has two strings of 1680 ampere-hour cells, the number of wires requires increases to 26- 750,000 cmil (13 BAT and 13 RTN).

$$\text{cmil required} = \frac{(11.1) (\text{length}) (\text{amperes})}{Vd} = \frac{11.1(120)(452)}{.065} = \frac{602,064}{.065} = 9,262,523$$

$$\# \text{ of } 750,000 \text{ cables} = \frac{12,041,280}{750,000} = 12.4 = 13$$

Proper Utilization of Secondary Distribution Voltage Drops

The engineering supplier that is installing a power plant is responsible for establishing the voltage drop allocation for that power plant. The power plant records shall indicate the allowable voltage drop, the voltage drops within the power plant and the voltage drop allowed from the power plant distribution board to the equipment. This will include a recommended voltage drop for equipment powered from Secondary Distribution Bays. This voltage drop is the *engineered voltage drop*.

A supplier engineering a Secondary Distribution Bay shall use the *engineered voltage drop* to determine the proper wire sizes from the power plant to the Secondary Distribution Bay and the *installed voltage drop*.

The voltage drop to a Secondary Distribution Bay is calculated using the maximum expected amperage on the circuit. For Example, a 400-ampere device shall be expected to carry 320 amperes of List 2 current. Due to the calculation method and wire sizes, a larger wire than needed for the voltage drop is generally installed. A recalculation is required to derive the *installed voltage drop* from the Main power Board to the Secondary Distribution Bay. This *installed voltage drop* shall be entered into the record. This voltage drop is then subtracted from the total allowable voltage drop to the equipment. The remainder shall then be entered into the record as the allowable voltage drop from the Secondary Distribution Bay to the equipment bays. The minimum voltage allowed from a Secondary Distribution Bay to the equipment shall be 25-volt-loop for 2-volt loop systems and .5 volt-loop for four-volt loop system.

See the example provided in the next paragraph. This *installed voltage drop* requirement is the voltage drop that shall be entered in the office records for the Secondary Distribution Bay. The initial or engineered voltage drop shall not be entered in the Secondary Distribution Bay record.

Voltage Drop Calculation Exclusions

In the calculation of voltage drops, the following are not included in the calculation.

- Other than the main shunt in the Power plant, do not include shunt drops in calculations.
- Do not include voltage drops for connector terminations.
- Do not include a voltage drop for drop wires into equipment or power board bays.
- Do not include a voltage drop for cable taps.

Installed Voltage Drop Example:

The maximum voltage drop allowed is 1.64. (Calculation of this value is found in the notes associated in Figure 4-1.)

The Secondary distribution bay is 200 feet from the Main Power Board. The circuit has a 400-ampere breaker and will be wired to support 320 amperes of List 2 load. The initial *engineered voltage drop* or allocation of voltage drop is 1.39 from power board to Secondary Distribution Bay and .25 from the Secondary Distribution Bay to the equipment bay.

$$\text{cmil required} = \frac{(11.1) (\text{length}) (\text{amperes})}{V_d} = \frac{11.1(400)(320)}{1.39} = \frac{1,420,800}{1.39} = 1,022,158$$

$$\# \text{ of } 750,000 \text{ cables} = \frac{1,022,158}{750,000} = 1.36 = 2 \text{ (2 BAT, 2 RTN)}$$

The actual or *installed voltage drop* is:

$$Vd = \frac{(11.1) (\text{length}) (\text{amperes})}{\text{cmil of cable}} = \frac{11.1(400)(320)}{2 (750,00)} = \frac{1,420,800}{1,500,000} = .95$$

This allows the voltage drop on the equipment side of the Secondary Distribution Bay to be .69-volt loop. This compares to a voltage drop of .25 that would be used if the *installed voltage drop* had not been re-calculated.

The use of .69 voltage drop allows a 2/0 wire to be run instead of a 350,000 wire in the following circuit.

$$\text{cmil required} = \frac{(11.1) (\text{length}) (\text{amperes})}{Vd} = \frac{11.1(200)(35)}{.25} = \frac{77,700}{.25} = 310,800$$

$$\text{cmil required} = \frac{(11.1) (\text{length}) (\text{amperes})}{Vd} = \frac{11.1(200)(35)}{.69} = \frac{77,700}{.69} = 112,609$$

(cmil of a 2/0 AWG wire is 133,100)

Low Voltage Equipment Secondary Distribution Bay

If approved by AT&T Power Engineering, a secondary distribution bay may be engineered for a loop voltage drop of up to four volts (4.0 volt loop -from battery post to equipment load) on power plant previously engineered for a 2.0-volt loop. These bays shall be marked as dedicated to equipment that operates to an end voltage of -40 volts DC. The engineering supplier shall ensure that wire sizes are capable of meeting protection devices rating. A dedicated secondary distribution bay shall have the technology entered in the Vtype field in the INFOBANK™ record. If the secondary distribution bay is not dedicated to a single technology, the VTYPE field shall contain DCOLV (DCO Low Voltage). The office drawings and the secondary distribution bay shall be marked the following note.

NOTE: ONLY equipment that has a minimum operating voltage of -40 volts DC or lower (-39.5) may be powered from this bay. Equipment with a higher minimum operating voltage (-42.75 or -42.5) may NOT be powered from this bay.

Example:

- The power plant has a MVPC of 1.86.
- The allowable voltage drop in the distribution loop is normally 1.64.
{(1.86)(24 cells) = 44.64 – 42.75 = 1.89 -.25 = 1.64}
- The new low voltage equipment BDFB is 200 foot from the power plant and will be cabled for 320 ampere of List 2 load and use a 400-ampere breaker.
- The equipment being served is a DCS™ 3/1.

The 400-ampere breaker will require that a single 750,000 cmil wire for battery and return. The 750,000 cmil is selected based on 480-amp ampacity verses the 380-amp ampacity of a 500,000 cmil wire.

Using 750,000 kcmil wires creates a 1.89 loop voltage drop. ((11.1)(400)(320)) / 750,000 = 1.89

- The largest fuse in the secondary distribution bay is 70 ampere.
- The largest List 2 drain served is 56.5 amperes.

The 70-amp fuse would require, at a minimum, a #6 AWG wire. (Given a 50-foot run to the equipment bay.)

The voltage drop becomes 2.39. ((11.1)(100)(56.5))/26,240 = 2.39

Adding the two drops we have a total drop of 4.28. This exceeds the four-volt requirement. By adjusting the wire size in the equipment side of the circuit, the four-volt limit can be achieved.

If a #4 AWG wire is used the voltage drop becomes 1.50. $((11.1)(100)(56.5))/41,740 = 1.50$
Adding the two drops we have a total loop drop of 3.39.

- Two circuits to be run on this BDFB have a 20-ampere fuse and a List 2 drain of 15.7 amperes.

Using the 1.5-drop derived above this circuit would require a #8 AWG wire. $((11.1)(100)(15.7))/1.5 = 11,618$ cmil

Another circuit has a 30-ampere fuse and a List 2 load of 14.0 amperes. Using the 1.5-drop, this circuit would require a #10 AWG wire. $((11.1)(100)(14.0))/1.5 = 10,360$ cmil

4.04 Shunt Replacement

Any time batteries or rectifiers are added to a power plant, the supplier shall compare the metered load on the power plant to the ampere rating of the shunt. If the measured load on the power plant exceeds 50% of the shunt's rating, the supplier shall notify the AT&T Power Engineering Representative. The AT&T Engineering Representative may either supplement the order to replace the shunt or wait for some later order activity to replace the shunt. Replacement of a shunt at 50 per cent is not required. AT&T Engineering must review the future plans for the power plant before determining when shunt replacement is necessary.

[Replacement of the shunt is required once it reaches 80% of its rating.](#)

4.05 Primary Distribution Bay Protection Device Numbering

All new Primary Power Boards shall have the protection devices numbered in the following manner.

- Each protection device shall have a unique number for that power plant.
- The numbering sequence shall start in the bay containing the power plant controller.

The numbering pattern shall be:

- The Initial Bay shall use numbers in the 100.01-199.99 range
- The first supplemental bay shall use numbers in the 200.01-299.99 range.
- The second supplemental bay shall use numbers in the 300.01 to 399.99 range.
- The third supplemental bay shall use numbers in the 400.01-499.99 range.
- The tens and ones portion of the number shall reflect the panel position of the panel on which the protection device is mounted.

For example, a protection device mounted in position 1 of a panel, which is mounted in bay position 1, in an initial bay, would become 101.01. The panel position numbers are found in the manufacturer's standard drawings for the equipment.

- If the bay does not have standard mounting positions, the panel numbering shall start at the top left side of the bay as viewed by someone standing in the front of the bay and facing the bay. The numbering shall continue from the top to the bottom of the bay. If the bay has the ability to mount panel side by side, the designation "L" and "R" may be added. In this case the numbering would become 101L.01 and 101R.01.
- [Primary Distribution Bays that are designed to grow from the bottom up may start the panel and position numbering at the bottom left panel in the bay.](#)
- Fuse or breaker panels that are capable of mounting varieties of devices shall be numbered as if the maximum number of devices is to be added.
For example a panel that has positions for six single pole breakers shall be numbered as XXX.01 to XXX.06.

- If a device installed on a panel uses more than one assignment space, the device is numbered as the first position used. The remaining numbers occupied by the device shall not be used. For example, a three-pole device may occupy panel positions XXX.01, XXX.02 and XXX.03. This device would be numbered as XXX.01 and the next device installed on the panel would be numbered as XXX.04

4.06 Task Lighting

The supplier shall provide AC operated task lighting in battery plant areas. The supplier shall provide proper lamps for all fixtures installed. DC lighting shall not be provided unless specified in the AT&T equipment order. Any DC lighting provided shall be -48 volt DC operated fluorescent fixtures.

Task Lighting shall meet the following criteria:

- One, two, three or four 48-inch lamp fixtures.
- Fixtures shall have a white, factory-baked enamel finish.
- T-8 lamps shall be provided.
- Up light shall be a minimum 5% and a maximum 20%.
- Fixtures shall utilize rapid start high efficiency electronic ballast.
- Ballast shall be grounded.
- Fixtures over battery stands shall be equipped with guards.
- Fixtures shall not be mounted less than 7-foot from the floor.
- [Illumination level shall exceed 10 foot-candles.](#)
- Comply with requirements found in AT&T 760-230-130, "Lighting in Network Equipment Buildings"

4.07 Combined DCO and Switch Return Bar

For those offices where the power plant and switch are on the same floor or only one (1) floor apart then the ground window for the switches shall be the distribution battery return bar assembly located at or near the single -48volt battery plant. The bar assembly shall consist of 3 bars, with the ground reference lead connected to the center bar as near the middle of that bar as practical. The bars shall be arranged in a "S" fashion with insulators in the openings between the bars. This basically makes one (1) long bar, instead of the triple stacked bars we use in the DCO arrangements. All distribution that needs to be on the isolated ground system will then go on the top bar, while that which can be on the integrated ground system will go on the bottom bar. This will provide a greater separation of the isolated and integrated circuits.

Other considerations include:

1. If the power plant and the switch are greater than 1 floor apart, then the ground window must be located in the switch area.
2. In both cases the ground window will be the only connection back to the CO ground bar for both the switch and power plant.
3. Under no circumstance will there be a connection from the CO ground bar to both the switch and the power plant.

4.08 Requirements for New Plants and Additions to Plants

Controller Options

- If available, all power plants with a capacity over 600 amperes shall be equipped with an option to estimate the battery hour reserve (BHR) time.
- Unless specified in the AT&T order, all power plants with a capacity of over 600 amperes shall be provided with an controller that is capable of remote access and has the ability to store history information.
- The load-monitoring feature on any microprocessor controller shall be programmed by the installer to display the following information as a minimum requirement:
 - The breaker or fuse position for the circuit
 - The BDFB, Inverter or PDF frame identification code (FIC)
 - The load or bus designation of the powered equipment.

Note: This must be done internally to the processor and shall not require cross-referencing to any document or marking.

- Spare controller circuit packs, per manufacturer's recommended list, shall be provided with the first controller installed on a floor. This shall be a complete set of spares. If a card is specified in the manufacturer's list as a spare and that card is installed in the controller or otherwise provided, a spare card shall be provided. For the second and third controllers installed on a floor, no spares shall be provided. When the fourth controller is installed, another complete set of spares shall be provided.
- If a controller is installed or upgraded that has an upgraded version of any circuit pack and the older version of the circuit pack will not function properly in the new unit, a spare circuit pack shall be provided. Additional spares shall only be provided if requested in the order from AT&T.
- Any time the software is being upgraded, the spares shall be upgraded to the latest version.
- After any plant update a new backup floppy disk shall be provided per section 4.09 of this document.

Breaker/Fuse Option

- Each plant shall be provided with a device that will allow pre-charge of DC circuits prior to fuse insertion or breaker operation.
- All breakers provided shall be capable of generating an alarm when tripped but shall not generate an alarm when manually operated.
- Equip all distribution circuit breakers with charge switches and shunts, if available.
- Provide the Load Monitor feature for all protection devices 100-ampere or larger feeding secondary distribution bays (BDFB, PDB, PD/PDF) or common equipment fuse panels.
- Provide the Load Monitor feature for any protection device 150 ampere (fuse/breaker) or larger.

NOTE 1:

AT&T recognizes that where large numbers of breakers are installed on a Tyco MCS™ plant, not all breakers can be attached to the shunt monitor circuit. In cases where the plant cannot be equipped with sufficient cards to monitor all breakers, the supplier's engineer shall provide the AT&T Power Representative with a breaker information list. This list shall have breaker number, breaker size, the load each breaker serves, the number of monitor points available and shall identify those BDFB's or PDF's that have internal shunts. The AT&T Power Representative shall return the list with a notation of which breakers to monitor. The breaker monitoring information shall then become part of the office "T" drawing

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records. This requirement applies to new power plants and to breakers or fuses added to existing Tyco Lineage 2000™ power plants

NOTE 2: Breakers or fuses that feed individual equipment bays do not require shunt monitoring unless the fuse panel in the equipment bay feeds other equipment bays.

Plant Options

- Power plants shall not be equipped with low-voltage battery or load-disconnect option.
Note: Power plants that are located in non- telecommunication buildings may require battery disconnects in order to meet local code requirement. See chapter 5, section 5.01 VRLA for additional details.
- Provide stile strips, end covers, rear and base covers, and blank panels for all bays.

On equipment orders, AT&T shall specify the shunt size (if required), initial and ultimate plant capacity. The maximum load is limited to 4160 amperes (measured). DO NOT exceed this limit without written consent of AT&T. **NOTE:**

Some dually powered equipment configurations will shift drains from one power plant to another during emergency conditions. This is true of most T-3 equipment (i.e., DACS III, DDM1000™, NGLN™⁴²) being installed in the network today. Because of this “load shift”, the maximum-metered load on the power plant must be limited to avoid overloading the power plant bus bars during such emergency conditions. A power plant with 5200 amps bus bars and 100% “load shifting” drains shall be limited to 2100 amps metered drain. The same plant with 40% of it’s drain shifting would be limited to 3000 amps metered drain. The same plant without such equipment loads is limited to 4000 amps metered drain.

*Example: Plant with 100% load shift.
Plant bus bars rated at 5200 amps.
2100 amps (metered) + 2100 amps (shifted load) = 4200 amps.
4200 x 1.22 (factor for voltage drop from 52 to 42.5) = 5124 amps.*

If a plant is equipped with distribution panels requiring fuses, provide spare fuse panels and fuses. If a plant does not have distribution panels with fuses, provide spare fuse panels and fuses for any fuses used within the plant controller.

- Designations on bus bars at power plants shall be designated per table 4-3.

Table 4-3: Power Plant Chandelier Designation

FROM: Marconi or Tyco T82603-31 Designation	TO: AT&T Marked Designation
GRD	RTN
CHG GRD	CHG RTN
DISCHG GRD	DISCHG RTN

⁴² NGLN™ is a trademark of Lucent Technologies, Inc.

4.09 Intelligent Controller Features

All power plants over 1000-ampere capacity shall be equipped with intelligent controllers or equivalent.

- Rectifier interface for the number of rectifier slots equipped in the plant.
- (IP) RS-232 Interface
- Battery Reserve Time Prediction
- Breaker/Fuse shunt monitoring for all fuses/breakers sized at 150 amperes or greater.
- Do not provide laptop computer with plant. Laptop is maintenance tools and will not be provided on the installation order.
- If VR cells are utilized, controller shall have a "Thermal Runaway Protection Circuit".
- A backup disk shall be provided at initial installation and at any time a change is made in the configuration. This backup disk shall be stored on the controller cabinet or frame in which the controller is installed. A plastic case shall be provided.
- Disk shall be marked as follows:
 1. Power Plant Controller (Per IIDI Records)
 2. FIC of Controller Bay
 3. Version of Software Installed
 4. Date of Installation, Company/Supplier and Installer's name.
 5. Date of installation of any upgrade, Company/Supplier and Installer's name.

4.10 Tyco Lineage 2000™ and Galaxy SC™ Power Plants Tyco J85500A (DA Product)

Power plants using Tyco J85504A-1 battery stands and individual return bar assemblies over the distribution bay shall be referenced to ground at the bus bar mounted above the battery stand and not at the return bus bar(s) mounted above the control bay. As an example, the connection shown on Tyco T82603-31 Figure H6 designated GRD and going to central office ground shall not be connected. A connection to either central office ground or to the ground window shall be made to a spare position on Tyco T82603-31 Figure H5 on the bar called DISCHG GRD.

- Power plants that do not use the bus bar assembly per Tyco J85504A-1 shall be referenced to ground at the center of the bus bar assembly unless otherwise specified for isolated ground requirements.

All new plants are to be equipped as follows:

- Initial bays (Tyco J85500A series) of 1200 amps or more shall be equipped with both upper and lower bus bars.
- Initial and supplemental bays (J85500 type) shall be wired with a minimum of six (6) 750-kcmil wires.
Note: Fewer than six 750 kcmil wires may be used, if approved by the AT&T Power Engineering Representative in writing. E.g., email or in the order.

- Return bars shall be equipped with the same number of wires that are run to the initial or supplemental bay.

Note: An initial and supplemental bay may share a return bar, but the circular mil of copper in the return bar runs must equal the circular mils in the initial and the supplemental bay's wire runs.

- Provide all Tyco J85500A series power plants larger than 600 amperes with the Galaxy SC™ Microprocessor controller option.

- TYCO Lineage™ power plants equipped with 1300-ampere bars shall be engineered up to 1920 amperes of **LIST 2** cabled capacity. Existing configurations shall be changed to meet this requirement when load rearrangements are prompted by some other requirement or specific instructions in an AT&T order.

NOTE:

A supplemental power bay may be equipped with three Tyco ED-83018-30 or -31 breaker panels per 1300 amp bus. The total value of List 2 cabled load on these breakers shall not exceed 1920 amps. If all three panels have two 400-ampere breakers each, and each is cabled for 320 amperes, this would be 1920 amperes of List 2 cabled drain. (6 x 320 = 1920) The vacant single pole positions on these panels shall not be utilized. If however 300 ampere breakers are used, the List 2 load would be 1440 amperes (6 x 240) and an additional 480 amperes of list 2 drain may be fed from the remaining single pole positions.

4.11 Tyco GPS4848™ and GPS2424™ Power Plants

The GPS4848™ and GPS2424™ power plants shall be configured as centralized power plants utilizing the TYCOJ85500A bay or the J85582C-1 bay.

If the power plant will have more than 600 amperes of load, the initial bay (Tyco J85582C-1) may be used provided that a J85500A is used for distribution. If a supplement bay is not provided, mount the controller in a J85500A bay.

TYCO GPS™ power plants shall have the following features.

- Each rectifier bay shall be equipped with shelves and wiring for the maximum number of rectifiers.
- If the rectifier bay is ordered with AC breaker panels, all breaker positions shall be equipped.
- AC feeds to each rectifier bay shall be sized for the maximum number of rectifiers.
- Provide Galaxy SC™⁴³ Controller or TYCO Millennium™ Controller (see section on Galaxy SC™ for configuration).
- Provide peripheral shunt monitoring for breakers.
- Provide Battery Reserve Time option.
- Capacitor Charge option.
- External Shunt and bus bar assembly.
- Provide blank panels for un-equipped fuse or breaker panel locations.
- Do NOT provide laptop computer with Galaxy SC™ controller.
- Provide spares for Galaxy SC™ controller per instructions in section of this practice on Galaxy SC™ Controller.
- Provide one spare rectifier fan unit for each rectifier bay provided.
- If a BLJ1 board is used with the controller, provide one spare BLJ1 board per location.
- Provide spare fuses and lamps per manufacturer's spares list.
- Rectifiers in supplemental bays shall be numbered so that the top three positions are odd numbers (G1, G3, and G5) and the bottom three rectifiers are numbered as even number rectifiers (G2, G4, and G6).
- If the building has two AC risers, the AC power for a supplemental bay shall be split equally between the risers.

⁴³ "Galaxy SC" is a trademark of TycoTechnologies, Inc.

4.12 TYCO GPS4812™ Power Plants

- TYCO GPS4812™ power plants shall be provided with Millennium Controllers WITHOUT remote communication option.
- The AC power shall be equipped for all slots on all rectifier shelves provided.
- All GPS4812 Plants, unless specified by AT&T shall be centralized configurations.
- Provide one spare rectifier fan unit for each rectifier bay provided.

4.13 RELTEC™ (Marconi) Power Plants

These plants shall be equipped as follows:

- The Data Gathering Unit (DGU) shall be used in power plants with a capacity over 1200 amperes.
- The controller shall be equipped as close to the requirements in section 4.09 arrangement as possible.
- Each rectifier bay shall be equipped with shelves and wiring for the maximum number of rectifiers.
- If the rectifier bay is ordered with AC breaker panels, all breaker positions shall be equipped.
- AC feeds to each rectifier bay shall be sized for the maximum number of rectifiers.
- Provide peripheral shunt monitoring for breakers.
- Provide Battery Reserve Time option.
- Capacitor Charge option.
- Provide blank panels for un-equipped fuse or breaker panel locations.
- Provide spares for the DGU controller per manufacturer's instructions.
- Provide one spare rectifier fan unit for each rectifier bay provided.
- Provide spare fuses and lamps per manufacturer's spares list.
- Rectifiers in supplemental bays shall be numbered so that the top four positions are odd numbers (G1, G3, G5 and G7) and the bottom three rectifiers are numbered as even number rectifiers (G2, G4, and G6).
- If the building has two AC risers, the AC power for a supplemental rectifier bay shall be split equally between the risers.
- Do not label PDU with G#, place label adjacent to equipment in the bay.
- Power plants shall be configured to monitor the "A" battery string for the "battery sense" leads. Sensing at the power plant bus bars is not acceptable.
- If a power plant is equipped with internal "battery sensing", i.e., sensing connection at the power plant bus bar, the sensing shall be moved to the "A" battery string as a part of any major plant modification. Battery or rectifier additions or battery replacements shall be considered a major plant modification.

Note: These leads shall be tagged and marked as follow:

1. **Do Not Disconnect**
 2. **Power Plant Regulation Lead (+) or (-)**
- Fuse numbering in Vortex main distribution bays shall start with panel 1, which is located in the bottom left side of the bay. The positions shall number from the bottom of the panel to the top. Panel 1 will start with 101.01. Panel 2 which is on the bottom right of the bay shall number from 102.01 and up. The second bay will use numbering from 201 to 299 and third bay will utilize 301 to 399. The fourth bay shall use 401 to 499. This numbering is related to the order the bays are added not the FIC.
 - For single-plant, dual-distribution power plants, the red side of the plant will use 101 and 301 position numbering. The blue side of the plant shall use 201 and 401 position numbering.

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Battery and Battery Stand Requirements

5.01 Central Office Battery Systems Requirements

Approved Products for Central Office Batteries

The only approved products for installation in AT&T Network buildings are listed below.

Lead Acid Battery:

- Tyco KS20472 round cell
- Tyco KS15544 battery cell
- Exide GU series cell

If time frames do not allow delivery of the above cells the following cells may be substituted.

- C&D LCT series cell
- C&D MCT series cell
- C&D HCT series cell

Approved for limited application with individual site approval:

- Tyco IR Series IIVR battery cell
- Tyco Unigy® II Series VR Battery cell
- Tyco Enhanced VR (EVR) Series Battery cell
- GNB Absolyte® XL
- GNB Absolyte® II and IIP

NOTE:

VR cells may not be used for core buildings without written approval from AT&T Infrastructure Process District. If VR cells are to be used, the power plant must be equipped to prevent thermal runaway of cells, A mid-point monitoring circuit is required and battery disconnects are required. Contact the AT&T Infrastructure Process District for approval of monitoring system. All batteries provided with plastic cases shall have an oxygen index of 28 or greater.

VRLA Cells

AT&T — PROPRIETARY
Use pursuant to Company instructions

VRLA (Valve Regulated Lead-Acid) cells may be installed provided they are specified in the equipment order. The following requirements apply to VRLA cells only.

- VRLA cells shall not be placed in parallel with "wet" cells.
- For single string power plants, the rectifiers on the plant shall be capable of operating without the battery string.
- The power plant shall be equipped with some type of thermal run-away protection.
- The string shall have some type of ohmic monitoring. This may either be a system that monitors each cell or a system that uses mid-point ohmic monitoring. The system shall compare the current ohmic reading with a 'standard' reading. The 'standard' reading may either be a nominal value for the type cell used or a reading established when the cells were installed. The circuit shall be alarmed. The alarm shall be a minor alarm. Alber' Corp. and Midtronics, Inc. are two manufacturers who have systems that meet these requirements.
- Each string shall be equipped with a manually operated protection device. The device shall meet the following requirements.
 1. The device shall be a manually operated breaker.
Note: A remotely operated device may be used if required by local code.
 2. The device shall generate an alarm when (off-normal, either manually or automatically). This is to be a major alarm.
 3. The device shall be mounted either on the battery stand or in the super structure above the battery stand.
 4. The device shall be protected from accidental operation or by accidental shorting to frame ground or to a higher voltage potential.
 5. The device shall be sized, at least three (3) times the expected drain of the string. For example: If the string has cells rated at 1600 amp-hour and has an expected discharge of 5 hours, the rate of 'normal' discharge would be about 225 amperes. Using a multiplier of three, the device would have to be 800 amperes (225 X 3 = 675 ampere).
 6. The device shall be capable of the termination of multiple 0000 AWG or 350-kcmil wire as required by GR-1275-CORE, requirement R17-86.
 7. The voltage drop of the device shall be considered in the calculation of the .25 or .5 volt drop within the power plant. (See Chapter 4 of ATT 790-100-669.)

Battery Requirements

AT&T shall specify in the order either:

The type of battery to be supplied and number of battery strings required.

OR

The type of battery to be supplied, the busy-hour reserve required and the estimated List-2 discharge load expected on the power plant.

On Tyco Lineage 2000™ plants using 200 amp or 400 amp rectifiers, the bus bar assembly located on the battery stand shall be configured for 5200 amps.

The first battery string on a Tyco Lineage 2000™ power plant (normally the "A" string) shall be placed closest to the initial power board and designated as the center string.

If the J85504A-1 List 5 or List 15 main charge and discharge bus bars or main splice plates is used, it shall be mounted above this battery stand and placed as close as possible to the power board. If the 10,000-ampere bar assembly is used, it shall be mounted above the aisle between the battery stand and the Main Distribution Bay.

The Tyco J85504A-1 List-20 bar assembly requires special cable rack considerations and shall not be used unless written the AT&T DC representative provides approval. This may be in the initial order or an email message originated by the AT&T representative.

A Tyco Lineage 2000™ power plant's main bus bars, per Tyco J85504A-1 List-5 or List-15, shall be installed so that the charge and discharge ground bus bar assembly is located above cell number 1 of the "A" string. Any configuration that requires the cables from cell 1 to cross over the cables from the highest numbered cell in the string shall be avoided.

Rectangular battery strings shall not be configured so that cell 1 and the highest number cell (24 cell for -48-volt strings) are adjacent.

All cells shall have stainless steel connector bolting material. If the bolting material uses washers with a sharp edge, the sharp edge of the washer shall not be placed toward the battery post.

All cells shall have explosion proof vents.

The power plant shunt shall be marked with the ampere rating in amperes. This marking shall be in black letters and shall be a minimum of one-half (.5) inch in height.

Some power plants have multiple shunts that are summed for total plant load. In this case all shunts used for this purpose shall be marked with the ampere rating of the shunt. This marking shall be in black letters and shall be a minimum of one-half (.5) inch in height.

All connections to battery cells shall have a thin coating of "NO-OX-ID 'A' Special™"⁴⁴—unless specified otherwise by the battery manufacturer.

Battery cells shall be ordered and installed as matched string sets from the manufacturer. If a single cell is to be replaced, a cell with similar float characteristics of the original string shall be obtained from the manufacturer.

Cells from different manufacturers shall not be mixed in the same string but may be used in parallel strings. Except for Tyco KS 20472 cells, do not mix cells of different manufacturers or dates in the same string. Used Tyco KS20472 List 1 and List 1S cells of different dates may be mixed in the same string.

Do not use wet cells and valve-regulated cells (VR) on the same power plant.

The wires from the battery post to the bus bar, either above the battery stand, inside the primary distribution bay, or at a return bar, shall use tracer marked wire for the 'return leads. For example a -48 plant would use tracer marked wire to the positive end of the battery string.

Battery Drop Wire Requirements

The size of the wires from the battery post to the bus bar on or above the battery stand shall be determined by the ampere-hour rating of the cell and the voltage drop allocation. The wires from the battery posts to the bus bars shall meet the following requirements.

⁴⁴ "NO-OX-ID" is a trademark of SanChem, Inc.

- For cells less than 1000 ampere-hour or greater than 3800 ampere-hour, the cable size shall be calculated as part of the voltage drop between the discharge return bar and the main distribution board. The amperage in this circuit shall be the discharge rate of the cell in question at the engineered reserve time. For example, a Tyco KS 20472 List 1S cell at a five (5) hour rate on a plant with 1.86 MVPC is capable of supplying 226 amperes of current. Unless the AT&T Engineering Representative provides written approval, the total voltage drop, including the shunt and all cabling (see Figure 4-1), shall not exceed .25 volts (loop).
- For cells greater than 1000 ampere-hour to 1800 ampere-hour use four (4) 0000 AWG class I wires from the positive end of the string and four (4) 0000 AWG class I wires from the negative end of the string.
- For cells greater than 1800 ampere-hour and less than 3800 ampere-hour, use six (6) 0000 AWG class I wires from the negative end of the battery string and six (6) 0000 AWG class I wires from the positive end of the battery string.
OR
For cells greater than 1800 ampere-hour and less than 3800 ampere-hour, use four (4) 350-cmil Class I wires from the negative end of the battery string and four (4) 350 kcmil class wires from the positive end of the battery string.

Note: VRLA installations may utilize different size wires, but the total ampacity and the total circular mil of the substituted wire shall be equal to or greater than the requirements above. The wire ampacity shall be determined the ampacity in the 75° column in table 310-16 of the National Electric Code 2002™.

The inter cell and inter tier wires shall match the size of the wires run from the bus bar to the battery post.

The wires from the bus bar to the battery posts shall have a minimum of one-inch (1) and a maximum of one (1) foot slack.

Battery bolting material shall meet SAE Grade Five (5) specifications.

Drop feeders at each end of a battery string, inter row and inter tier wires shall be attached to the battery posts with lead coated compression terminals. If battery connection plates are provided, they shall be lead-coated-copper and utilize one half (.5) inch bolting material. The connectors attached to this plate shall be lead plated. Connections made to battery bus bars that are plated shall be plated, not lead coated.

All wire used to attach to battery strings shall be tin-plated. This includes direct connection to a battery post or connection to a plate that is mounted on the battery post.

Wet Cell Battery Strap and Hardware Requirements

All new or reused battery cells shall be provided with new quad straps, inter-cell, inter-tier and inter-row cabling, explosion proof vent, stainless steel hardware, plastic dust cover and new cabling from cells to bus bars above battery stand. If any of these items are not provided, the installer shall contact the supplier's engineer for assistance.

Note: This requirement does not include individual cell replacements.

Inter-cell connector straps shall be inspected for white oxide salt crystals prior to installation. These crystals are due to improper handling or storage and may cause high resistance connections. The straps shall not be cleaned on site or installed. Straps with white crystalline deposits shall be returned to the supplier for replacement.

All wet cell batteries capable of using quad straps shall be equipped with quad straps. Battery straps shall be a minimum of 1/8" thick. The minimum size for straps shall be one-eighth inch (.125) by one (1) inch

for cells up to 3000 amp hours and one-fourth (.25) inch by two (2) inch for cells over 3000 amp hour. **Wet cell battery straps shall be lead coated copper.** No copper shall be exposed.

The stainless steel bolts shall be installed in the cell post with the nuts on the side of the post nearest the outside edge of the battery stands. The bolting material shall match the diameter of the holes provided in the cell post. **This may be reversed if required for proper torque of the cell bolts.**

If the bolting material uses washers with a sharp edge, the sharp edge of the washer shall NOT be placed toward the battery post. For example, the material **normally** supplied with the Tyco KS 20472 L-1S cell has the number "316" stamped on the washer face with the smooth edge. **Normally**, the "316" should face toward the post.

The battery bolting material shall be torqued per the manufacturer's recommendation. Terminal lugs used on batteries shall be lead coated single hole lugs.

Battery Regulation Leads

Power plants shall be configured to monitor the "A" battery string for the "battery sense" leads. Sensing at the power plant bus bars is not acceptable.

If a power plant is equipped with internal "battery sensing", i.e., sensing connection at the power plant bus bar, the sensing shall be moved to the "A" battery string as a part of any major plant modification. Battery or rectifier additions or battery replacements shall be considered a major plant modification.

Battery sensing leads shall be tagged at both ends with the following information on the tags.

- "Battery Sensing Leads- Do Not Disconnect"
- Plus (+) or (-) depending on proper connection point.

Miscellaneous Battery Stand Wiring

Miscellaneous wiring on battery stands includes, but is not limited to voltage sensing leads, cell monitoring systems and battery disconnect leads. These leads shall be installed using the same good workmanship requirements as any other lead covered by Telcordia GR-1275-CORE™. Included, but not limited to the following:

- Leads, not in conduit, shall be tied with textile cord or plastic tie wraps at six- (6)-inch intervals. If plastic ties are used they shall meet AT&T standards found in section 9.04 of this document. Plastic electrical tape may NOT be used for this bundling.
- Plastic spiral wrap may be used for bundling provided it has an oxygen index of 28 or greater.
- Wire that does not meet the standards established in Section 8.01 of this document shall be fiber wrapped at each tie point.
- Leads, not in conduit, shall be supported at two-foot intervals.
- Plastic "Stick-on" supports may be used to support the wire. Any support used must have an oxygen index of 28 or greater. The support's adhesive shall have a tensile strength of six (6) pounds per inch and a temperature range of from -50° F to 180° F.
- All wire shall be fiber protected from metal edges.
- All leads shall have cable tags as required in Section 8.09 of this document.
- Terminal strips or connection points, other than on the batteries themselves, shall have a protective cover. This cover shall be plastic and have an oxygen index of 28 or greater.

5.02 Battery Stand Requirements

Approved Products

The following are approved products for installation in AT&T facilities:

- **Tyco J85504A-1 for Tyco KS20472 round cells**
- **Tyco "J spec" metal stands for other Tyco KS cells.**
- **Exide battery stands for the GU series cell.**
- **Stand designed for VR cells.**
- **Tyco ED83139-30 Battery Spill Containment System**

General Requirements

Do not locate battery stands on raised floors unless the floors have been modified to provide proper support for the weight of the batteries and an approved acid spill arrangement has been installed.

Bond all metal battery stands to the integrated ground system. All sections of metal battery stands shall have continuity (less than 1K ohms) to the ground connection for the battery stand.

Bond metal earthquake bracing on fiberglass battery stands to integrated ground system.

Three-tier battery stands are not recommended. Three-tier stands may be used if required by floor space requirements and approved by AT&T's Central Office Planning and AT&T Power Engineering. Three tier stands may be used in order to meet earthquake-bracing requirements. The top tier of the battery stand shall be used for bracing purposes only and shall not be equipped with battery cells.

Any new installation of battery stands will comply with the manufacture's recommendation for the seismic zone of the location. The seismic zone will be based on latest seismic map published in the Uniform Building Code (UBC). If an office is not clearly in one of two zones, for existing locations use the zone information in GEOLink. If the zone is unclear for a new location, the supplier shall consult with the ATT DC Power Planner.

Note:

In 1994, the UBC divided seismic zone 2 into two parts, 2A and 2B. In February 2000, ATT published a letter that stated that ATT would engineer zone 2A to zone 1 requirements and that zone 2B would be engineered to zone 3 requirements. While this is applicable to cable racking issues and bay anchoring, it should not be applied to battery stands. Only the manufacturer of the battery stand can designate what seismic forces the product can withstand. For some manufacturers, it is apparent from the documentation which stand should be used in zones 2A and 2B. For other manufacturers, the zone 2 is not differentiated, for example- for the Tyco's fiberglass battery stand, the product information only refers to zone 2 and makes no reference to zone 2A and 2B. In this case, BOTH zone 2A and zone 2B SHALL meet zone 2 requirements. Do not use zone 1 requirements for zone 2A or zone 3 requirements for zone 2B.

Battery stands located in zone 2A may not be properly braced. If this condition has occurred, please contact the power planner for the office for a determination of proper action. This will not be considered an emergency, but shall be corrected on the next addition to the power plant.

Battery Stand Placement Requirements

The following SHALL be the minimum distances between a battery stand and other objects. If office conditions do not permit these standards to be met, the supplier is required to request a wavier for the installation PRIOR to job start. Information on this process is found on AT&T's InfoSWAP web site.

1. All battery stands shall be thirty-six (36) inches from an adjacent or parallel stand. This shall be measured from the stand to the next stand, not from spill containment wall to spill containment wall. The usable walkway will be 28 inches due to the four-inch containment around each stand.
2. The long side of two row stands shall be thirty-six (36) inches from the nearest wall.
3. There shall be thirty-six (36) inches from any battery stand to an equipment bay or any wall mounted equipment.
4. The narrow end of a battery stand (2T2R) may be within 4 inches of a wall for two row stands provided that all connections are accessible from the long side of the stand.
5. A two tier-one row (2T1R) stand may be within 4 inches of a wall on one long side and on both narrow sides so long as all connections are accessible from the remaining long side. The stand may be attached to the wall.

Battery Spill Containment

Battery Spill Containment for all new battery installations or battery relocations shall be provided ONLY after a review of the local codes has determined that a specific location requires spill containment. This review by AT&T Building Engineering and AT&T DC Engineering shall determine what type spill containment, if any, is required. If a study has determined that the local codes do not require spill containment, spill containment may be authorized providing the engineer documents specific environmental concerns at a location. The Infrastructure Development District shall be consulted during the planning stages of any spill containment to be installed that is not required by local code. Unless specifically required by local code and / or Fire Authority, existing battery stands, unless involved in relocations, shall not be retrofitted.

Primary Spill Containment

Primary Spill containment is defined in this document as containment capable of containing and neutralizing the amount of acid found in the largest cell mounted on a single battery stand. This containment restricts the acid to the immediate area of a battery stand and neutralizes the acid.

Each battery stand, requiring containment, shall have it's own primary containment system. The Tyco product per Tyco ED83139-30 is the AT&T recommended product. Any product meeting the requirement of the Uniform Fire code section 64 may be considered for use. These products must present documentation of third party testing and be submitted for approval to the DC Power Element Manager and the Environmental, Health and Safety Manager.

At acceptance, a printed statement shall be turned over to the On Site Work Force specifying that the installed system meets or exceeds the requirements of the Uniform Fire Code section 64. The DC Power Representative shall populate the field in IIDI labeled "Spill Containment" and add a note describing the type containment provided. This note shall specify that primary containment has been provided for the specific battery stands.

If a battery stand retrofit is required, use the Tyco ED83139-30 product. Do not remove battery cells from the stands. The containment system may be installed on metal or fiberglass battery stands with the batteries remaining on the battery stand.

For square or rectangular cell applications, provide ten (10%) percent spare neutralizer pillows for each battery stand equipped with spill protection.
For round cell applications, provide ten percent (10%) spare neutralizer tubes for the largest battery stand in each battery room or area.
For battery rooms or areas with mixed cells, provide 10% spare pillows for each square or rectangular cell stand and 10% spare tubes for the largest round cell stand that is installed.

Provide one leak repair kit per battery room or area.

The supplier shall notify the ATT Central Office Planner (COP) that the battery stands have primary containment systems.

The supplying engineer shall place a note on the office drawing specifying what type of containment was provided, the area covered and the ordering information for the appropriate patching material. The battery stand shall be marked (labeled) with black lettering at least one half inch in height. This labeling shall include the following information.

- **PRIMARY SPILL CONTAINMENT**
 - **The manufacturer's product number and Company Name**
 - **The manufacturers part number for a patch kit.**
 - **The installing company name.**
 - **The installation date.**
 - **Either <NEW> or <RETROFIT>**

Example for the Tyco ED83139-30 product.

- **PRIMARY SPILL CONTAINMENT**
- **ED83139-30 (Tyco Electronics Inc.)**
- **WPXXXXX List XXX**
- **Tyco Electronics Inc.**
- **02/04/98 <NEW>**

Secondary Spill Containment

Secondary Containment is defined as a system that will contain the acid from the largest single cell in the battery room plus the amount of water from the automatic sprinkler system will put into the room within a twenty-minute period. This system would include a liquid tight, sealed floor and/ or walls. Some systems drain the liquid away from the area to a containment vessel. Drain and contain systems are not recommended for AT&T buildings.

The DC Power Representative shall contact the AT&T Building Engineering Representative and request a list of any offices that have local codes that require protection beyond what the Tyco ED83139-30 product provides. Secondary containment may be required if the battery area has a charged water automatic fire extinguishing system.

- ◆ Notify the Central Office Planner (COP) that the battery room will require a secondary containment system.
- ◆ The DC Power Engineering Representative shall add a note in IID1 that this office requires secondary containment.
- ◆ If the battery area requires secondary spill containment, refer this issue to AT&T Building Engineering for engineering and installation.
- The office drawings shall contain a note specifying what type was installed, the area covered and the ordering information for the appropriate patching material.
- Each battery stand shall be marked (labeled) with black lettering at least one half inch in height. This labeling shall include the following information.
 - **SECONDARY SPILL CONTAINMENT**
 - **The manufacturer's product number and Company Name**

- **The manufacturers part number for a patch kit.**
- **The installing company name.**
- **The installation date.**

Battery Stand Bus Bars

Supplemental battery stands shall be equipped with bus bar assemblies if cables larger than 0000 AWG are used. These bars shall meet all requirements in section 6.06, "Bus Bars" of this practice. The bus bars shall have a minimum continuous rating of 1000 amperes.

Wire runs to battery stands shall be sized to meet the requirements of the maximum number of battery string that may be installed on the stand. For example, a stand that can have two strings of battery cells shall have sufficient wire capacity for two strings even if only one string is initially installed. Three tier stands that are installed for bracing purposed may be cabled for the number of strings that are expected to be installed on the stand.

The [battery and return bus bars](#) supplied for supplemental battery stands shall NOT be mounted in the same vertical plane. The bars shall be mounted a minimum of one (1) foot apart on a horizontal plane. The [individual bars](#) may be mounted in either the horizontal or vertical plane.

Unless approved in writing by the AT&T DC Representative, the bars on a supplemental battery stand shall be mounted beneath the cable rack and over the battery stand. The wires to the bus bar shall not be supported by the other bus bar or the other bus bar's supports.

Battery Stand Marking

All battery stands, where the right side is accessible, shall have the manufacture's part number and the installed date marked on the lower right hand side of the stand. The right hand side of the stand is the side on your right when you are facing the narrow end of the stand that holds cell number one. Single row battery stands that have the right side against a wall shall have this marking on the left side of the stand or the side nearest the power plant control bay. These markings may be any size between three-eighth inch and one inch in height.

The battery stand shall be labeled, in minimum one inch lettering, with the string designation and the string nominal voltage. This marking shall be midway of the long side of the stand on both sides of the stand unless the stand is against a wall.

The battery stand shall also be labeled directly below each cell with the cell number and a letter "TR" for any cells designated as 'pilot or temperature regulation' cells. The markings for the cell number and "TR" shall be one inch in height.

The [battery stand FIC](#) shall be labeled, in minimum one-inch lettering, on both long sides of the stand. This marking shall be on the base of the stand below the point where the wires leave the bay.

Metal Battery Stand Requirements

Battery cell additions, removals or relocations on a metal battery stand will require a continuity check on the battery stand. The installer shall verify continuity between CO ground connection of the stand and each section of the stand.

All new or re-used metal battery stands shall be installed with floor anchors. Any metal stand from which battery cells are removed shall have floor anchors installed prior to reinstallation of cells.

Whenever a metal battery stand is reused or relocated, it shall be cleaned and spot painted. New wrap-around shelf covers and floor anchors shall be provided.

Unless otherwise stated in the manufacturer's documentation, all mounting holes in a metal battery stand base shall be equipped with floor anchors.

5.03 Battery Safety and Maintenance Requirements

Safety Materials and Tools

The supplier is responsible for procurement and on site maintenance of safety material used during battery installation. AT&T is required to procure and maintain proper safety material prior to acceptance of the battery. At the completion of the order the OSWF will provide safety equipment per requirements in AT&T 154-001-000AC and AT&T 010-160-110, "Spill Clean-Up Guidelines Handbook".

Note:

Baking Soda is no longer approved for emergency spill containment in AT&T offices.

The following items, provided by the supplier, shall be turned over to AT&T OSWF at turnover of batteries:

- One hydrometer per battery string

Note: If the hydrometer holder is equipped with a glass cup, the supplier shall replace it with a plastic cup (Tyco comcode 402667166.).

- One thermometer per string per tier.(two-tier stand requires two thermometers)
- Eye Wash kits (The supplier shall mount the eye wash kits so that no cell is more that twelve feet (12-ft.) from an eyewash bottle.).

AT&T OSWF shall be responsible for having in place the following equipment at battery acceptance:

- Goggles
- Gloves for high voltage work
- Gloves for battery maintenance
- Apron for battery work
- Neutralizing material (See AT&T 010-160-110 for list of approved material.)

All new and reused wet cell batteries shall be equipped with explosion-proof vents and dust covers.

Insulated tools shall be used for all work within power plant bays or battery stands.

Insulated tools are defined as tools that are insulated by the tool manufacturer and certified to withstand the voltage being serviced.

Note:

In emergency conditions and with the approval of AT&T Management, temporally insulated tools may be used to restore service. Temporally insulated tools are tools that have at least two layers of electrical tape wrapped diagonally to provide protection.

Un-insulated wrenches, ratchet sets or metal measuring tapes shall not be used for power work. Proper protection shall always be in place prior to work operations on or near exposed bus bar, terminals or batteries. This protection may be in the form of fiber, rubber mats, electrical tape or non-conducting barriers.

Reuse of Batteries

When a service provider removes battery cells for reuse, the explosion proof vents shall be removed prior to shipment or transport and shipping plugs shall be used to seal the vent holes. Removal of the explosion proof vent and installing the shipping plugs shall be the last step prior to closing the shipping container. The supplier shall inspect the explosion proof vents. Defective vents shall be sent for disposal. The remaining vents shall be packed and shipped to the reuse site. These vents shall be turned over to the OSWF for use as spares

CAUTION:

The explosion proof vent MUST BE IN PLACE prior to handling, moving or charging of a battery cell. As soon as the cell has been uncrated the explosion proof vent must be installed. For cells being packed for shipment, the replacement of the explosion proof vent with the shipping plug shall be the last thing done before sealing the packing carton.

After shipment and installation supplier shall provide plastic dust covers for cell vents and new spark arrestor vent funnels. For example, the Tyco KS20781 List-2, dust cover, comcode 406069773 would be provided for Tyco KS 20472 cells)

Charging Requirements for New and Reused Battery Cells

All battery cells, new or reused, shall receive the equivalent of an initial charge, as detailed in the manufacturer's documentation. The installation forces shall charge and complete all documentation prior to acceptance. All the battery manufacturer's requirements concerning charging and handling of cells shall be followed.

Cells removed from float for re-cabling do not require an initial charge if both the following conditions are met:

- The cells do not remain off float longer than 24 hours.
- The cells are not physically moved.

Unattended charging is permissible if an over-current protection device and adequate room ventilation is provided (normal room ventilation is usually adequate). If questions arise on the level of ventilation provided, OSWF shall contact AT&T Building Engineering for verification.

Battery Records Requirements

The supplier shall, with the concurrence of the AT&T Power Engineering Representative, establish minimum cell voltage (MVPC) on all new power plants. The supplier shall document the specified MVPC and voltage drops on the job drawing, wiring list, block schematic and IIDI-GEOLink records.

Battery Change Records

The supplier shall provide the OSWF a complete set of battery records upon completion of the initial charging of a battery string. Minimum requirements for the charging record are manufacturer's name, product name, product manual, manufacture date, date of initial charge, installation date, a copy of initial charge record and float history prior to turnover as well as any other documentation required by the manufacturer for proper warranty service on cells. Certification that all work meets warranty requirements is required.

Initial Battery Ohmic Records

Before any battery string (Wet or VRLA) can be accepted, the resistance or conductance of all cells and inter-cell connectors shall be read and recorded by the supplier's installer. This record becomes part of the battery records (turned over to OSWF) and must remain with the battery string. These records are used as a baseline for future readings. The test shall meet the following requirement.

- Supplier shall use one the three test sets.
 1. Alber' Corp. Cellcorder™
 2. Biddle Model 247000 Digital Low Resistance Ohmmeter
 3. Midtronics, Inc. Cellatron™
- Each cell and cell strap shall be measured.
- A paper copy of the results will be left on site.
- A disk with the test results shall be left on site.
- Individual reading shall be less than 12 micro-ohms
- No reading shall be more than 20% above the average for the string.
- The form provided in Chapter 12 shall be used as a paper record.
- A computer diskette with a spreadsheet and a graph shall be provided.
- The diskette and paper copy shall be left on site with the battery records.

Electro-Static-Discharge (ESD) Connection Point

Any new battery stand or bay containing batteries shall be equipped with a connection point for an Electro-static-discharge (ESD) wristband. Any work on existing battery stands, metal and fiberglass, that requires batteries to be moved shall require that ESD connection points be added, if not already equipped.

The ESD connection point shall be an unpainted grounded terminal (ESD socket - 166 jack) at a convenient location on the equipment for connecting an Electro-static-discharge (ESD) wrist-strap (industry standard 170 plug). The grounded terminal shall provide electrical continuity to the central office ground either directly to a C.O. bar or through the aisle frame ground network. On metal battery stands, the grounding connection to the battery stand may also be the connection point for the ESD.

A connection point shall be within 10 feet of any point on the battery stand. For stands less than eight (8) feet in length, one connection point located at either end of the stand is sufficient. For stands in excess of eight feet, but less than 20 feet, a single connection point on each side of the stand and located at the mid-point of the stand meets the requirement.

The connection point shall be marked with a label containing the term "ESD". The letters "ESD" shall be a minimum of one-half (1/2) inch high and be red in color.

6

Chapter 6- Rectifiers and Converter Requirements

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Chapter 6- Rectifiers and Converter Requirements

6.01 Rectifier Requirements

Approved Products and Suppliers

Rectifiers associated with the list of power plants found at the beginning of Chapter 4 of this document are approved for use in AT&T buildings.

For additions only, the latest model of any rectifier already existing in a power plant is also approved.

NOTE:

The preceding equipment has been authorized for use in the AT&T network. Use of any other equipment requires written permission from the AT&T Engineering Representative and the AT&T Infrastructure Life Cycle Management District.

Rectifier Equipment Requirements

All rectifiers are to be equipped as follows:

(Any discrepancies shall be reported to the supplier's engineering department.)

Spare component parts for rectifiers, if required, shall be specified in the AT&T order.

Rectifier requiring individual rectifier regulation leads shall be equipped with individual fuse protection for each regulation lead.

The minimum size cables for DC output lead on Tyco Lineage™ Tyco J8550XX rectifiers are:

— 400-amp rectifier four (4) -350 kcmil (two (2) Bat. and two (2) Rtn.)

— 200-amp rectifier two (2) -350 kcmil (one (1) Bat. and one (1) Rtn.)

---125-amp rectifier two (2)- 2/0 AWG (one (1) Bat. and one (1) Rtn.)

---100-amp rectifier two (2) -1/0 AWG (one (1) Bat. and one (1) Rtn.)

The DC output wires from the rectifiers to the battery stand shall be on dedicated rack. Rectifier racks shall be limited to two layers of wires.

Provide rear cover and both side panels on all Tyco Lineage 2000™ Tyco J85503C 400-amp rectifiers.

All floor-mounted rectifiers shall have a minimum of two floor anchors. Additional anchors may be required, based on the seismic zone or manufacturer's recommendations.

All rectifiers shall be equipped with meters, if available. Digital meters are preferred.

Do not run control leads for rectifiers within the same rack with charge cables.

Control leads for rectifiers may be run using "J" hooks mounted on the cable racks containing charge cables.

Control leads on power plants with capacity less than 1000 amps may be tied to the sides of the cable rack containing charge cables. The control leads shall be tied using waxed twine.

AT&T shall specify, on the order, AC voltage and phase required for rectifiers.

AT&T shall specify, on the order, if AC frequency is other than 60 Hertz.

Rectifiers on power plants with two AC panels shall be evenly distributed between the two AC panels.

Spare and Re-Charge Rectifier Requirements

Power plants, in a single-plant-dual-distribution configuration, shall be equipped with "N+2" rectifiers. For DC power plants, N+2 is defined as two more rectifiers than is required to supply the metered load current at float voltage. The power plant shall also have sufficient rectifiers to provide a minimum of one hundred and twenty percent of load current at float voltage. This extra twenty percent capacity is used for battery re-charge. The spare (N+2) rectifiers shall be considered as part of this re-charge capacity.

Plants that utilize manufactured discontinued rectifiers shall be provided with N-2 where possible. In some locations space and conditions may limit the number of rectifiers installed.

Power plants in a dual-power-plant configuration or in a single-plant-single-distribution configuration are only required to have N+1 rectifiers.

Example:

A power plant has 800 amperes of metered load at float voltage and uses 100-ampere rectifiers. Eight rectifiers are required to provide for the 800-ampere load ($8 \times 100 = 800$). A ninth rectifier is needed to provide N + 1 operation. The plant must have at least 160 amperes of re-charge capacity ($800 \times .2 = 160$). The spare (N+1) rectifier provides 100 amperes of this recharge. A tenth rectifier is installed to provide for the additional sixty amperes of re-charge needed.

If this plant is in a single-plant-dual-distribution configuration, the two spare rectifiers (9 and 10) also provide for the N-2 requirement.

In the example, if 200 –ampere rectifiers are used, four would be provided for the metered load and a fifth rectifier would be provided as the N+1 AND the recharge rectifier. For a single-plant-dual-distribution configuration, the sixth rectifier would have to be provided to meet the N+2 requirement.

Rectifier Spare Circuit Pack Requirements

Spare circuit packs, per manufacturer's recommended list, shall be provided on the initial appearance, the sixth appearance, the eleventh appearance, and the sixteenth appearance of a rectifier type in a power plant.

For each power plant equipped with rectifiers containing field replaceable fans, provide one spare cooling fan as the maintenance spare.

6.02 Converter Plant Requirements

The converter type shall be specified in the AT&T order. Converters shall meet the following requirements.

- Approval from the AT&T Power Engineering Representative must be obtained before powering non-ESS equipment using Oring diodes from converter plants.
- When circuits are moved from a battery plant to a converter plant or from a converter plant to a battery plant, all protection devices in the DC path must be coordinated and verified.

- For converter plants, list DC-to-DC conversion formulas on job drawings. These formulas allow the calculation of the List 2 current drain based on a given load for the converter plant.
- All converter plants shall have front and rear bus bar protection.
- Converter plants must be fed from battery plants, not other converter plants.
- Each converter in the plant should be individually fused.
- The Alarm Battery Supply (ABS) for a converter plant shall be provided with an individual supply circuit.
- Provide spare circuit packs on initial appearance of a converter plant.
- When converters of a different type or model are added to a converter plant, the supplier shall provide spare packs.

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Chapter 7- Protected AC Power Requirements

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7

Protected AC Power Requirements

7.01 General

Protected ("no-break") 120/240/208V AC power for critical network equipment shall be supplied by an inverter powered from the -48 volt Central Office Battery Plant. Inverters generally provide a higher availability (than a stand-alone UPS system), are simpler in design, and provide the same battery reserve time as the central office battery plant.

7.02 Inverter Features

The inverter shall be equipped with the following features:

- A static switch that transfers the equipment from the inverter to the AC line, and on re-transfer from the AC line to the inverter. This switch shall operate in less than 200 milli-seconds.
- An external maintenance bypass switch. This bypass arrangement must be physically external to the inverter and will be designed to totally remove AC and DC power from the inverter. Operation of the bypass switch shall not interrupt service to the equipment; when operated, the bypass switch will feed the equipment load directly from the AC line. This will provide a means to safely perform maintenance on the inverter and to allow total removal and replacement of the entire unit, if required.
- An external AC distribution panel. This must be done to accommodate the total isolation of the unit in the external maintenance bypass mode, and to provide distribution for the inverter loads.
- Separate alarm contacts for local and remote indications. The Inverter System should provide the following alarms:
 - Inverter Fail
 - AC Output Voltage Fail
 - Inverter Fuse/CB Fail
 - Bypass Not Available
 - AC Input Alarm
 - Any other alarm critical to inverter
 - Provide a separate supply for Alarm Battery Supply (ABS) on inverter plants.

NOTE: All remote alarms shall be installed per requirements in AT&T 154-103-101, Alarm Standards Manual.

- The inverter and maintenance bypass switch shall be installed in the DC power plant area.

7.03 Approved Products and Supplier

Tyco Electronics Inc. WP91652 inverter is the only unconditionally approved supplier for inverter system. Table 7-1 and is a listing of approved products and ordering information.

Table 7-1 Tyco Technologies™ WP Inverters

Size	Tyco WP91652 List #
500 VA	L-14
1 KVA	L-22
2 KVA	L-30A
3 KVA	L-40A
5 KVA	L-52
10 KVA	L-62

NOTE:

Refer to AC PWR-003, (part of AT&T 154-001-050) Inverter Power for Critical Network Elements, for additional requirements and approved applications for inverters in the AT&T network.

7.04 Dedicated Inverter Documentation Requirements

AT&T will indicate whether the inverter is dedicated to a particular service. For dedicated inverters, reserve the inverter and distribution equipment for the application by marking the equipment and the engineering drawings.

7.05 Inverter Engineering Requirements

All inverters systems shall meet the following criteria before being used for AT&T loads:

- Meets application design criteria (AC PWR-003).
- Not reserved or dedicated to another application as indicated on associated job drawings.
- Has capacity available for new loads.
- The power plant powering the inverter has available and adequate BHR.
- Has an externally mounted maintenance bypass switch. This switch may be mounted in the same bay as the inverter but shall not be within the inverter cabinet.

A separate Drain Table shall be created and maintained in the AT&T office drawings for all inverter systems. This table shall show current AC drain and the manufacturer's DC-to-AC conversion formula.

The neutral bar and ground bar in downstream Protected AC panels shall not be connected together.

All AC circuits shall be provided with an AC Equipment Ground (that is, green wire ground on all AC circuits).

7.06 Inverter Test Requirements

Inverters shall be installed and tested per the supplier's installation and acceptance guidelines and manufacturer's manual, with the exception of static DC switches, which shall be tested using the office battery instead of a regulated power supply.

In outline form, this test may be accomplished as follows:

1. Prior to placing in service, power the inverter from the DC source and AC source.
2. Confirm that the inverter has output AC.
3. Remove the DC source by removing the fuse or operating the DC breaker.

4. The inverter shall indicate a switch to commercial AC and have an AC output.

7.07 Inverter Spares

Each inverter shall be provided with a spare fuse kit per the manufacturer's list.

Each inverter shall be provided with a set of spare cards per the manufacturer's list.

7.08 Inverter Distribution

1. AC panels fed from inverters shall be marked with the AC source per Section 12.15, paragraph "AC Power Labeling", of this document.
2. All AC outlets fed from inverters shall be marked per Section 12.15 regardless of mounting location (within a bay, floor mounted or on a wall). This marking shall be orange or red in color and shall be a minimum height of three-eighths (3/8) inch and one (1) inch.

Note: Do not use orange colored outlets. The orange colored outlets are designed for isolated "AC" per the National Electrical Code™ and using them for "Protected-AC" circuits creates problems with the local Code Officials and electricians.

3. AC power fed from an inverter shall be designated as "Protected" AC service.

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Chapter 8- DC Power Distribution Requirements

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8

DC Power Distribution Requirements

8.01 DC Power Wire

DC power wire and cable shall meet or exceed the following standards:

- Copper
- UL™ listed as RHH/RHW /600 volt
- Class I or Class B stranding
- Temperature Rating of 90 degrees C.
- Listed for cable tray use (CT)
- IEEE 383, Vertical Tray Flame Test
- IEEE 1202/FT4
- UL 1685, Fire Test Of Limited Smoke (LS) Cables
- Toxicity Index per Mil-C-24683, Acid Gas Generation (Low Corrosive Gasses) Test.
- Corrosively Index per Mil-C-24643, Acid Gas Corrosively Test.
- Smoke Density per ASTM E662
- Telcordia™ Technical Reference TR-NWT-000347, "Generic Requirements for Central Office Power Wire".
- Limiting Oxygen Index (LOI) per ASTM with an Oxygen index rating 28 or greater.
- Appliance Wiring Material (AWM) I B 105° C per CSA standard C22.2 No. 210.2
- Meets or exceeds the following requirements of UL 44:
 - Mechanical properties of Class XL insulation in UL-1581, Table 50.231
 - Crush resistance for XHHW cables
 - Cold bend
 - Heat Deformation
 - VW-1
 - Sunlight Resistance
 - Oil Resistance II
- Tinned wire is only required at connection points on battery cells.

Based on the standards above, the following wires are approved by AT&T for DC distribution.

[AIW Telcoflex II, III, & IV](#)

Cobra Wire & Cable Cop-Flex-2000

Okonite Company, Inc. OKOCLEAR-CO

[Perilli Telcom Safe](#)

Tyco Electronics KS 24194 List 2 and List 3

Tyco Electronics WP 93811

The standard color code for DC power wire in AT&T offices is:

- Ground wires shall be green.
- Battery and battery return wires shall be gray, red or blue.
- Battery return wires (gray, red, or blue) shall have a black tracer. (Tracer is only required on 8 AWG wire and larger)
- Black wire may be use for connections within battery strings or if specified in the equipment order.

Note: In some local offices, different color codes were used. For example, the battery lead may be black in color and the return wire is white in color. Where such codes exist, existing areas may continue to use the same code provided that one the AT&T approved wires is utilized. In new areas, the color code above will apply.

Un-tinned wire is acceptable for all applications except for battery connections. Tinned wire is required at connection points on battery cells. This includes direct connection to a battery post or connection to a plate that is mounted on the battery post.

Armored cable shall not be used for DC power distribution.

Wires (factory-attached leads) that are provided by the equipment manufacturer as “drop” leads are specified by the manufacturer. For example, some of these leads may be THHN wire. The wire provided by the manufacturer shall be tapped to the main run of the DC circuit within 6 feet of the point at which the manufacturer’s wire enters the bay. If this wire does not have a fabric cover, it shall be protected with fiber at each point it is tied down or comes in contact with a metal surface.

The rating for all DC-wire shall be per the 75° column in Table 310-16 of the NEC 2002™. Because the wire size is controlled by the voltage drop requirement, de-rating per the table note is not required. If the wire, connectors and the equipment being fed are ALL rated for 90-degree operation, the 90° column may be used.

8.02 Grounding

Grounding Practices

All equipment additions shall be grounded according to AT&T Grounding Practice ATT 803-501-100. This document is available at the ODMS web site for internal user and at INFOSWAP™ web site for external users

NOTE:

When new equipment areas are established within a building, contact the AT&T Power Engineering Representative to determine the type of ground system to be installed.

All equipment framework and safety-grounding conductors shall utilize green insulated THHN or RHH stranded copper wire and shall be terminated with circumferential-crimp two-hole connectors or exothermic welded two-hole connectors.

Bare tinned copper wire or copper bus bar may be used if specified in equipment standard drawings for the equipment being installed.

If an existing (installed) grounding cable is gray in color, it may remain in place if marked at both ends with green tape or a green plastic sleeve. This marking shall cover at least six (6) inches of the cable in two areas near the termination of the cable. The cable shall be permanently tagged as a grounding conductor **at both ends**.

Connectors and Lugs for Grounding

The only ground connection methods to be used are listed below:

- Exothermic weld (Cadweld™⁴⁵) is always required for buried connections
- Two hole crimp (circumferential compression) cable connectors
- Crimp (circumferential compression) type parallel cable connectors.

The following requirements are for grounding conductors in equipment areas.

- 'H' type wiretaps shall be provided with a non-conductive cover.
- 'C' type wiretaps (used only for connections to AWG 6 wire) do not require a cover.

DC System Grounding

Battery return buses in Secondary Distribution Bays and battery return splice plates external to the Secondary Distribution Bays shall NOT be connected to central office ground. The ground reference for these bays is derived at the power plant or ground window depending on the application.

The reference wire from power plant to a ground window shall be green in color and run mounted on the side of the power rack.

The CO ground reference for power plants, using a chandelier above the battery stand, shall be connected to the chandelier. This connection shall be marked "GRD". The ground reference shall not connect to the "return bars" above the primary distribution bay.

For power plants using a combination return and discharge bars, which are mounted above the plant or above the aisle area, the grounding conductor shall be attached at the central point of the discharge return portion of the bar.

If a second bus bar (return) chandelier is added to a Lineage power plant, the CO ground reference shall be re-located to the chandelier above the "A" battery stand. The CO ground wire may be spliced (taped) using a circumferential compression tap. In this case, a green wire of the same circular mil shall be run to the chandelier over the battery stand. If the original ground wire is gray in color, apply green tape to the cable. The green tape shall cover six inches of the linear wire length and shall be placed within six inches of the splice (tap). The grounding wire shall also be marked with green tape in a similar manner within six inches of the termination on the CO ground bar. In no case shall the 'equalizer' wire be run between the two sets of the return bars.

Ground Window Runs

If a secondary distribution bay is required to attach to a ground window, it is permissible to run only the return leads to the ground window. The return lead must be paired with itself to and from the ground window and must exit and reenter the rack or path that carries the battery lead at the same point. On distribution cabling run through a ground window in this manner, the voltage drop shall be calculated using the sum of the battery lead length and the return lead length. I.e., Loop distance.

This should result in the same size cable being run in the battery and return path.

8.03 Connectors and Lugs

All DC connections shall be made with tinned, copper, circumferential-crimp two hole lugs. An exception is permitted if the equipment manufacturer specifies a different type connector. In those cases where the manufacturer provides a choice between a one-hole connector and a two-hole connector, the two-hole connector shall be used. Short or long barrel connectors may be used depending on the needs of the application.

⁴⁵ CADWELD™ is a trademark of ERICO Products, Inc.

On some equipment bays, non circumferential-crimp connectors are specified. For wire sizes #10 AWG and higher, a circumferential-crimp connector shall be substituted.

For Example, some secondary distribution bays specify a T&B™ D-36 connector for a #8 AWG wire. In this case a T&B™ 541XX connector or a Burndy™ connector YA8C-XXBOX should be used.

The following terminals and taps are approved for AT&T use.

- Tyco connectors per WP91412
- Tyco Taps per Tyco KS23836
- Taps or connectors required by equipment manufacturer.
- Terminal and taps per AT&T 032-385-100.

The crimping tool used must make a distinguishable mark on the connector that is directly related the proper die used with the terminal or tap.

Note:

A circumferential crimping tool of one manufacturer may be used on a connector of another manufacturer provided the manufacturer of the crimping tool specifies that it may be used for the other manufacturer's connector. The installer shall provide upon request the manufacturer's documentation of the proper die mark conversion between the two manufacturers.

Mechanical (pressure) type lugs are not authorized for AT&T power work.

Aluminum connectors or lugs are not authorized for AT&T power work.

Use crimp (circumferential compression) type connectors for all power feeders.

Prior to making a connection, the wire shall be coated with a conductive corrosion inhibitor. The connections shall be as clean and corrosion free and the mating surfaces prepared for maximum current and heat transfer. Plated connectors or bus bars shall not be cleaned with abrasives. All electrical connections shall have a coating of conductive "No-Ox-ID™"⁴⁶ or an AT&T approved commercial equivalent applied. For connections to battery posts, the manufacturer's specified compound shall be used. If a compound is not specified; No-OX-ID™ Special "A" shall be used.

The manufacture's instruction shall be followed when making any tap or connection. The term connector is taken to mean any device that either joins two wires or provides a means to connect to a terminal strip or bus bar.

The following general rules also apply:

- Connections shall be made per quality requirements in GR1275-CORE.
- Once a connector has been crimped and removed, it shall be discarded.

Other than for factory made connections, only clear shrink-wrap may be used.

- The shrink-wrap shall have a minimum oxygen index of 28.
- Clear heat-shrink wrap shall be applied on any connector at battery potential that is within four inches of return or ground potential.

⁴⁶ "NO-OX-ID" is a trademark of Sanchem, Inc.

8.04 Wire and Cable Run Requirements

General

Every effort should be made to keep main DC power distribution circuits from the power plant to the secondary distribution frame (BDFB, PDF, etc.) a maximum of 150 ft. actual cable length. If power distribution feeders will exceed this requirement, the supplier shall request approval in advance from the AT&T Power Engineering Group.

Ambient temperature shall be 30 ° C for cable calculation unless otherwise specified by the AT&T Power Engineering representative.

Standard bending radius, per manufacturer's documentation, shall be followed. [If the manufacturer's requirement is not available, the requirements of GR-1275-CORE shall be utilized.](#)

The power wire size shall be determined first by voltage drop. The wire ampacity shall then be compared to the capacity (size) of the protection device in the circuit. The ampacity of the wire must exceed the capacity of the protection device to ensure that the device will operate prior to over heating of the power wire.

[Note: The rating for this wire shall be per the 75°-degree column in Table 310.16 of the NEC 2002™. If the wire, connectors and the equipment being connected are rated for 90-degree operation, the 90°-degree column may be used.](#)

Cable Racking

[Cable racking shall be engineered and installed per ATT 801-006-100, "AT&T Cable Management Standard for Common Systems- Engineering Design Guidelines" and Telcordia GR-1275-CORE™.](#)

Primary DC power feeders from the power plant to the secondary distribution frame (BDFB, PDF, etc.) shall be run on separate dedicated cable racks. No other cables are to be run within these racks.

Note:

Equipment circuits that are powered from the power plant main power board are considered "primary distribution circuits" and may be placed on the same cable racks with the wires to the secondary distribution bays. These "primary distribution circuits" must be from the same power plant and use gray or the same color wire as the wires to the secondary distribution bays. [Once a circuit comes off of a primary rack, they are considered secondary and shall follow secondary distribution cabling rules.](#)

[The distance from the rack's supporting surface to the outside edge of the stacked cable farthest from the rack surface shall not exceed 7 inches for cables run vertically or horizontally.](#) The supplier's installation representative shall report any rack that approaches within one inch of these limits to the supplier cabling engineering. The supplier's cabling engineer shall mark the rack drawing to indicate cable blockage. Racks found exceeding these limits will require AT&T Engineering's written approval prior to addition of power cable.

Vertical cable racks dedicated to power cables shall not exceed 1' 8" in width.

Any change in the initial cabling plan or in the floor plan will require approval of BOTH the AT&T Central Office Planner and the AT&T Power Engineering Representative.

Battery and return leads shall be run paired on the same rack. This means that the return wire for a circuit shall be run along side of or adjoined to the battery wire for the same circuit. Unless specified by AT&T in writing, all power wire or cable shall be a continuous run. Splices are permitted, within ten foot of a distribution bay or equipment bay, in order to terminate multiple wire runs to an equipment bay.

Note: If the bay is equipped with wire from the manufacturer that does not meet AT&T standards, the tap shall be within six (6) feet of the entrance to the bay.

Power wires or cables shall be cut and dressed to remove any slack greater than three feet. Calibrated loss wire such as shunt leads shall not be cut, but shall be neatly bundled and tied to the rack or equipment bay.

Wire or cable runs to secondary distribution bays from main power boards shall be on dedicated power rack. Ground, signaling and control wires or cables may be run on standoffs but NOT within the power racks.

If an existing rack has both DC power wire and signaling wire, the two wire types may be run on the same rack with the following provisions:

- Wire or cable runs from secondary distribution bays to equipment bays may be run on existing rack with signal cables if separation is provided. Bundling DC power wires or cables to separate them from signal wires or cables may accomplish this separation. Bundling is accomplished by tying waxed twine around the power wires at six-foot intervals.
- When installation of new DC rack is required, the rack shall be designated as power rack and signal wires or cables shall NOT run with the DC power wires. Those racking systems that provide separate compartments for the DC wire or cable and the signal cables are permitted.

Main wire or cable runs from primary distribution boards to secondary distribution boards shall NOT use racks with rack pans.

Under floor installations shall have dedicated cable rack for DC power wires or cables feeding secondary distribution bays from primary distribution boards. DC power leads from the secondary distribution bays to equipment bays may be placed on the floor in the under floor areas but must be segregated by color and from ground and signal wires or cables. This segregation shall be accomplished by bundling. The wires or cables shall be bundled using waxed twine or plastic cable ties at interval not to exceed six feet.

Cable Protection Requirements

Power wire or cable shall be supported at a minimum of every two- (2) foot for wire sizes smaller than 2/0 AWG. For wire sizes 2/0 AWG and larger, the wire may be unsupported for up to three (3) feet.

Any wire or cable used for DC circuits that does not have a textile covering shall be protected with fiber at each point that the cable has been secured. The minimum thickness of this protection shall be one thirty second (1/32) of an inch. This requirement does not apply to wire for which the manufacturer provides third party test results that support not providing fiber protection.

Note:

All wires approved for Dc use in section 8.01 do not require fiber protection at every tie point. In all cases fiber protection is required at transitions and where the wire crosses a sharp edge.

Un-fused wires shall not be run on racks with fused wires. Un-fused wire shall be ran as directly as possible and shall not be run between floors without written approval from the AT&T DC Power Engineering Representative.

Any wire or cable on a cable rack must be properly terminated or have its end protected by tape or a heat shrink cap. This is also true for wires or cables that are being placed on cable racks. For the running of wire this may be accomplished using electrical tape. For wire that is to be left in place on the rack, a heat shrink cap shall be used to insulate the exposed end of the wire.

The installer shall ensure that neither the wire nor cable being installed or the existing wires nor cables are damaged during installation efforts. This involves the application of adequate protection for the cables

at bends and transitions. The supplier shall repair any damage per instructions in Telcordia GR-1275-CORE™ and the manufacturer's recommendation. Any repair made shall be reviewed by an AT&T representative.

Tracer Wire

A tracer marking is a black dashed line that has been placed on the wire by the wire manufacturer. This marking is used to indicate a return wire on a DC circuit. AT&T utilizes these wires to verify that DC circuits have been properly paired when run on cable rack.

- Tracer markings shall be required on gray, red or blue wires **8 AWG** and larger used as return wires in primary distribution circuits.
- Tracer markings are not required on circuits utilizing black insulation.
- Circuits fed directly from the power plant to the equipment that utilize gray, red or blue wire, which is **8 AWG**, or larger shall utilize tracer type wire for returns.
- Circuits that are served from secondary distribution bays (BDFB or PD or GPDF) require tracer markings.
- Tracer type wire is required for wire **8 AWG** and larger within power plants. This includes wire to the battery from the power plant return bar and the wire from the battery post to the plant return bar. This requirement does not include inter cell, inter-row or inter-tier connections within battery strings.

Securing Wire

All cables shall be secured by waxed twine and shall be protected against cutting or abrasion by any sharp edge that touches the cable. This protection may consist of fiber protection. Plastic cable ties may NOT be used on cable racks, but may be used to bundle cables dropping into equipment bays and for bundling in under floor areas.

Cable runs to PDs and BDFBs shall be laced at a minimum on every other cross member on horizontal runs. Vertical runs and transitions shall be laced on every cross member of the rack. In no case shall distance between lacing exceed 4 feet on main power runs. Cable runs from PD or BDFBs to the equipment shall only be sewn to facilitate separation of red and blue cables or to maintain cables on rack.

Per Telcordia GR-1275-CORE™ section 13, wire size 750,000 kcmil shall be secured using a minimum of four (4) strands of nine cored at each tie down point.

Cable Tap Requirements

Taps shall be installed per the manufacturer's instructions. Taps shall not be re-used.

Taps in battery and return leads shall be provided with an insulated, non-conductive covering. The preferred method is a plastic cover provided by the tap's manufacturer.

Note:

In emergency conditions the tap may be insulated by first applying four layers of rubber tape covered with two layers of friction tape. This tape must extend onto the wire at least one inch beyond the tap on any side that a wire extends from the tap. These taps can be used in under the floor applications.

The wire in a tap shall be flush with the outside edge of the tap. AT&T does not require that a short section of wire be extended beyond the tap. If an end is extended beyond the tap, that end shall be properly insulated with a heat shrink cap.

If a plastic cover is used, no less than four wraps of twine or a single plastic tie wrap shall secure the cover. The tie wrap must meet the requirements found in Section 9.04 of this document.

Cable Tap Location Requirements

Taps shall not be installed on vertical runs. Taps shall be supported by securing to the rack or to other wires that are secured to the rack.

Taps made on "top-fed" bays in a raised floor environment may be made in the vertical plane, so long as they are properly supported.

Taps to factory supplied "drop-wires" shall be made within six (6) feet of the entrance of the wire into the equipment bay. Field installed drop wires that meet AT&T wire standards may be tapped within ten (10) feet of the entry point into the equipment bay.

Taps installed on racks shall be accessible. This access may be from the bottom, side or top. Future wire runs shall not cover or bury existing taps. If additional wires must be run over taps, the taps are to be re-located to the side of the rack to allow inspection.

Short sections of cable rack may be used parallel to a cable rack for the purpose of taping wires.

Taps made within ten (10) feet of the wire entrance of the bay do not require cable tags at the tap. Taps beyond ten (10) feet require a tag on each side of the tap. These are in addition to the tags required at each end of the wire. See Chapter 8, Section 8.09 for marking required on these tags.

8.05 Diversity Requirements

Diversity Types

All "Single Power Plant" without designated "Red" and "Blue" secondary distribution bays shall utilize gray wire throughout.

A "Single Power Plant", with secondary distribution bays that are designated as "Red" and "Blue", shall use gray wire to the secondary distribution bays. All secondary distribution bays shall be designated "Red" or "Blue". Wires on the output of the secondary distribution bays that are designated, as "Red" and "Blue" shall use the appropriate color wire i.e., red or blue.

A "Single Power Plant with Dual Distribution" shall have primary distribution bays that are designated as "Red" and "Blue". [The Primary Distribution bays shall be a minimum of six-foot apart.](#) Once the distribution leaves the power plant, it will have the same requirements as a Dual Diverse power plant system.

"Dual Diverse Power Plants" shall use red wire for the red plant and blue wire for the blue plant. All distribution including singularly power equipment bays shall use red or blue wire.

Primary Distribution Separation Requirements

All elements, including cable racks within the power plant, of 'Red' and 'Blue' power plants (Dual Diverse) shall be six (6) feet apart unless approved by AT&T in writing. Cabling from red and blue plants to secondary distribution bays (BDFBs or PDs) shall be on separate racks. These racks do not have to be separated by any standard distance. AT&T does not require a 'standard' separation distance between red and blue distribution cables.

Secondary distribution bays (BDFB or PDs) designated as "Red" and "Blue" shall be separated by six feet and served by separate DC racks from the power plant.

Red and blue primary distribution cables from “Dual Diverse” plants to Secondary Distribution Bays (BDFB or PDF) shall not be run on the same rack.

Offices equipped with “Dual Diverse” A (red) and B (blue) power plants must utilize red or blue wire for all distribution from the power plant to the Secondary Distribution Bays (BDFB) and from the Secondary Distribution Bays (BDFB) to the equipment. Equipment fed directly from the power plant shall also follow the color code of the power plant.

If due to emergency conditions or a pre-existing condition, gray cable is used for major distribution on blue or red plants. The gray wire shall be marked with plastic tape or cable marker of the proper color at the PDB and at the Secondary Distribution Bays (PD or BDFB). This marking shall be at least two (2) inches wide and be clearly visible to a person standing on the floor near the front or rear of the bay. Gray wire is only allowed in these applications if approved by the AT&T DC Engineering Representative.

Secondary Distribution Separation Requirements

If a secondary distribution bay is designated as a "gray" bay, all distribution wire from that bay shall be gray.

Red and blue secondary distribution wires may be on the same rack but shall be separated and bundled (tied) at least every six feet. A minimum of six- (6) inches separation shall be provided.

Red and blue secondary distribution may cross within ten (10) feet of termination into an equipment bay or secondary distribution bay. At this crossing the color wire that is on top shall be fiber wrapped and bound with twine. Plastic tie wraps may be used in under floor areas. The fiber protection shall be for the length the two colors cross.

In situations where the cable plan requires that a bundle of one color must cross another, the wire bundle that is on top shall be wrapped in fiber and secured with either twine or tie wraps (under floor areas only). In under floor areas this method shall be used in place of a cable bridge. In cases where the wire crosses telecommunication cabling, a bridge shall be used.

At points where two bundles of colored wire must cross, only two color layers are allowed. Addition wire to be run through these crossings will require the new wires be added to the proper bundle.

Equipment drops shall be color coded to match red or blue colored wire run from the Secondary Distribution Bays or Power Board to equipment bays. If the drop is custom engineered, the same color wire must be used. If the equipment manufacturer as part of the unit provides the drop wire, the drop cable shall either have a plastic sleeve or plastic tape added to the drop wire. This sleeve or tape shall be of the same color as the main power wire.

In single plant applications, the secondary distribution bays shall be designated as RED or BLUE based on PWRARCH documents e.g., NGLN™ equipment. If this is done, all distribution run after the designation has been made shall be run using the proper color for the secondary distribution bay.

In switch applications the red and blue wire shall be used to identify the “0” (Red) and “1” (Blue) side of the switch. Any circuit for which the detail engineer must order bulk wire shall meet the color code requirement.

For example, wires from the power plant to the PD would be color-coded as to the side of the switch served. Equipment fed from the PD shall be color coded, unless the switch manufacturer requires a specific cable-assembly. Any wire that the manufacture identifies by a general specification rather than a manufacturer and part number shall be color-coded

Additional requirements and information on Diversity issues may be found in AT&T 154-001-050, DC PWR-001, and DC Power Diversity Standards for AT&T Designated Critical Offices.

8.06 Fuses and Circuit Breakers

Interrupting Rating

In those applications that use a class R fuse (i.e., type NON), a fuse with an interrupting rating of 100,000 AIC (Ampere Interrupting Capacity) shall be used. The WP or TPN type fuses meet this requirement.

DC breakers used on power plants with an ultimate plant shunt size of greater than 400-ampere shall have a minimum interrupting rating of 20,000 AIC at the operating voltage.

DC breakers used on power plants with an ultimate plant shunt size of 400-amperes or less shall have a minimum interrupting rating of 10,000 AIC at the operating voltage.

Load Monitoring

All breakers or fuses 150 amperes or larger shall be monitored. The load-monitoring feature on any microprocessor controller shall be programmed by the installer to display the following information as a minimum requirement. This must be done internally to the processor and shall not require cross referencing to any document or marking:

- The breaker or fuse position for the circuit
- The Secondary Distribution Bays (BDFB or PDF) or Inverter frame identification code (FIC)
- The load or bus designation of the powered equipment.

Protection Device Sizing

Equipment, that has redundant in-bay converters or equipment containing Oring Diodes, is referred to as being dually powered. In this configuration, the failure of one power source will not cause a service failure.

Protection devices for dually powered equipment shall be based on the pwrarch documents found in AT&T 154-001-050. The pwrarch documents are available at the AT&T InfoSWAP website and on the AT&T ODMS web site.

If a pwrarch document exists for the equipment being installed, the drain figures and protection device sizes provided in the pwrarch shall be used.

At times, a DC distribution panel or bus is installed for general use and the size of future circuits is unknown. In this case the protection device feeding the distribution panel shall be sized for 400% of the value of the largest protection device that can be installed on the equipment side of the panel being fed.

DC power cables shall be engineered for maximum List 2 or List 2X drain.

Note:

List 1X drain is defined as the amperage that will flow in one side of a dually powered circuit when the other circuit has failed and the power plant feeding the remaining circuit is at float voltage.

List 2X drain is defined as the amperage that will flow in one side of a dually powered circuit if the other circuit is failed and the power plant feeding the remaining circuit is at the equipment's low voltage operation point.

If dually powered equipment is not covered in a PWR ARCH Standard, the following rules shall be followed:

- Fuses and non-Tyco KS circuit breakers shall be sized at 150% of the List 1X amperage.
- Tyco KS circuit breakers shall be sized at 125% of List 1X amperage.
- The protection device must be larger than the List 2X drain of the circuit.
- Cables must be sized to maintain engineered voltage drop using List 2X amperage.

Equipment that is not dually powered and not covered in a PWR ARCH Standard shall meet the following guidelines:

- Fuses and non-Tyco KS breakers shall be sized at 150% of the List 2 drain.
- Tyco KS breakers shall be sized at 125% of the List 2 drain.
- Cables must be sized to maintain engineered voltage drop using List 2 amperage.

Generic Fuse and Breaker Requirements

All fuse and breaker positions shall be identified by bay marking and in the office records as to the capacity of the position, the size device installed and the equipment served.

If fuse blocks are equipped with designation pins receptacles, these pins shall be installed to indicate the size fuse installed.

All fuses or breakers located on primary or secondary distribution bays shall have a fuse alarm.

Spare or unequipped fuse position shall be provided with dummy fuses. [This requirement applies to all alarm fuses and to main fuses that have exposed fuse clips.](#)

Prior to installation, cartridge fuses shall be cleaned and a coating of corrosion resistant compound applied.

Anytime a circuit is added; the protection device's alarm shall be tested.

[Breakers and fuses shall feed only one circuit.](#)

Exceptions:

1. [Multiple Buses on a Secondary Distribution Bay may be fed from a single breaker or fuse at the power plant.](#)
2. [Fuses and alarm circuits for DS1 and DS-3 cross connect bays may share a common fuse provided the circuit is designed for the maximum drain expected.](#)

8.07 Bus Bars

General

Bus Bar assemblies shall be installed per the specification. General requirements for bus bars are:

- Bus Bar shall be 95% hard drawn copper. Aluminum or soft drawn copper is not acceptable.
- All bus connections shall be torqued per manufacture's specifications.
- The distance between bus bar supports shall not exceed six (6) feet.
- Bus bars shall be a minimum of three (3) inches from any structure other than its supports.
- Bus bar bolting material both connection and supporting shall be either copper or zinc plated.
- Unenclosed Bus Bars shall be a minimum of 7 ft above the finished floor.
- Bus bars at battery potential are allowed but must be properly protected (insulated) from accidental contact with other potentials, returns or grounds. This protection may be insulated covers.

- Bus bar runs shall be run paired. Separation between runs shall be a minimum of three (3) inches
- Mated surfaces of bus bars shall NOT be cleaned using abrasive compounds.
- The bus bar connections shall be clean and corrosion free.
- Bus bars mated surfaces shall be flat to ensure proper contact connection.
- Bus bar bolts shall have a locking or "pal" nut installed after the bolt has been properly torqued.
- The minimum overlap when two bus bars are connected is the width of the largest bus bar. For Example, bars that are one-quarter (.25) inches thick and four (4) inches wide shall have an overlap of four (4) inches.
- All sharp edges or burrs shall be removed from bus bar surfaces.
- Bus bar drop plates shall have provision to accept four (4) two hole lugs and shall be drilled for one half inch bolts.

"Back-To-Back" Terminations

The term "back to back" relates to two lugs sharing a common set of hole(s) and mounting hardware on a bus bar. This applies whether the bus bar is mounted in the vertical or horizontal plane. "Back to back" terminations are allowed based on the following.

- Terminations for multiple wires within the same circuit may be attached "back to back".

Example:

If a secondary distribution bay bus requires two wires for the return, these two wires may be mounted "back to back" on the return bars.

- A single return wire for a secondary distribution bay bus shall not be terminated "back-to-back" with the return wire for a circuit on another secondary bay bus.

Example: The buses for a secondary distribution bay require a single 750,000-kcmil wire per bus. These connectors shall NOT be mounted "back to back". If each bus requires two 500,000 kcmil wires per bus, the two 500,000 kcmil wires for any single load may be mounted "back to back".

- Circuit returns for equipment loads may be terminated "back to back" with other loads for that bay that are fed from the same bus.
- Circuit returns for equipment loads may NOT be terminated "back to back" with other loads for that bay that are fed from a different bus.

Example: A bay of equipment requiring four loads (A, B, C, D). In this case, equipment loads A and C are fed from the A bus on a secondary distribution bay. Loads B and D are fed from the B bus on the same secondary distribution bay. The returns for equipment loads A and C may be mounted "back to back". The returns for loads B and D may be mounted "back to back". Loads A and B and loads C and D may NOT be mounted "back to back".

- Returns for different equipment bays may be mounted "back to back" with circuits fed from the same secondary distribution bay bus.

Example: If bay 020001.01 and bay 020001.02 are fed from the same bus, the returns may be mounted "back to back".

- If there are not enough termination positions on the return bus bar at its maximum configuration, do not add another bus bar assembly. The added circuits may be placed "back to back" with existing circuits. For Tyco J85568C or Lucent J85568D bays, a maximum configuration consists of a single List K-1 and two List K-2 bars.

Note:

Placement of a new circuit "back to back" with an existing circuit will require an SMOP with transition procedures.

"Piggy-Back" Terminations

The term "piggy-back" refers to the placement of one connector on top of another connector on a bus bar. In this arrangement, both connectors depend on a common footprint on the bar for the connection. This arrangement is NOT allowed in AT&T offices without express written consent by the AT&T Power Element Manager.

8.08 Cable Holes and Openings

It shall be the responsibility of the supplier's installation forces to maintain fire rating capabilities on any opening in fire rated walls and floors that are compromised for the purposes of work done by the supplier's installation forces.

Any openings provided for new installation shall meet or exceed the requirements in AT&T 770-350-100, REV, AT&T Fire Safety - Fire Stopping of Penetrations for current instructions.

8.09 Wire and Cable Identification and Tags

Tagging During Installation

During installation all wires and cables in active areas must be properly tagged at both ends with a YELLOW tag. An active area is defined any area within six (6) feet of a AT&T circuit that is or is capable of handling customer service or cables handling control circuits for AT&T or it's customers.

This tag may be obtained from any source as long as it meets the following requirements.

On one side "Ask Yourself©" shall be printed in black letters.

These letters shall be a minimum of 1 centimeter in height and .5 cm in width.

The other side shall contain the following information:

Order number _____ Spec Number _____
MOP number _____
MOP Step Number _____
This Cable From _____ To _____
This Cable is Cable _____ of _____ Cables
Tagged By _____ (Installer)
Date _____ Time _____
Verified By _____ (AT&T Technician)
Date _____ Time _____
If required, the following shall also appear:
Color Code _____
Cable Routing _____

At the completion of the installation the yellow tag shall be removed. All DC distribution wires or cables 10 AWG or larger shall be equipped with permanent cable tags at both ends of the wire or cable.

Permanent Wire and Cable Tagging

All power wires, size 10 AWG or larger, shall be permanently tagged, at each end, with a small fiber tag. This tag shall be secured to the wire using waxed twine. This tag shall normally be within one foot of the termination point. Exceptions may be made with the concurrence of AT&T Engineering, so long as the tag is placed no more than 8 feet from the termination point. The tag shall remain on the wire or cable as long as the wire or cable is physically on the rack. The tag shall have a minimum area of 4 square centimeters (2 cm by 2 cm) and a maximum area of 12 centimeters (3 cm by 4 cm). This tag shall have a minimum thickness of 1.5 mm. The tag shall be marked with the following "Near-End" and "Far-End"

information. All marking shall be machine printed. Hand printed tags are not acceptable. The lettering shall correspond to the color of the wire used for the main run as follows.

- Gray or black wire requires black letters
- Red wire requires red lettering
- Blue wire requires blue lettering.
- On white background

Note:

The term *Near-End* refers to the end of the wire that the person has in their hand. *Far-End* refers to the distant end of the wire the person has in their hand.

These items are required on all tags.

- The Near-End information shall be provided on one side of the tag and the Far-End information shall be provided on the other side.
- The voltage of the circuit i.e. “-48 V” shall be provided.
- Either “BAT” (battery) or “RTN” (return) depending on use shall be provided.
- The voltage and either BAT or RTN shall be on the side with the Near-End information.
- If the Near-End and Far-End are less than 10 feet apart, the words “FAR END” on the Far-End side of the tag shall be provided,
- The Near-End FIC is provided before the circuit information and the Far-End FIC is after the circuit information on the tag.

The following are the requirements for the Near-End information on the tags. In each case the same information used on the “Near-End” tag will be placed on the Far-End tag as Far-End information. The only difference will be the placement of the FIC. See figures 6-1 and 6-2 for examples.

Power Plant to BDFB/PD circuits (see figure 8-1):

These items are required on the side of the tag used for “Near End” information at the Power Plant.

- The FIC of the Near-End termination of the wire.
- The fuse or breaker position at the near-end for battery leads.
- The return bar position at the near-end and the near-end fuse or breaker position for a return wire.
- .

These items are required on the side of the tag used for “Near End” information at the BDFB or PD.

- The FIC of the Near-End termination of the wire.
- The panel and load designation at the Near-End for battery leads.
- The return bar position at the Near-End and the Near-End panel and load designation for a return wire.

Power Plant to a Secondary Distribution Bay (BDFB/PD) Example:

Battery lead at the Power Plant-

Near-End information “-48V BAT - 010010.01-- FS 223”

Far-End information “PNL 1 LD “A” 020041.01”

Battery lead at BDFB/PD

Near-End information “-48V BAT 020041.01 PNL 1 LD “A”

Far-End information “FS 223- 010010.01”

Return Lead at the Power Plant-

Near-End information "-48V RTN -010010.01 FS 223 RTN POS A12 "

Far-End information "PNL 1 LD A RTN POS A4-020041.01"

Return Lead at the BDFB/PD-

Near-End information "-48V RTN 020041.01 PNL 1 LD A RTN POS A4"

Far-End information "FS 223 RTN POS A12 -010010.01"

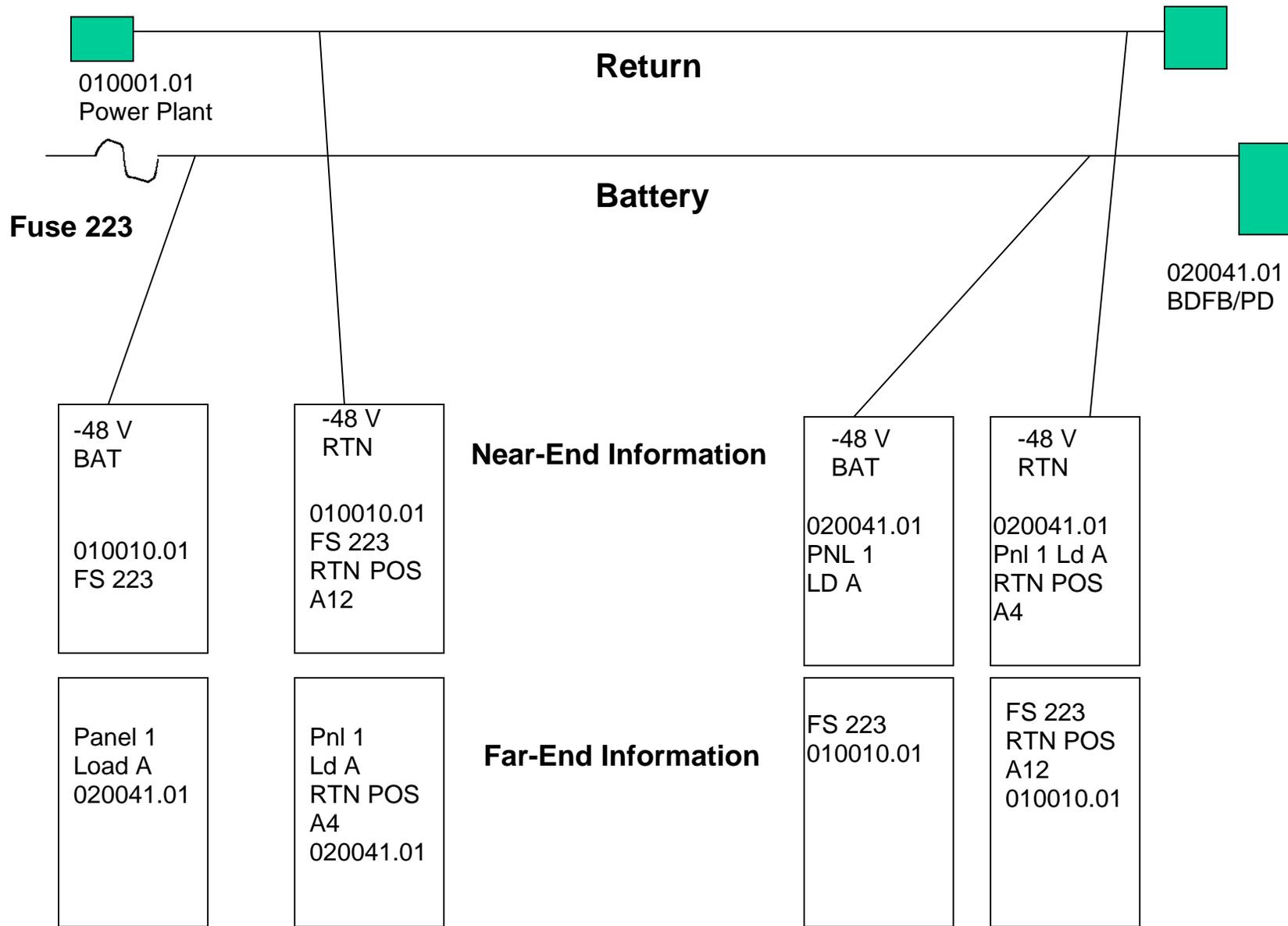


Figure 8-1 Power Plant to BDFB/PD

AT&T — PROPRIETARY
Use pursuant to Company instructions

BDFB/PD to equipment bay circuits (See Figure 8-2)

These items are required on the side of the tag used for “Near End” information at the BDFB or PD.

- The FIC of the Near-End termination of the wire.
- The load (LD) and fuse/breaker (FS/BKR) designation at the Near-End for battery leads.
- The Near-End load (LD) and Fuse/breaker (FS/BKR) designation and the return bar position (RTN POS) at the Near-End for a return wire.

These items are required on the side of the tag used for “Near-End” information at the equipment bay.

- The FIC of the Near-End termination of the wire.
- The equipment load designation if applicable. For example, for a fuse panel, this may be load “A” or load “B” or it may be a panel designation. The purpose is to be able to identify and locate the equipment bay where the equipment will be connected.
- The terminal Strip (TS) and position (P-) or connection point for the circuit at its termination for both battery and return leads.

Secondary Distribution bay to an Equipment bay example:

Battery lead at the BDFB/PD-

Near-End information “-48V BAT -020041.01 LD A FS 8”

Far-End information “LD B TS12 P-32 020070.01”

Battery lead at the equipment bay-

Near-End information “-48V BAT 020070.01 LD B TS12 P-32”

Far-End information “LD A FS 8- 020041.01”

Return Lead at the BDFB/PD-

Near-End information “-48V RTN -020041.01 LD A FS 8 RTN POS F14 ”

Far-End information “LD B TS 12 P-33- 020070.01”

Return Lead at the equipment bay-

Near-End information “-48V RTN 020070.01 LD B TS 12 P-33 ”

Far-End information “LD A FS 8 RTN POS F14 -020041.01”

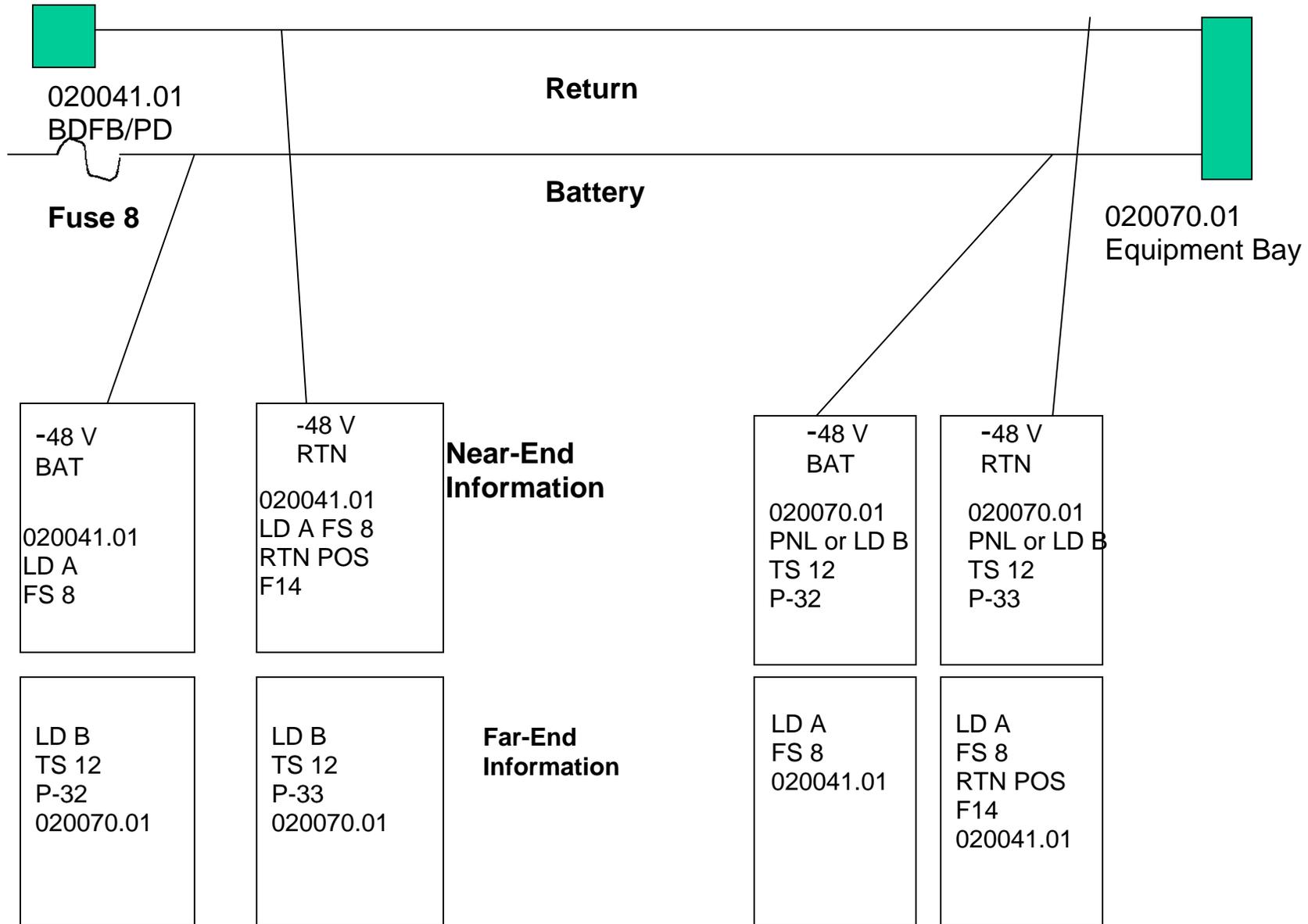


Figure 8-2 BDFB/PD to Equipment Bay

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Tagging Exceptions

The following exceptions are allowed for this tagging.

- Formed cables, where the battery and return wire are within a single sheath, require only one tag per end. Both fuse and ground information must be on the tag. If such a formed cable splits the battery and return by more than six (6) feet, then a tag on both the battery and return is required.
- Any battery or return wire, less than six (6) foot in length, which can be seen for its full length and is not subject to be hidden by subsequent wire runs, does not require tagging. An example would be inter-cell or inter-row battery cables.
- Wires that terminate the battery and return wires into a single plug, require only one tag. Both fuse and ground information must be on the tag.
- In 4ESS™, 5ESS® and DMS®⁴⁷ secondary distribution bays, the battery wires shall not be tagged. All return wires, size 10 or larger, within these bays shall be tagged.

The tag on power wires size zero (0) AWG or larger, that are made spare or removed from but left on the rack, shall be marked with “Spare from” and the FIC location of the distant end of the cable. If a FIC is not available, use the floor and the nearest column to the distant end of the cable.

Example: “SPARE FROM 030001.01” or “SPARE FROM Column 32 2nd FL”

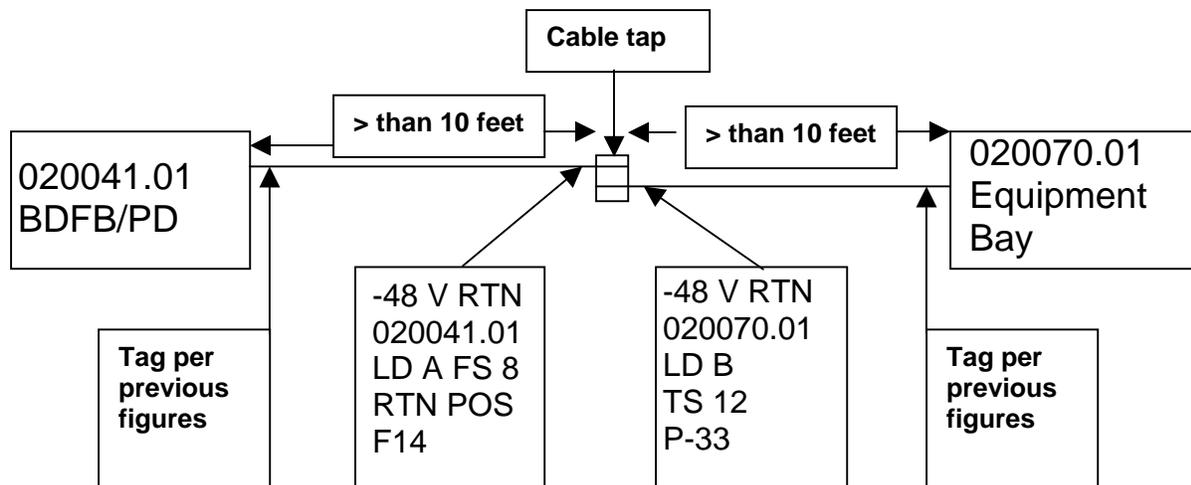
Tagging for Cable taps (See Figure 8-3)

Taps made within ten (10) feet of the wire entrance of the bay do not require cable tags at the tap. Taps beyond ten (10) feet require a tag on each side of the tap. These are in addition to the tags required at each end of the wire. The tags shall be marked with the information about the far end termination of the wire to which it is attached.

Note:

This type of tap is generally due to the re-use of cable or a wavier granted due to office conditions.

Figure 8-3 Cable Tap Tagging



8.10 Building Loads on DC Power Plants

⁴⁷ DMS® is a register trademark of Nortel, Inc

General

In general, the DCO power plants are the first choice for DC power for building loads such as small DC motors, Switch gear and Programmable Logic Controllers (PLC). Power plants dedicated for Nortel DMS®, Lucent 4ESS™ or Lucent 5ESS® shall not be used, unless specified in writing by the AT&T DC Power Engineering Representative.

Motor Loads

The following guidelines are given to determine if DC building motor loads may be installed on DCO power plants.

- Existing motor loads shall remain on the power plants unless a direct service reaction has been documented.
- Building DC motor loads shall not be placed on switching (Lucent 4ESS™, Lucent 5ESS®, NCP, STP, and DMS®) power plants.
- Current AT&T AC Engineering Practices require DC pumps for two applications.
 - To lift fuel in locations where manual (hand) pumps will not work. This provides a means to re-prime the engines if they have failed to start due to loss of fuel prime.
 - To compress air for engine air start systems if the engine has failed to start, the air start system is depleted and commercial AC is not available.

Note:

Both of these requirements improve the survivability of the office. These motors may be placed on DCO power plants so long as the total peak motor load does not exceed one percent (.01) of the battery capacity on the power plant. i.e. a power plant with a single string of L1S cells could have a motor load of 16.8 ampere ((1680)(.01) = 16.8) Two string would allow 33.6 amperes.

- “Soak back pumps”, which are used to maintain lubrication in standby engines, may be placed on DCO power plant but the preferred method is to use AC pumps for this application.
- Building AC loads may be served from Protected AC inverters serving network equipment. Dedicated FASTAR inverters have special requirements that must be met. If Building AC loads approach 40 amperes, a dedicated Building Inverter system shall be provided and the same order shall provide sufficient capacity for the load on the DC plant. In the case of motor loads, the office drawings shall indicate the peak starting current as the load for the equipment.
- DCO power plants, if provided with a DC power option may also power those items in ACPWR-003 that are authorized for protected AC.
- In all cases, the AT&T DC Power Engineering Representative must approve the load to be added to the DCO plant and adequate battery and rectifier capacity shall be added to the power plant to handle the additional load.
- In all cases, an AT&T approved power installation supplier must make the connection into the power plant.
- Building loads that have characteristics similar to motor loads shall utilize high in-rush breakers on the DC distribution.

Building Electronic Loads

Electronic or lighting loads may be powered from DC power plants or secondary distribution bays. All DC circuits shall consist of a battery and return lead. The circuits, if run on common cable racks, shall use wire as designed in Section 8.01 of this practice and follow all wiring requirements in this section. If the circuits are run in dedicated building racks or in conduit, THHN wire may be used. If THHN wire is used, once the wire leaves the conduit and enters the power plant or secondary distribution bay, it shall be fiber wrapped at each tie point and at each point it crosses any sharp edge. The connectors used to attach to the power board or secondary distribution bay shall meet ATT standards as outline in Section 8.03 of this document.

TeleCool™ Equipment

The DC powered Telecool™ system shall only be used for offices that are classified as "high heat producing." These are offices that would experience an extreme rise in temperature during a sustained loss of AC power to the cooling system. The following requirements are for DC powering of TeleCool™ equipment.

- The DC pumps shall not be fed from power plants supplying switching systems that utilize an isolated grounding system (Lucent 4ESS™ & 5ESS®, Nortel DMS™, etc)
- The total load of the DC pumps being supplied by a power plant may not exceed one percent (1%) of the battery capacity of that power plant.
- No more than one circuit breaker per bus may supply the DC pumps for the cooling system.
- Relays must be utilized to insure no more than one pump will come on line simultaneously. The relays must be set so that the time delay between the start of each pump is at least 3 seconds.
- When dual battery plants are utilized, the pumps shall be powered evenly from both plants. This will insure maximum diversity and will minimize the impact to each plant.

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9

Chapter 9- Secondary DC Power Distribution Board Requirements

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9

Secondary DC Power Distribution Board Requirements

9.01 Approved Products and Suppliers

The following Secondary Distribution Bays are approved for use within AT&T facility and switching buildings.

- **Tyco Technologies™ J85568B-1 Two bus Secondary Distribution Bay**
- **Tyco Technologies™ J85568C -1 Six (6) bus Secondary Distribution Bay**
- **Tyco Technologies™ J85568D-1 Eight (8) bus Secondary Distribution Bay**
- **Tyco Technologies™ J855681E-1 Mini Secondary Distribution Bay**
- **Marconi (RELTEC) 1293V3™ Six (6) bus Secondary Distribution Bay**
- **Marconi (RELTEC) 1293V3™ Eight (8) bus Secondary Distribution Bay**

9.02 Framework Requirements

General

Mount all Secondary Distribution Bays on seven-foot frames or in seven-foot cabinets.

Secondary Distribution Bays shall be ordered with side panels and protective rear covers or doors installed.

When available, bottom fed Secondary Distribution Bays shall be equipped with a top cover that will prevent tools or other objects from falling into the bay.

Secondary Distribution Bays shall be fed from the power plant on dedicated power racks.

Dedicated power-rack, used for primary distribution, shall be ladder type and installed without internal pans.

Dedicated vertical power cable rack shall be no wider than one-foot and eight inches (1'8").

Dedicated power rack shall be supported and braced for maximum allowed cable pileup.

All floor-mounted frames shall be anchored to the floor with a minimum of two anchor bolts.

Secondary Distribution Bay buses shall be ordered with shunts where available. If available, a Secondary Distribution Bay shall be equipped with a metering system, digital preferred, which monitors all equipped buses.

BDFB's with a mixture of 2-volt and 4-volt buses shall have separate return bars for the 2-volt and 4-volt equipment

External and internal return bars used with secondary distribution bays shall be marked with a letter denoting the hole-row and a hole-number denoting certain positions. The first and the last position on each row shall be marked. For rows that exceed nine positions, every tenth position shall be marked. This marking shall meet the requirements in Chapter 12, Section 12.15 of this practice. Included in that requirement is the use of red, blue or gray print. This is in addition to the requirement for the FIC of the secondary bay, which is required on external return bars.

External Return Bars

ALL Secondary Distribution Bays shall be equipped with an external bus bar (Return Bar) assembly for return wires. This bus bar assembly is to be isolated from frame ground. The Return Bar shall not be connected to the central office ground system except through the Power Plant ground reference or a Ground Window ground reference.

In low ceiling rooms, internal bars may be utilized.

Note: Some bays are equipped with internal return bars. The AT&T Power Representative may approve the use of the internal return bars. This requires written approval (EQUIPMENT ORDER or email). The Tyco J855681E-1 Mini Secondary Distribution Bay is an example of such an application

The external return-bar(s) shall be mounted under the floor for bottom fed Secondary Distribution bays. The bars shall be mounted in the overhead cable rack for top fed Secondary Distribution bays.

Each secondary distribution bay shall have it's own return bar or set of return bars. Each return bar shall be marked with the FIC of the associated bay. This marking shall be at least three-eighths of an inch in height.

Return bar assemblies may be mounted above (across) the cable rack feeding the Secondary Distribution Bay provided that a **minimum** of twelve inches of useable space is between the lowest return bar in the assembly and the top of the side rail of the rack. Return bar assemblies mounted parallel to the cable rack do not have to meet this requirement unless there is a cable rack directly below the bus bar assembly.

9.03 Marconi (RELTEC) 1293V3™ Configurations

The Marconi (RELTEC) 1293V3™ bay shall be provided as follows unless specified differently in the order from AT&T.

Note: Buses may be equipped with either 300 or 600-ampere shunts, based on individual office requirements and breaker size.

Six Bus Secondary Distribution Bays

- 1 ea. 1293V3 List 3 or 4 RELTEC™ J5821-206-00-03, Top feed (7 ft. bay) or RELTEC™ J5821-206-00-04, Bottom feed (7 ft. bay) equipped with:
- 6 ea. 1293V3 List 20 RELTEC™ J5821-206-00-20, 20 position TPS fuse panel
- 1ea. 1293V3 List 41 RELTEC™ J5821-206-00-41, Return Bar assembly (see note below)
- 1ea 1293V3 List 50 RELTEC™ J5821-206-00-50, Pre-charge option
- 1ea 1293V3 List 52 RELTEC™ J5821-206-00-52, Digital Meter option

Eight Bus Secondary Distribution Bays

- 1 ea. 1293V3 List 1 or 2 RELTEC™ J5821-206-00-01, Top feed (7 ft. bay) or RELTEC™ J5821-206-00-02, Bottom feed (7 ft. bay) equipped with:

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8ea. 1293V3 List 10	RELTEC™ J5821-206-00-10, 12 position TPS fuse panel
1ea. 1293V3 List 40	RELTEC™ J5821-206-00-40, Return Bar assembly (See note below)
1ea 1293V3 List 50	RELTEC™ J5821-206-00-50, Pre-charge option
1ea 1293V3 List 52	RELTEC™ J5821-206-00-52, Digital Meter option

Note:

The standard arrangement for List 40 and 41 call for a return bar for each bus. The AT&T engineer may elect to have only three bars installed in a similar manner that the Tyco Electronics Inc. bay is configured. This must be documented by correspondence between the supplier's engineer and the AT&T power Representative.

9.04 Distribution Requirements

Distribution from Secondary Distribution Bays shall be limited to the same floor on which the Secondary Distribution Bay is located.

The following cable and connectors are authorized for use:

- See section 8.01 for wire that are approved for ATT use.
- Connectors shall be per Tyco Technologies WP91412.
- Cable taps shall be Tyco Technologies, Inc KS23836.
- Terminal or taps per AT&T 032-385-100.

In the secondary distribution areas, plastic tie wraps may be used as follows:

- Plastic tie wraps shall have a Limiting Oxygen Index (LOI) of 28 or greater.
- Plastic tie wraps shall not have sharp edges or metal components.
- Plastic tie wraps may be used to bundle power wires at six-foot intervals in under floor areas only.
- Plastic tie wraps may be used to bundle wires as they enter bays.
- The heads on plastic wraps shall always be positioned away from any surface that additional wire may be run on.
- Plastic wraps shall not deform the insulation of the wire being secured.
- Plastic wraps shall be properly tensioned per the manufacturer's requirements and utilizing the tools recommended by the manufacturer.

The fuse type recommended by the manufacturer shall be provided with the following exceptions.

- A PWRARCH document exists that supersedes the manufacturer's recommendation.
- If the manufacturer's recommendation is for a NON-type fuse, the appropriate Bussmann™ type TPN, TPS or TPL shall be provided.
- If the manufacturer's recommendation is for a WP type fuse, the appropriate Bussmann™ type TPN, TPS or TPL may be provided.

Prior to assigning fuses for equipment bays, the supplier shall verify that they are using the latest issue of the equipment's pwrarch. This information is available on the InfoSWAP web site.

Secondary distribution fusing is limited to 70 amperes unless the secondary distribution bay is designed to limit spikes produced by operation of protection devices.

9.05 Shunt Monitor Feature (bus load monitor feature)

DC breakers on Tyco Lineage 2000™ plants providing DC power for Secondary Distribution Bays shall be provided with the shunt monitor option. When a breaker is added to an existing power plant, not

equipped with shunt monitoring, the supplier shall provide the shunt monitor feature on the power plant as part of the order adding the breaker.

9.06 Secondary Distribution Buses

Cabling, Fusing and Circuit Breaker Requirements

Secondary Distribution Bay buses for general distribution shall be provided with individual over current protection. Each Secondary Distribution Bays bus shall be initially cabled for the maximum current allowed, based on fuse or breaker size feeding the bus. For fuses and non-Tyco KS breakers, dividing the fuse or breaker size by 1.5 derives this value. For a Tyco KS breaker, dividing the breaker size by 1.25 derives the value. The combined List 2 (not dually powered equipment) and List 2X (dually powered equipment) drains on any device shall not exceed this value. The secondary distribution bays buses may be cabled for smaller capacities if documented in the manufacturer 's standard equipment drawings or AT&T DC PWR ARCH documents.

All general-purpose (DCO) secondary distribution bays shall be installed with a minimum .5 loop voltage from the secondary distribution bay to the equipment. A waiver from the AT&T Power Element Manager may be granted prior to the start of installation, if office conditions preclude using a .5 loop. In no case shall the loop voltage from a secondary distribution bay to the equipment be less than .25 loop.

All Fuses on primary distribution panels shall have Ampere Interrupting Current (AIC) rating of 100,000 amperes. Tyco WP and Bussmann™ TPN, TPS and TPL fuses meet this requirement.

If existing secondary fuse panels will accept WP or TPN fuses, this type fuse shall be furnished.

New fuse panels that accept a wire size greater than a # 10 AWG shall be equipped with fuses that are rated at 100,000 AIC.

Circuit breakers on primary distribution bays shall have an interrupting rating of 25,000 AIC. Breakers on secondary distribution shall have a rating of 20,000 AIC or better.

The buses on secondary distribution bays shall be assigned with letters starting with bus "1". The letter designations may be A, B...H or AA, AB...AH, BA, BB...BH or A0, A1...A7.

The alarm fuse associated with a fuse block shall not be used to power any other circuit, such as a secondary distribution bay alarm circuit. A fuse block of the correct size shall be utilized.

Secondary Distribution Bay Ampacity Capacity

The supplier shall notify the AT&T Power Engineering Representative in writing when the order being engineered causes a Secondary Distribution Bay bus to reach 80% of its calculated List 2(X) drain. Further notification shall be given when the installed equipment load reaches 100% of its calculated List 2(X) drain. When a Secondary Distribution Bay bus's List 2(X) calculated drain reaches 100% of its rated amperage, a note shall be placed on the Secondary Distribution Bay drawing prohibiting further distribution assignments. When notification has been issued that a Secondary Distribution Bay bus has reached either 80% or 100% of calculated List 2(X) capacity and the load on that Secondary Distribution Bay bus has decreased, the supplier shall notify the AT&T Power Engineering Representative of this decrease in writing.

Secondary Distribution Bay Fuse Capacity

The supplier shall notify the AT&T Power Engineering Representative in writing when the order being engineered uses fuse or breaker positions that cause over 80% of the available positions on the bus to be in use. Further notification shall be given when bus reaches 100% of installed fuse or breaker capacity. If

the order reduces the percentage of positions filled below 80 %, the supplier shall notify the AT&T Power Engineering Representative of this decrease in writing.

9.07 Secondary Distribution Bay Alarms

Alarm Configuration

Each Secondary Distribution Bay shall have a fuse or breaker alarm.

If available as a standard option, a lamp shall be provided to indicate that the Secondary Distribution Bay has a fuse alarm.

The Alarm Battery Supply (ABS) for a Secondary Distribution Bay alarm circuit shall be powered from a dedicated circuit. This circuit shall have an individual over current protection device. This circuit shall be powered from the same power plant that is serving the Secondary Distribution Bay.

For single power plant applications, the ABS shall either be obtained from the Primary Distribution Board or from another Secondary Distribution Bay on the same floor as the Secondary Distribution Bay being supplied with ABS.

In dual power plant applications, the ABS shall be obtained from the Power Plant Primary Distribution Bay or from another Secondary Distribution Bay served from the same Power Plant and located on the same floor as the Secondary Distribution Bay.

The alarm fuse associated with a fuse block shall not be used to power any other circuit, such as a secondary distribution bay alarm circuit. A fuse block of the correct size shall be utilized.

Spare Alarm / Monitor Cards

- The supplier shall provide a spare alarm / monitor circuit pack for Secondary Distribution Bays by type.
- One alarm card with first application of the specific Secondary Distribution Bay Type on the floor.
- A second alarm card with the fifth application of the specific Secondary Distribution Bays on the floor.
- A note shall be added to the Secondary Distribution Bays record indicating the type card, the year provided and provided and the order that provided the card.

9.08 Secondary Distribution Bay Fuse Position Numbering

For all new secondary distribution frames (BDFBs, PDs, PCFDs or GPDFs) installed in the AT&T network, each fuse block or breaker shall be assigned a unique numeric within the bay. This numeric shall be documented in the office record and marked on the distribution panel adjacent to the fuse block or breaker position. The Bus Designation shall not be the differentiating factor. Fuse positions or breakers numbered with a pattern such as A1 and B1 do NOT meet this requirement. Letters may be used in addition to the fuse block numeric for fuse blocks that hold two or more fuses. For example, if a fuse block mounted in position 15 is designed to hold three 70 type fuses, these positions shall be designated as 15A, 15B and 15C.

Each secondary distributing frame bus has a maximum number of fuse block mountings or breaker mountings. In the following patterns that number is represented by "NN". The first bus (A, 1, or A0) in a secondary distributing frame shall be assigned positions "1" to "NN". The remaining buses shall be assigned "((last number on previous bus)+1)" to "((bus number)(NN))" and so on through the last bus equipped. In this manner a secondary distribution frame that uses panels with 10 fuse block mountings would have the fuses 1 - 10 on the A, 1 or A0 bus, fuses 11-20 on the B, 2 or A1 bus, and fuses 21-30 on the C, 3 or A2 bus . A panel that has 20 fuse block mountings would have fuses 1-20 on the A, 1 or A0 bus and positions 21-40 on the B, 2, or A1 bus. See Table 9-1 for examples.

This numbering scheme shall be followed even if buses are connected together. The bay labeling shall designate the first bus as obtaining its power from the power source (usually a primary power board).

Buses that obtain power from another bus shall indicate the bus feeding the power to it. A bus being fed from another bus shall not reference the breaker feeding the preceding bus.

Table 9-1. Secondary Distribution Frame Fuse Numbers

Bus	10 Position Panel	20 Position Panel	12 Position Panel
A, AA, BA, 1, A0 or B0	1-10	1-20	1-12
B, AB, BB, 2, A1 or B1	11-20	21-40	13-24
C, AC, BC, 3, A2 or B2	21-30	41-60	25-36
D, AD, BD, 4, A3 or B3	31-40	61-80	37-48
E, AE, BE, 5, A4 or B4	41-50	81-100	49-60
F, AF, BF, 6, A5 or B5	51-60	101-120	61-72
G, AG, BG, 7, A6 or B6	61-70	121-140	73-84
H, AH, BH, 8, A7 or B7	71-80	141-160	85-96

9.09 Miscellaneous Fuse Panels

Fuse panels added to provide distribution to network equipment shall meet the following minimum standards.

- Fuse panels shall be firmly mounted.
- Fuse panels shall be marked with DC source information as outlined in Chapter 12 of this practice.
- Each fuse position shall be marked with fuse size, position number and circuit served.

Note: This may be accomplished in three ways. The preferred method is marking adjacent to each fuse. The second method is a card mounted in a cardholder that is mounted on the bay. The third and least preferred method is a fuse book mounted in a holder on the bay.

10

Chapter 10- AC Power Distribution Requirements

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10

AC Power Distribution Requirements

10.01 AC Services

There are three types of AC service in AT&T offices.

- Commercial AC is the AC provided to the building by the local Electric Company.
- Standby AC is the AC provided by standby engines within the office.
- UPS or Protected AC provided by Inverters and batteries.

The AC powered equipment is divided into two general categories.

- Essential AC is provided to that equipment that can tolerate a short duration without AC power. This is provided with Standby AC from the engines during Commercial AC outages
- Non-Essential AC is provided to equipment that does not require power during an AC outage. If the Commercial AC has failed, this equipment will not operate.

UPS and Protected Power

Some AC systems cannot tolerate even a short duration loss of AC power. For these systems, two power sources may be specified.

- "Protected AC" is provided from inverters that use the Central Office battery plant as a DC backup. To qualify for protected power the equipment must be necessary for the office to operate. The AC power is provided for the same time as the DC power to the communications equipment.
- "Building UPS" is AC power provided from stand alone UPS systems. These systems generally have shorter reserve times than the inverters used for Protected AC.

10.02 Ac Wire and Cable

All AC circuit shall conform to the current issue of the National Electric Code® (NFPA 70).

AC Power wire and cable shall be copper only, of insulation type as specified in AT&T 760-400-101, AC Power Distribution - System Design Criteria, and color coded red, black, white, yellow, brown, orange, or green.

If there is not a color code required by local code, ordinance or building practice⁴⁸, AC wire shall be color coded per the following table. The supplier may choose to use black or gray wire with tape identifying the color. The wire shall be taped with the appropriate color at both ends and in any location that the wire is

⁴⁸ Some offices have established color codes for AC wiring with in the office. Contact the AT&T Building Engineer to confirm that such a code exists.

accessible including splices and terminations. The tape marking shall be half lapped and cover a minimum of two inches of the wire's length. If a black or gray wire is used for a wire, which should be green, the wire shall be taped with green tape for the entire length that is exposed.

Table 10-1 AC Color Code

PHASE	120/240 VOLTS	120/208 VOLTS	277/480 VOLTS	120 VOLTS UNGROUNDED
A	Black	Black	Brown	Orange
B	Red	Red	Orange	Brown
C	Orange	Blue	Yellow	Yellow
Neutral	White	White	Gray	Green
Equipment Ground	Green	Green	Green	

All AC circuits shall be provided with AC Equipment Ground (ACEG), (i.e., green wire ground on all AC circuits).

10.03 Connectors and Lugs

Wiring requiring a terminal lug shall be terminated with a circumferential-crimp two-hole connector unless the equipment on the termination side will not accommodate a two-hole lug.

10.04 Conduit and Cable Racks

EMT conduit is preferred to rigid conduit where local codes permit. EMT is not to be used to support any rack or equipment and is not authorized for hazardous locations. A hazardous location is any of the locations classified as such in the National Electric Code® (NEC). EMT may be used in sizes up and including 2 inches in diameter.

EMT conduit is not to be buried in earth or encased in concrete or used in damp locations. If EMT conduit is received and local codes prohibit the use of EMT or the area in which the conduit shall be installed qualifies as an unauthorized location, contact the supplier's engineer for replacement of material.

AC circuits shall not be run within DC or telecommunications cable racks.

DC power circuits may be run in conduit with an AC circuit provided that the DC circuit is a control circuit or back-up power circuit for the AC circuit. An example would be the DC power circuit to an AC/DC light fixture.

Liquid-tight conduit may be used for runs less than 10 feet, but must follow the same rules as armored cable

10.05 Armored Cable

Armored cable may be used for AC circuits when deemed cost effective and provided the installation is not in violation of the NEC (National Electric Code®) or local codes. DO NOT use armored cable on DC circuits.

Support armored cable that is run outside cable racks at a maximum of 4 feet 6 inches by the most economical means.

NOTE:

Do not mine armored cable from cable rack unless directed by the order. When armored cable is to be removed, the cable shall be cut into six-foot lengths prior to removal from cable racks. The armored cable

shall not be pulled from underneath other cables. If armored cable is cut and left on a rack, the ends must have all metal burrs removed, each wire shall be individually insulated and the metal sheath shall be insulated for at least three (3) inches from the end of the cable.

Segregate all armored cable from DC power cable, transmission cable, and signal cable used in all future work.

10.06 Power Distribution Service Cabinets (PDSC) or (PCCD)

General

The term PDSC or PCCD is defined as a panel, wall mounted or floor mounted that provides a means to distribute AC power to equipment.

PDSCs provided with power plants shall be dedicated to that power plant. Other loads shall not be added to these panels without written approval of the AT&T DC Power Engineering Representative.

Power plants with internal AC panels may be utilized provided the panels meet the AIC (Amperes Interrupting Current) requirement for the AC feed to the power plant.

PDSC Capacity

The supplier shall determine the capacity of power plant PDSCs. PDSC capacity shall be determined by the larger of the following criteria.

- The size of the AC feed as indicated on the AT&T power order.
- The AC requirement of the ultimate plant layout as found on the floor plan provided by AT&T Central Office Planner.

AT&T shall specify in the EQUIPMENT ORDER the size of the AC feed to be provided for a new power plant PDSC. AT&T Power Engineering shall provide the following wire size information to the AT&T Central Office Planner for use by the AT&T Building Engineering Representative. The AT&T Building Engineering Representative will install the AC power feed and terminate in a ceiling mounted pull box with drop feeders per the information below. This information is included to enable the PDSC supplier to order lugs and place cable size on drawings. The supplier shall contact AT&T Power Engineering if further information is required.

- For up to 210 amp AC circuits, drop wire at pull box shall be 4/0 AWG.
- For 211 to 299 ampere AC circuits, drop wire at pull box shall be 350 kcmil.
- For 300 to 400 ampere AC circuits, drop wire at pull box shall be 500 kcmil.
- For 401 to 601 amp AC circuits, drop two sets of 350 kcmil wires per phase from pull box

PDSC Available Fault Current Criteria

Every effort should be made by the supplier to obtain the Available Fault Current data for the AC power system. Contact the AT&T Power Engineering Representative and ask that he/she obtain this from AT&T Building Engineering. If this data is available from AT&T it shall be used for the engineering of the new PDSC. If Available Fault Current data is not available, the supplier shall provide PDSC, AC panels and breakers with AIC (Ampere Interrupting Capacity) as follows:

PDSCs and AC distribution cabinets shall have an AIC rating of 100K or greater at the operating voltage.

- At locations with two or more floors, provide AC breakers with a minimum rating of 40K AIC at the operating voltage.
- All other locations shall be required to have a minimum rating of 25K AIC at the operating voltage.

Engineering Records and Drawings

The supplier shall update or create office-drawing records detailing drain information on AC distribution cabinets installed for power plants or for protected AC.

Note: A major purpose of these records is to ensure load balancing for three phase PDSCs and to avoid overloading inverters supplying protected AC.

PDSC Bussing Arrangement and Loads

All PDSCs dedicated for feeding 3-phase rectifiers are to be provided without a neutral bus.

AC circuits other than rectifiers are NOT to be fed from these PDSCs.

Three-Phase PDSC Assignments

A PDSC dedicated to supplying three-phase AC to Power Plant rectifiers shall comply with the following designation rules and table 9-1.

- If the panel has a single row of breakers, each breaker shall be numbered from 1 to n with n being the last breaker mounted. If positions are skipped due to design limitations of the panel, the skipped positions shall be labeled as un-assignable. For example, the Tyco KS 22088 panels require three vacant spaces between breakers over 100 amperes.
- If the panel mounts breakers in two rows, the odd breaker numbers shall start on the left top, as facing the panel, run down the left side. Even numbered breakers shall start at the top right and then continue down to the bottom of the panel.
- Each breaker position shall be assigned three panel positions and the office drawing shall indicate this relationship.

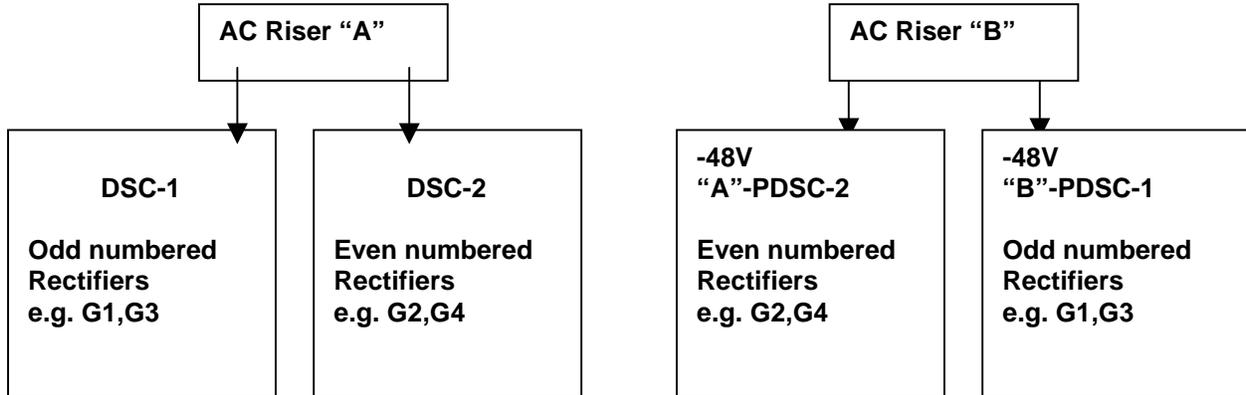
TABLE 10-2 Position Numbering for a typical AC panel.

Breaker Number	Panel positions
1	1,3,5
2	2,4,6
3	7,9,11
4	8,10,12
5	13,15,17
6	14,16,18
7	19,21,23
8	20,22,24
9	25,27,29
10	26,28,30
11	31,33,35
12	32,34,36
13	37,39,41
14	38,40,42
15	43,45,47 (if available)
16	44,46,48 (if available)

AC Power Diversity Criteria for DCO Plants

When two AC sources are available, equip new DCO power plants with two AC distribution bays (PDSC) or with two feeds to each rectifier bay. Rectifiers in each power plant shall be alternately assigned to the two AC distribution bays or AC feeds. AC feeds for the two bays shall be from totally separate and diverse sources as far back into the AC distribution system as economically possible. See figure 9-1.

Figure 10-1 AC Power for DCO Plants

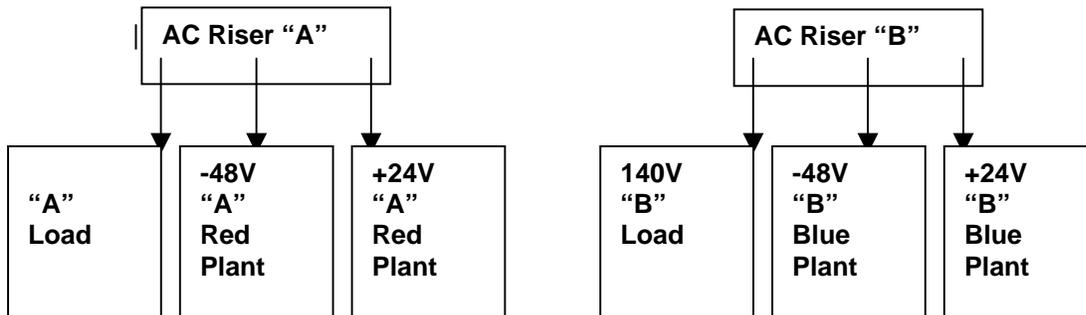


AC Power Diversity Criteria for Lucent 4ESS™ Plants

A Lucent 4ESS™ Power System normally has two (2) plants per voltage (+24 V, -48 V). The AC power for the plants shall be alternately assigned between AC feeders. This means that the +24 V Plant A and -48 V Plant A are connected to Feeder A, and the +24 V Plant B and -48 V Plant B are connected to Feeder B. Each Lucent 4ESS™ power plant shall be equipped with one PDSC (A and B -48 and +24 volt power plant).

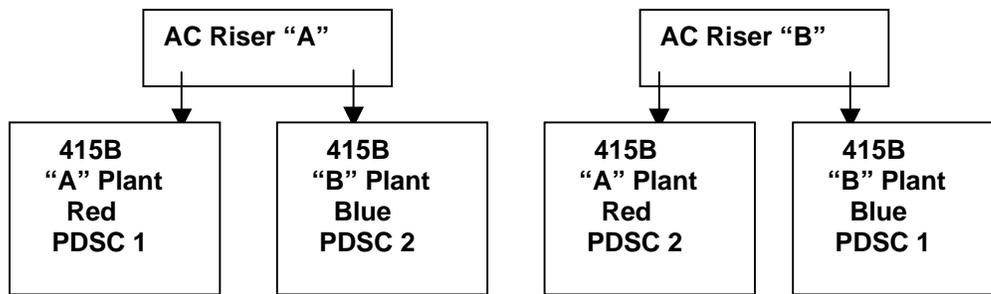
The 415A™ power plants have two AC feeds that terminate in a single PDSC. Each of these AC feeds shall be from separate AC risers. This arrangement meets diversity requirements for this power plant. See figure 9-2.

Figure 10-2 AC Power for Lucent 4ESS™ +24V, -48V and 140V Power Plants



The 415B power plants require two AC panels per power plant. The two PDSCs on a 415B shall be fed from separate AC risers. The AC for the companion 415B may be fed from the same risers as the first power plant or from two different risers. See figure 9-3.

Figure 10-3 AC Power for Lucent 4ESS™ 415B™ Power plants



NOTE:

See *Power and Infrastructure Standard, DC PWR-001*, for additional information on AC power diversity for DC power plants.

10.07 AC Power Lock-Out/Tag-Out Requirements

Provide lockout feature on all AC breakers.

Each breaker feeding a rectifier shall have a lockout device. The door lock on an AC panel does not meet this requirement.

The panel door on all PDSCs or distribution cabinets shall be equipped with a locking device.

10.08 Lighting

For the purposes of this document, the following lighting definitions apply.

- "Stumble" or "egress"⁴⁹ lights are lights required by code for the evacuation of people from the building.
- "Low Intensity" lighting is lighting that allows walk through areas not in normal use and is designed to conserve AC power.
- "Task Lighting" is lighting that allows normal maintenance work to take place.

The supplier shall provide AC operated task lighting in battery plant areas. The supplier shall provide proper lamps for all fixtures installed. DC lighting shall not be provided unless specified in the AT&T equipment order. Any DC lighting provided shall be -48 volt DC operated fluorescent fixtures.

Task Lighting shall meet the following criteria:

- One, two, three or four 48" lamp fixtures.
- Fixtures shall be white with a factory baked enamel finish.
- T-8 lamps shall be provided.
- Up light shall be a minimum 5% and a maximum 20%.
- Fixtures shall utilize rapid start, high efficiency electronic ballast.
- Ballast shall be grounded.
- Fixtures over battery stands shall be equipped with guards.
- Fixtures shall not be mounted less than 7 foot from the floor.
- Illumination level shall exceed 10 foot-candles.
- Comply with requirements found in AT&T 760-230-130, "Lighting in Network Equipment Buildings".

⁴⁹ These lights are sometimes mistakenly referred to as "emergency lights".

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11

Chapter 11- Alarm Requirements

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11

Alarm Requirements

11.01 General Requirements

Provide all power plants, rectifiers, converters, inverters, UPS, and Secondary Distribution Bays (BDFB or PDF) with local and remote alarms.

All DC fuse or breaker positions (power board, BDFB, PDF, misc. fuse panels, etc.) shall be equipped with local and/or remote alarms.

No power plant work will be accepted until all alarms, local and remote, are tested and verified as working. A note to the installer outlining this requirement shall be included in the supplier's detail specifications.

AT&T will indicate, in the initial EQUIPMENT ORDER, the requirements for the appropriate local and telemetry alarm system(s) for alarm assignment.

Some alarm systems connect duplicate alarms from numerous identical units together. In this configuration, there is only one alarm pair for all the units connected together. This configuration is commonly called a "daisy-chain." Remote power alarms shall not be "daisy-chained" between different power plants.

Other than discharge fuse and rectifier fail alarms, do not "daisy chain" or "multiple" remote alarms within the same power plant.

Provide remote alarms as called for on standard equipment drawings and in the Alarm Standards Manual (AT&T 154-103-101).

Local alarms consist of an audible and a visual alarm. The audible alarm shall be located in the immediate area of the power equipment and shall produce a sound level sufficient to be heard by a person with slightly less than average hearing at any point within the power area. This point shall be measured six (6) feet from floor level. Alarm silencing capability shall only exist at the equipment that is generating the alarm. The visual alarm shall be located within the same room as the equipment and less than 100 feet away from the control bay of the power plant or Secondary Distribution Bays. This visual alarm is in addition to any indications located on the equipment bay and shall be mounted a minimum of six (6) feet above the floor.

Remote alarms shall be tested from point of failure to the remote alarm center. Local alarms shall be tested from point of failure to all local alarm displays provided. Standard alarming configurations are found in AT&T 154-103-101.

The Tyco Millennium™ Controller is approved for general use in the AT&T network. In those location where this controller is deployed, the alarms and alarm points shall be configured as closely to the Tyco Galaxy SC™ as possible.

11.02 Galaxy SC™ Alarms

The following are the AT&T setting for the Tyco Technologies L2000 Galaxy SC™ Controller alarms and control. Controllers manufactured by others shall meet the same requirements for alarm points and settings.

Table 11-1 Galaxy SC™ Remote Alarms –24/48 Volt

Terminal Strip	Punching	Alarm Text
TB3	1, 17	High Voltage
TB2	15,31	Rectifier Fail
TB2	11, 27	Output Fuse / Circuit Breaker Fail
TB2	13, 29	Battery on Discharge
TB2	14, 30	AC Input Failure
TB2	16, 32	Very Low Voltage
TB3	2, 18	Microprocessor Fail
TB3	3, 19	Reserve Time

Table 11-2 Galaxy SC™ Local Alarms –24/48 Volt

Terminal Strip	Punching	Alarm
TB2	5, 21	Power Major Visual
TB2	4, 20	Power Major Audible
TB2	8, 24	Power Minor Visual
TB2	7, 23	Power Minor Audible

Table 11-3 Galaxy SC™ Controller – Plant Alarms 24/48 volt

Symbol	Name	Default Severity	Default LED	Default Relay
VLV	Very Low Voltage	Critical ²	BATT	VLV
BD	Battery on Discharge	Major	BD	BD
HFV	High Float Voltage	Minor	RECT	None
HV	High Voltage	Major	RECT	HV
BTJ	Battery Thermal Major	Major	BATT	None
BTN	Battery Thermal Minor	Minor	BATT	None
RBT	Regulation Battery Fuse	Minor	CTLR	MNF
BTPF	Battery Thermal Protection Fuse	Minor	CTLR	MNF
RPF	Remote Peripheral Fuse	Minor	CTLR	MNF
PCF	PC Power Fuse	Minor	CTLR	MNF
INTF	Intelligent Controller Fuse	Minor	CTLR	MNF
BATTF	Battery Fuse	Major	CTLR	MJF
ABS	Alarm Battery Supply Fuse	Major	CTLR	MJF
VS	V sense fuse	Major	CTLR	MJF
FAJ	Fuse Alarm Major	Major	DIST	MJF
FAN	Fuse Alarm Minor	Minor	DIST	MNF
AMJ	Auxiliary Major	Major	None	None
AMN	Auxiliary Minor	Minor	None	None
OSA	Open String	Minor	BATT	None
LVDA	LVD Failure	Minor	BATT	None
LVD	LVD Active	Minor	BATT	None
IND CONT	Independent Controller Failure	Major	CTLR	CTLR
INT CONT	Intelligent Controller Failure	Major	CTLR	CTLR
PSHUNT	Plant Shunt Not Set	Warning	None	None
ETO	Engine Transfer Timeout	Minor	RECT	None
MRFA	Multiple RFA	Major	RECT	RECT

Table 11-4 Galaxy SC™ Controller – Rectifier Alarms 24/48 Volt

Symbol	Name	Default Severity	Default LED	Default Relay
RFA	Rectifier Fail Alarm	Minor	RECT	RFA
ACF	AC Fail Alarm	Minor	AC	ACF
PH	Phase Alarm	Minor	AC	None
LCA	Low Current Alarm	Minor	RECT	None
LSF	Share Fuse Alarm	Minor	RECT	None
MAN	Manual Alarm	Minor	RECT	None
ETS	External Transfer Shutdown	Minor	RECT	None

² The default controller configuration ties the Critical alarms to Major Alarms.

Table 11-5 Galaxy SC™ Controller – Alarm Thresholds 48 volt

Condition	Default Value (volts)	New Value (volts) Wet Cells	New Value (volts) VRLA cells
HV (Float)	53.60	53.00	55.50
HV (Boost)	53.60	55.00	55.75
HV (Hardware set)	54.00	55.50	55.50
HFV (Float)	53.00	52.60	54.75
HFV (Boost)	53.00	54.60	54.75
BD (Float)	51.00	51.25	53.65
BD (Boost)	51.00	51.25	53.65
Rectifier On (RO)	44.00	44.00	44.00
VLV	46.00	46.00	46.00

Table 11-6 Galaxy SC™ Controller – Alarm Thresholds 24 volt

Condition	Default Value (volts)	New Value (volts) Wet Cells
HV (Float)	28.75	26.75
HV (Boost)	26.75	28.75
HV (Hardware set)	29.00	29.00
HFV (Float)	26.60	26.60
HFV (Boost)	28.60	28.60
BD (Float)	25.50	25.50
BD (Boost)	25.50	25.50
Rectifier On (RO)	23.00	23.00
VLV	23.00	23.00

12

Chapter 12- Power Installations – Generic Requirements

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12

Power Installations – Generic Requirements

12.01 General

This section shall be used by the Supplier for the installation of equipment within the AT&T core network. Where this instruction addresses a specific issue, it shall supersede generic supplier installation standards. Any issue not directly addressed defaults to the applicable AT&T Practice, supplier installation procedures, or manufacturer's installation manual. It is also understood by all parties that specific instructions in an AT&T order shall supersede this instruction.

The installer shall install the equipment per the detailed engineering specification using the materials provided in the specification. If any question arises concerning the application of specific equipment or material, the installer shall first consult the suppliers engineering department. Any deviation from the detailed specification must be documented. Deviation from AT&T standards as found in this document or other AT&T documents shall not be implemented until AT&T Engineering has agreed in writing and the office records have been documented. Specific notes within the equipment order from AT&T may constitute written permission to deviate from these standards.

12.02 Power Preconditioning

General Requirements

All pre-conditioned circuits shall be tagged with a "PCO" tag. This tag shall be marked with all pertinent information on the circuit. This information must include the following "PCO" order number.

- A contact number for the supplier who installed the pre-conditioning.
- The Frame Identification Code (FIC) of the new bay.
- The FIC of the power source bay.
- The fuse or breaker size and position in the source bay.
- The manufacturers part number for the pre-conditioned bay.
- The date installed.
- The initials of the supplier's installer.

When the actual bay is installed, included in the installation effort shall be the removal of this "PCO" marking and any "PCO" tags. The engineering supplier that provides for the installation of a bay into a pre-conditioned position (MMO process) shall also remove any "PCO" indicators in office drawings. All pre-conditioned circuits require a continuity test and a verification of proper identification tags as part of the acceptance of these circuits.

Requirements for DC Circuits

DC circuits for pre-conditioned equipment shall be installed per normal installation procedures with the following additional requirements.

At the equipment end of DC circuits:

- If the pre-conditioning provides a termination point, the wires shall be properly terminated at that point. For Example: If the bay frame is installed as part of the preconditioning and the bay frame comes equipped with a fuse panel, the wires shall be terminated in the fuse panel.

- If the pre-conditioning does not provide a termination point, the wires shall meet the following requirements.
 - The proper lugs or cable taps shall be installed on each wire.
 - The wires shall be formed and installed with sufficient length to be installed in the proper place in the equipment bay to be provided.
 - The wire shall have no more than 1 foot of slack when attached to the proper place in the equipment bay.
 - Each wire shall have a "PCO" cable tag indicating the circuit information.
 - The ends of the wires shall be insulated. This insulation shall be sufficient to prevent the wire from becoming energized or grounded by an external source.
 - The insulated ends of the wires shall be placed in a clear plastic bag and tie wrapped to the outside edge of the cable rack just above the location of the bay to be served.
 - The wire storage bag must be clearly marked on the outside of the bag with the equipment bay FIC.

At the source end of the circuit (Secondary Distribution Bay or main Distribution bay):

- The wires shall be installed as in a normal installation.

- The proper lugs or cable taps shall be installed on each wire.

- The wires shall be formed and installed with sufficient length and be connected and secured to the proper place in the source bay.

- The wire shall have no more than 1 foot of slack when attached to the proper place in the equipment bay.

- Each wire shall have a "PCO" cable tag indicating the PCO condition, the circuit information and the PCO order information.

- If the circuit uses a fuse and testing has been completed, the fuse and corresponding alarm fuse shall be removed and turned over to OSWF for future use in the circuit.

- If the circuit uses a DC breaker and testing has been completed, the breaker shall be turned to the "off" position and tagged with a "PCO" tag.

- The marking on the front of the bay for the circuit must clearly indicate the circuit is "PCO".

- The "PCO" marking and the "PCO" tag shall be removed as part of the "MMO" process.

Requirements for AC Circuits

AC circuits shall be installed in accordance with AT&T standards and code requirements.

At the equipment end of AC circuits:

- The wires must be terminated into an approved electrical device.
- A properly mounted junction box is considered an approved electrical device provided:
 - The wires are terminated within the box.
 - The wires within the box are insulated to prevent them from being grounded or energized.
 - The box has a removable cover or plate.
- This device shall be marked as "PCO" and have the source information marked on the device and on a "PCO" tag, as detailed above, attached to the device.
- The "PCO" marking and tag shall be removed as part of the "MMO" process.

NOTE:

In no case shall un-terminated AC wires be left in a condition where they can be accessed without first removing some type of cover. That is, if a pre-conditioned circuit is terminated into an AC receptacle, the receptacle plate or cover must be installed as part of the pre-conditioning.

At the source end of the AC circuit (AC panel board):

- The AC circuit shall be installed per existing AT&T AC requirements and electric Code requirements.
- The circuit shall be connected and tested prior to acceptance. Once accepted, the breaker shall be turned off or the fuse(s) removed and the circuit "tagged out" using the "PCO" tag. The "PCO" tag shall be marked with all pertinent information on the circuit. This information must include the following.
 - The "PCO" order number.
 - A contact number for the supplier who installed the pre-conditioning.
 - The FIC of the new bay.
 - The FIC of the power source bay.
 - The fuse or breaker size and position in the source bay.
 - The manufacturer's part number for the pre-conditioned bay.
 - The date installed and the initials of the supplier's installer.
 - The AT&T employee accepting the installation.
- The marking on the front of the bay for the circuit must clearly indicate the circuit is "PCO". This marking is in addition to the marking required to identify the circuit.
- "PCO" marking and "PCO" tag shall be removed when the equipment is installed. The supplier that provides for that final installation shall remove the pre-conditioned indicators from the office records for that equipment.

12.03 Power Equipment Acceptance

General

The Supplier's Installation Force is entrusted with the acceptance of the equipment into the network. AT&T may require that the supplier be monitored by OSWF or other entities as determined by the timing and type work involved. AT&T reserves the right to review the supplier's installation for defects.

The Supplier's Installation Force and OSWF are required to use the "Ask Yourself©" checklist for all AT&T work operations. This document, AT&T 010-515-170, may be obtained at the InfoSWAP web site.

12.04 Correction of Engineering Drawings

If during installation activities, the supplier's installation force becomes aware of office drawings which are incorrect due to previous installation activity or drawings which need to be corrected due to the work in progress, the supplier shall mark the prints and forward them to the AT&T Power Engineering Representative. The AT&T Power Engineering Representative shall be responsible to select the proper method of completing the corrections to the drawing or records.

12.05 Deviation from Standards and Specifications

Occasionally, deviation from standards may be required. Waivers may be granted PRIOR to installation start by the Subject Matter Expert (SME) for that technology. A list of these SMEs is found on the AT&T InfoSWAP web site. The supplier shall reference this waiver memo in the detailed specification. If the supplier's specification does not provide materials or work items as required per current AT&T standards and the original AT&T order does not specifically remove the requirement for such material or work items, the installer shall contact the supplier's engineer for verification. The supplier's engineer may have additional documentation as detailed above, exempting the requirement for the order.

AT&T policy is that entities causing costs are responsible for those costs. AT&T's engineering records must reflect actual office conditions at the completion of the work. Any deviation discovered after job start shall be considered as a supplier error and so noted on the supplier's report card. The supplier shall contact AT&T for proper resolution of these issues.

12.06 Installation Test Records and Documentation

General

The supplier's installation force shall, at equipment turnover, provide OSWF a copy of supplier checklist forms indicating all tests performed on the equipment and the results of the tests. [This checklist shall be a copy of any form used by the supplier to check the equipment and a copy of the 105 checklist. This information may be in electronic format.](#)

All exceptions or defects shall be noted on this form. An explanation of resolution of defects or exceptions shall also be detailed on this form. All forms shall be dated and signed by the supplier's installation supervisor or representative, with the original form retained as part of the supplier job file.

Equipment Documentation

Product manuals for every equipment type installed on an order shall be given to OSWF at completion of order. Any office drawing changed on the order and any database report (IID-DC) for any changed database shall be turned over to OSWF at completion of the order. Any drawings sent in for revision shall be copied and a marked print shall be left on site with a copy of the transmittal request attached.

Battery Connection Acceptance Record

The following procedures and forms shall be used as Acceptance Tests and Forms to record battery micro-ohm readings. These readings are required to verify that the proper torque was applied to the cell connections and to establish a base line for future readings by OSWF.

CAUTION:

DO NOT APPLY THE METER PROBES ACROSS THE (+) POST AND THE (-) POST OF THE SAME CELL, AS DAMAGE TO THE METER MAY RESULT.

AT&T — PROPRIETARY
Use pursuant to Company instructions

CAUTION:

DO NOT ALLOW THE PROBES OF A TEST METER TO PENETRATE THE LEAD COVERING OF THE STRAPS. THIS MAY CAUSE COPPER TO BE EXPOSED, WHICH MAY REQUIRE THE REPLACEMENT OF THE STRAP.

Required Test using Micro Ohmmeter.

This test is required for all battery string -installation (new or used cells).

The installer shall provide and use one of the following test sets.

1. Alber' Corp. Cellcorder™
2. Biddle Model 247000 Digital Low Resistance Ohmmeter
3. Midtronics, Inc. Cellatron™

After the test, a paper copy of the results and a floppy disk with the raw data shall be left on site with the initial charge records for the battery string.

This test shall be made while battery string is at float.

Measure from each post having inter-cell straps or wires to the post the straps or wires are connected.

Using the Acceptance forms, log the measurements.

Read and log the resistance from post to post.

Calculate the average resistance for connections using battery straps. After all cells are measured, total the readings for posts, which use straps, and divide by the number of readings.

The average reading for connections using straps is expected to be in the 10 to 15 micro-ohm range.

The installer shall investigate and lower any connections that are greater than twenty (20) percent of the average.

Example: If the average is 12-micro-ohms, any readings over 14.4 shall be reworked until they come within compliance.

The final readings shall be reported and shall be included in the battery record turned over to OSWF at acceptance.

Calculate the average requirement for inter tier, inter row and battery to bus bar cables by comparing the strap length to the cable length of the wires used.

Example:

The strap length is one foot and has an average resistance of 12 micro-ohms. The inter-tier wire is six feet in length. The average resistance for the inter-tier wire is six (6) times the 12- micro-ohm reading or 72 micro-ohms.

The installer shall investigate and lower any connections that are greater than twenty (20) percent of the average.

Note:

If the Alber' or Midtronics test set is used, the installer shall follow the instruction found in the product manual.

Optional Test using a Milli Voltmeter

The installer shall use a Fluke 8060A Digital Multimeter or an equivalent meter having the same or better operating characteristics. Strike out the term "micro-Ohm and add "mill-volt" to the form.

A DC current flow of 12.5 percent or more of the ampere rating of the battery cell shall be maintained from the battery string during the test.

Example:

For a 1600 amp/hour cell, 200 amperes of current flow is required.

For a 3200 amp/hour cell, 400 amperes of current flow is required

NOTE:

With approval of the OSWF, a smaller current may be used. If a smaller current flow is used the resulting readings must be compared to a normalized requirement. The normalizing factor is obtained by dividing

the current used for the test into the required current. For example, if the required current is 200 amperes and the current used is 30 amperes, the factor is .15 ($30/200 = .15$) The requirement, as states for a 1600 ampere/hour cell (10 milli-volts) is then multiplied by this factor. The result is the requirement for that current flow. ($10 \times .15 = 1.5$ milli-volts)

Measure from the terminal lug at one end of the battery string to the first battery post or set of posts. Measure from each post having inter-cell straps or wires to the post the straps or wires are connected. Using the Acceptance forms, log the measurements. After all cells are measured, determine the average reading by totaling the readings and dividing by the number of readings. The average reading is expected to be 10 milli-volts or less for battery straps and 20 milli-volts or less for inter tier or row cables.

NOTE:

If the required current was not used to make the reading, then these requirements must be multiplied by a factor to obtain the requirement. In the note above, a 30-ampere current was used instead of the required 200 ampere current. The requirement then becomes 1.5 milli-volts for straps and 3 milli-volts for inter-tier cables. ($30/200 = .15$; $10 \times .15 = 1.5$ and $20 \times .15 = 3$).

The installer shall investigate and lower any connections that are greater than thirty (30) percent of the average.

Example: If the average is 22 milli-volt, any readings over 28.6 shall be reworked until they come within compliance.

The final reading shall be reported and shall be included in the battery record turned over to OSWF at acceptance.

Acceptance Form for Micro-Ohm readings Page 1 of ____
 Power Plant Name _____ Power Plant Voltage ____ Battery String Code ____
 Date of Test _____ Installing Order _____
 Installation Representative _____ AT&T Representative _____

Readings were made using [] milli-volt meter or [] micro-ohm meter.
 Manf. _____ Model _____ Serial # _____

Battery Current _____ Average Reading _____

CELL #	INSIDE POST	OUTSIDE POST	NOTES
CA to Post			
1-2			
2-3			
3-4			
4-5			
5-6			
6-7			
7-8			
8-9			
9-10			
10-11			
11-12			
12-13			
13-14			
14-15			
15-16			
16-17			
17-18			
18-19			
19-20			
20-21			
21-22			
22-23			
23-24			
CA to Post			

Continuation of Micro-Ohm readings.

CELL #	INSIDE POST	OUTSIDE POST	NOTES:	CELL #	INSIDE POST	OUTSIDE POST	NOTES
24-25				53-54			
25-26				54-55			
26-27				55-56			
27-28				56-57			
28-29				57-58			
29-30				58-59			
30-31				59-60			
31-32				60-61			
32-33				61-62			
33-34				62-63			
34-35				63-64			
35-36				64-65			
36-37				65-66			
37-38				66-67			
38-39				67-68			
39-40				68-69			
40-41				69-70			
41-42				CA TO Post			
42-43							
43-44							
44-45							
45-46							
46-47							
47-48							
48-49							
49-50							
50-51							
51-52							
52-53							

12.07 Fire Protection and Personnel Safety Requirements

Cable Holes

It shall be the responsibility of the supplier's installation force to maintain fire-rating capabilities on any opening in fire rated walls and floors that are compromised for the purposes of work done by the supplier. Any openings provided for new installation shall meet or exceed the same requirements as existing openings.

The use of mineral wool bags ("blue bag") fire stop material is no longer adequate for long term closure of cable holes for AT&T. Refer to AT&T 770-350-100 REV, Fire Stopping of Penetrations, for current instructions. The labeling of the closures described in this practice is not optional but is required.

The installer shall provide temporary protection for open cable holes. This protection shall prevent personnel or objects from falling into the cable hole or through the cable hole to the next floor. This temporary protection does not remove the requirement to close all cable holes at the end of a shift.

Combustible Material

Proper disposal of combustible waste material is a prerequisite for installation work to proceed. The supplier shall remove combustible waste material generated during a work shift at the end of that work shift. Disposal of all packaging material generated by a supplier is the responsibility of that supplier.

The supplier shall insure that all flammable containers are properly stored in a fireproof container and empty containers are removed from the site and properly disposed of in a legal manner.

Open Flame Devices

The use of an open flame for any purpose is strongly discouraged in AT&T offices. Exception processes shall be followed if such a procedure is required. Any device used to produce an open flame for any installation process will require written procedures as to monitoring and use. OSWF shall be made aware of this equipment and agree to procedures for use. The supplier shall contact local building and equipment management for approval. OSWF is encouraged to contact their Regional Environmental Safety Organization (RESO) for advice in this process.

Lighting

All fluorescent lighting shall have grounded ballasts.

The supplier shall equip all lighting fixtures added by the supplier with proper lamps.

All egress or stumble lighting fixtures provided by the supplier shall be -48 volt operated fluorescent type.

DC egress or stumble lighting shall not be provided unless specified in the EQUIPMENT ORDER.

Packing Material

The supplier shall properly dispose of all packing material at the end of each workday. Packing material and trash are not to be stored on site.

Disposal of Hazardous and Toxic Waste

Hazardous and toxic wastes shall be disposed of according to the current AT&T, local, state, and federal regulations and methods. All removed batteries must be disposed of in accordance with EPA, state law, local ordinances and AT&T corporate guidelines. The AT&T Chemical and Environmental Management Services (CHEMS) group at (800) 892-7839 is the authorized agent for lead acid and NICAD battery disposal.

Emergency Evacuation

The supplier shall insure that personnel have knowledge of emergency evacuation routes, and that all fire doors and evacuation routes are unlocked and unobstructed.

Personnel Safety

Insure that the installation team is aware of the location of all fire alarm and fire fighting equipment in the work area and that this equipment is unobstructed. Insure that all personnel have a knowledge of the use of fire fighting equipment.

The supplier shall insure the proper use of personnel protective equipment, such as safety glasses, goggles, hard hats, gloves, etc. The use of insulated tools is a requirement for any work in a power area.

Metallic objects such as rings, watches, necklaces, bracelets or large belt buckles shall not be worn.

When working on energized equipment, metal frame glasses are acceptable only when worn under goggles, Safety glasses are required when soldering, handling wire ends, and cutting wire or cable.

The supplier will insure that all equipment, material, and potential hazards are marked to prevent accidents by utilizing barrier ropes and signage.

The installation supplier shall ensure that all personnel used for AT&T work has been trained and tested as to the hazards involved with working in power rooms and with power circuits in a live environment. Proof of "Ask Yourself ©" and "Power Awareness" is a minimum requirement. If requested by AT&T personnel, the supplier shall provide documentation of such training. The Installation Supplier shall ensure the installers adhere to all local safety codes and OSHA safety rules.

If possible without detriment to the AT&T Network, all work on power circuits shall be done with the power source removed.

Un-insulated wrenches, ratchet sets or metal measuring tapes shall not be used for power work. Proper protection shall always be in place prior to work operations on or near exposed bus bar, terminals or batteries. This protection may be in the form of fiber, rubber mats, electrical tape or non-conducting barriers. Insulated tools are defined as tools that are insulated by the tool manufacturer and certified to withstand the voltage being serviced.

Note:

In emergency conditions and with the approval of AT&T Management, temporally insulated tools may be used to restore service. Temporally insulated tools are tools that have at least two layers of rubber tape covered by two layers of electrical tape wrapped diagonally to provide protection.

While working on live AC or DC circuits, two people trained in safety procedures, emergency procedures and DC work procedures shall be present. One of these people may be the AT&T OSWF person. The SMOP shall designate those steps that require the presence of two trained people.

During transitions or additions connections may be made to existing circuits. Prior to connection, the polarity of the circuit shall be verified and the current flow in each circuit. Connection shall not be made between circuits that have a potential difference of greater than .5 volts.

The local operating procedures for LOCK OUT/ TAG OUT shall be followed for all AC circuits.

12.08 Earthquake Bracing Requirements

AT&T will specify the earthquake zone on the EQUIPMENT ORDER. All bracing must be added according to the latest AT&T practices and local code requirements.

12.09 Cable Verification

Prior to connection, removal or tapping of any power cable, the identification of the cable shall be verified and tagged by two individuals. This verification shall be by hand if possible. Hand identification is defined as the ability to start at one end of a cable and move to the other end of the cable without removing that hand. If hand identification is not possible then a tone test set shall be used. The tone shall be verified from both ends of the cable. This will require the sending of the tone from first one end of the cable and then the other end. The person doing verification is required to have had training in the use of the test set prior to work operation. The tags used for verification are to contain information on the circuit, date and time of verification and the names of the two people doing the verification. Total reliance on visual identification, drawings or bay marking is not adequate for AT&T's operations.

The only test set approved for use on **connected** AT&T cables is the RD400 RADIODETECTION™⁵⁰ test set with the LCT-X tone test set. Any commercial test set may be used to identify wires that have not been connected.

12.10 Risk Evaluation and Transition Work

Transitions

Transitions are defined as the moving of operating equipment or transfer of working circuits from one source to another. A detailed list of transition material must be included within the supplier's detail specification if a transition is required.

Cables to be transitioned must be measured for voltage, polarity and amperage and tagged. When two power sources are tied together and one of the sources is then removed, metering of the amperage on each cable is required. The meter readings must indicate that load sharing is taking place prior to the removal of one of the sources.

Prior to connection, the voltage on any two circuits shall be within .25 volt.

When a circuit is to be transitioned and the metered drain is greater than 50% of the ampacity of the protection device, work shall NOT proceed until the type loads on the circuit have been verified by the supplier's installer and the OSWF and if required the supplier's engineer. If the loads are NOT dually powered or do NOT contain Oring diodes, work may proceed. If the loads are dually powered or do contain Oring diodes, action must be taken to ensure that a complete failure of one power source for the dually powered equipment or equipment containing Oring diodes will not cause the operation of the protective devices.

When dual power sources (A&B) are provided, the two sources shall not be tied together except for transitions. These transitions shall be clearly noted in the SMOP and labeled as a hazardous condition. The transitions shall NOT be allowed to exist except for short periods of time and then only under the direct observation of the supplier's installer and AT&T OSWF. Any work operation that requires the "paralleling" of dual power sources for more than eight (8) hours requires written approval from AT&T Engineering, PTSG, and NCC.

⁵⁰ RadioDetection™ is a trademark of RadioDetection Limited.

Risk Assignment

Assignment of risk to the AT&T Network at Critical offices shall be determined by the number of circuits to be transitioned. If any order requires twenty (20) or more circuits to be transitioned, the supplier's engineer and the AT&T Power Engineering Representative shall consider making a field trip to the office. A field trip is required if requested by AT&T Power Engineering, the suppliers' engineering or installation forces or AT&T OSWF. One purpose of this trip shall be to hold a conference with OSWF and the supplier's installation representative to review the order. On all orders requiring a transition at a "Critical" office, the minimum requirement is a conference call. The Supplier's Engineering Representative shall initiate and host this conference call.

AT&T Engineering shall participate on the call and be responsible for involving OSWF and PTSG on this call.

Sequencing may be required either by an AT&T order from other than a DC power group, if more than one supplier is involved in a project or to facilitate the supplier's engineering. In these cases, the supplier's engineer shall notify the AT&T Power Engineering of the need for sequencing. The AT&T Engineering Representative shall provide sequencing information for both suppliers. The supplier's engineering and the installation teams shall then be responsible for sequencing the work between the orders.

All questions and concerns shall be addressed before actual work is started on transitions.

12.11 Removals

General

Removals shall be done in such a manner as to avoid any loss of working circuit continuity or alarm system integrity. AT&T allows cable mining only where no other option is available. MOPs (Method of Procedure) for cable mining shall contain specific details on temporary support of cable or rack during removal operation.

When armored cable is to be removed from cable racks containing telecommunication cables and/or DC power cables, the armored cable shall be removed in less than six (6) foot sections and at no time shall the armored cable be pulled from underneath cable pile-up. Any armored cable not completely removed shall have each conductor in the cable individually insulated and the end of the cable assembly shall also be isolated and covered to remove any sharp edges.

For the purposes of this document, two types of power wire removal are considered. They are power wire removal and power wire mining.

Power Wire Removal

"Power Wire Removal" is generally the activity of removing a bay from an area that will remain active. The removal of a bay shall include the removal of the power wire in the bay and the removal of the distant end wires. These wires shall be removed from the power source. Removing the wires from the fuse or breaker position and from the Distribution Bay return bar does this. All marking on the remaining bays referring to these wires shall be removed. All wires removed shall be cut back to the rack above the bay. The wire shall be cut back up to 15 feet plus any slack that had been stored on the rack when the bay was installed or created when the bay was relocated. If the wire has been tapped, the wire shall be removed back beyond the cable tap. This assumes that other wires will not require relocation for the removal.

This activity does not include relocating or temporary support of other cabling. The ends of these wires shall be properly insulated by the application of proper size heat shrink material to the end. There shall not be any copper left exposed. For cable sizes '0' or larger, the wire shall have a tag indicating the distant end of the wire.

If all the wires on a rack are to be removed, and the cable rack has been verified as having no service, the activity shall be termed a Power Wire Removal. Prior to contract approval, the AT&T DC Power Engineering Representative shall be provided with a firm price quote (E, F and I) for this portion of the work for cost evaluation. An example would be wires that could be removed all the way back to the power plant without requiring the activities listed under cable mining.

Power Wire Mining

“Power Wire Mining” is the removal of power wire from cable racks that contain other wires. These wires are either not going to be removed or cannot be verified as having service. This type of removal will generally involve the temporary relocation and /or temporary support of the power wire or signaling cables that is to remain. The proper lacing of the relocated wires or wire that has had it’s lacing removed to facilitate the removal, shall be considered a part of this procedure.

Removals shall be done in such a manner as to avoid any loss of working circuit continuity or alarm system integrity. AT&T allows cable mining only where no other option is available. MOPs for cable mining shall contain specific details on temporary support of cable or rack during removal operation.

When armored cable is to be removed from cable racks containing telecommunication cables and/or DC power cables, the armored cable shall be removed in less than six- (6) foot sections and at no time shall the armored cable be pulled from underneath cable pile-up. Any armored cable not completely removed shall have each conductor in the cable individually insulated and the end of the cable assembly shall also be isolated and covered to remove any sharp edges.

12.12 Framework Installation

All power bays shall be installed and fasten to the floor and braced as required by the seismic requirements of the office. The minimum requirement for anchoring is the manufacturer’s suggested anchoring. If re-bar or metal is encountered in drilling floor anchors, the installer shall try to re-locate the hole. If the hole cannot be relocated, contact the AT&T Building Engineering Representative. The bit used to drill the hole must match the anchor manufacturer’s specification. If the anchor hole penetrates to the floor below or if these are evidence of flaking on the lower floor contact the AT&T Building Engineering Representative for instructions.

Bays shall be installed per assignment on AT&T central office floor plans. The installed height of adjacent bays of the same height shall vary no more than one half centimeter (.5 cm). If this requirement cannot be meet with shims or creates an unstable arrangement, contact the AT&T Engineering Representative. Bays, frames and battery stands shall be installed with a maximum deviation from vertical plumb of one half centimeter (.5 cm)

All bolts shall be proper attached, not stripped or cross-threaded. All connections shall be torqued to the manufacturer’s specification.

12.13 Battery Installation

Battery installation and removal work requires special consideration. There are dangers of an electrolyte spill, damage to personnel, damage to other equipment and service outages.

The following are minimum requirements for safe battery work.

- All safety material shall on site prior to moving battery cells into the office. This includes eye wash material, aprons, gloves, protective face/eye shields, ESD wrist straps, acid resistant tape and material to neutralize an acid spill.
- The minimum amount of absorbent and neutralization material on hand shall be enough to absorb the acid in one cell. This material shall be in the same room as the battery work.
- Sufficient acid resistant tape shall be available to seal two cracked cells.
- Prior to installation start the installer and the OSWF shall jointly review the local spill procedure plans.

- In the case of a spill, do not dispose of absorbed or neutralized acid until the AT&T representative has approved the disposal procedure.
- Cells shall not be moved within 72 hours of charge.

Note: This is AT&T's requirement. If the manufacturer requires a longer time period, the supplier shall follow the manufacturer's requirement.

- Cells shall not be moved without the explosion proof vent in place.
- ESD (Electro-static-discharge) protection must be used when moving or performing tests on battery cells.
- In low humidity areas, less than 25%, extra precautions concerning static discharges shall be taken.
- ALL installers shall be trained on acid first aid practices and spill containment procedures.
- Any time cells or acid is being moved or handled, aprons, gloves and eye protection shall be worn.
- Avoid physical contact with acid or lead components of battery cells.
- Always use gloves, eye protection or if required a mask or face shield when handling battery materials.
- Battery installation shall be performed in such a manner as to maintain the manufacturer's warranty.
- Sufficient documentation shall be turned over at battery acceptance to satisfy the manufacturer's warranty requirements.
- The bolts connecting the battery straps to the battery post shall be installed with the nuts on the side nearest the outside edges of the battery stand, unless another arrangement is required for proper torque application.
- The installation supplier shall clean every cell install, new or used, with a soft, damp cloth prior to placement on the stand.
- After the initial charge, the top of the cells shall be cleaned and neutralized by the installation supplier prior to acceptance.
- All connections and exposed metal on the battery shall have a thin coating of a corrosion inhibitor. The inhibitor specified by the battery manufacturer shall be used. If the battery manufacturer does not specify a product, No-Ox-ID™ shall be used.

12.14 Service Protection

"Ask Yourself©" and "Power Awareness"

Before performing work in AT&T network buildings, the Supplier's Installation Force must have completed a comprehensive training course in "Ask Yourself©" and "Power Awareness".

The Supplier's installers and AT&T's On-Site Work Force (OSWF) are required to use the "Ask Yourself©" checklist for all work operations. This document can be obtained at the AT&T InfoSWAP web site.

Seed Documents

As part of the SMOP process, AT&T has developed documents containing outline procedures for common work items. These documents are called "Seed Documents". For example, the modification of a bay that exists in many offices and is to be modified in a standard manner or a procedure to make connections in a Secondary distribution bay or Power Plant may be subjects of a "Seed Document". This "Seed Document" shall be modified to meet the office specific conditions at the job site.

The AT&T PTSG (Power Technical Support Group) and the ACTSG (AC Technical Support Group) are charged with the approval of SMOPS for work done in the AT&T Network. As a requirement to the approval of certain work items, an AT&T Seed Document must be used as the basis of the SMOP. Contact the AT&T OSWF for the latest issue of any Seed Documents covering the work to be performed. For example, there is a Seed Document for connection of wires within a Secondary Distribution Bay.

AT&T — PROPRIETARY
Use pursuant to Company instructions

Prior to preparing an SMOP to do work in an AT&T office the supplier's installation forces shall obtain from AT&T's OSWF the latest version of any applicable "Seed Document". Failure to do this will delay the approval of the SMOP by the technology SME and create unnecessary work and or delays on the part of the supplier and AT&T.

General Method of Procedure (MOP)

General Method of Procedure(s) (MOPs) should be prepared to provide procedures for basic service protection, building protection, material staging and storage, start date of the installation activity, equipment to be added or removed, customer coverage, personnel, safety, housekeeping, and reference to any work operations that will be included within the scope of the document.

The General MOP (for work that does not require a network event) should be submitted to the On-Site Work Force (OSWF) only. The guidelines for this type work are contained in the latest "Ask Yourself©" Handbook.

NOTE:

The supplier's installer should always check with the On-Site Work Force (OSWF) for the latest issue of the Ask Yourself© Handbook News because this document is subject to change at any time.

SMOP – Generic Requirements

The Service Method of Procedure (SMOP) is a document that describes a work methodology to line personnel who perform potential service affecting activity in AT&T controlled locations. It should be prepared to cover installation activities that require a detailed description of procedures, equipment and service protection, shifts to be worked, skill level of installation personnel, test equipment required, service restoration responsibilities, etc.

It consists of the following:

- A detailed MOP (which can be a locally generated step-by-step procedure, a generic MOP developed by the technology SME(s), or a form that has been approved by the Alarm center. A detailed, step-by-step procedure is an integral part of the SMOP and shall be prepared to detail the specific sequence of activities required to accomplish a particular work operation. The step-by-step should define equipment to be removed from or restored to service, transition steps, testing requirements, etc. and should include responsibilities and compliance checking requirements for both installation personnel and the end-user.

NOTE: AT&T requires that the Step-by-Step include detailed technical procedures and verification procedures, not just a list of work to be done.

- NT668 Check List
- Supporting Technical Documentation (AT&T Practices, ECPs, TOPs, Cns, etc.)

The detailed MOP (for work that does require a network event) should be submitted to the AT&T Representative for approval and transmission to the Network Event Center as a SMOP (Service Method of Procedure) at least one week prior to work date. The guidelines for this type work are contained in "Ask Yourself©" Handbook News. Refer to AT&T 010-515-170 for further instruction on MOP and SMOP development and requirements.

Method of Procedure - Checklist

The following provides generic information and examples for some of the information, which should be included in a Power SMOP. The following is provided as information only, and is not to be used as a "seed document" for detailed SMOP preparation:

Refer to "Ask Yourself©" Handbook, Section 2, "Service Method of Procedure"

Use proper forms & latest issue.

Handwriting must be legible.

Any copies must be of a good quality

All work operations must be identified separately (step-by-step, not a narrative)

Back-out procedures shall be noted.
Steps that require OSWF participation shall be identified.

Working procedures and proper tools:

- Personnel safety must be addressed.
- Insulated tools must be available and used.
- Voltmeter, clamp on ammeter and capacitor forming tool should be on-site if required.
- Equipment protection, including all power circuits, not just the affected equipment.
- Housekeeping.
- Walk-through should be included.
- Technical bulletins and flashes must be addressed.
- Back out procedures must be included.
- Service restoration must be included.
- Include a list of affected equipment.
- Be aware of downstream equipment, which could be affected.
- Notify the power module prior to start of work.
- Planned work must meet work schedule guidelines.
- Alarms must be verified:
 - Before start of job.
 - At completion of job or tour.
 - As required during the procedure.

Walk-Through

A “walk-through” is required prior to performing any installation or removal activities. The walk-through is defined as a process that requires a visual assessment of all work to be performed for an associated MOP and SMOP, at the location at which the work is to be performed, accompanied by a step-by-step review of the associated MOP and SMOP during the visual assessment.

- The walk-through shall be based upon the associated MOP and approved SMOP, supplemented by single-line drawings as specified in Power Awareness, Section 3, and AT&T 154-001-000AC, Network Power Management, Section 11 and Appendix U, as well as applicable engineering specifications and engineering drawings.
- Discussion must take place between all parties i.e. OSWF, installation, PTSG when participating on-site, etc., to the extent that risk to service associated with the individual Steps of the MOP and the total job must be evaluated and understood by all parties. Included in the risk assessment is a fundamental understanding by all personnel involved of the power systems circuits being worked on and their immediate relationship to the specific technology, e.g., Lucent 4ESS™, Lucent 3B™⁵¹ processor, Lucent DIF™⁵², Lucent TSI™⁵³, etc.
- Steps deemed critical shall be afforded special attention and appropriate procedures developed to ensure that the work is completed with absolute minimum risk.
- If the power systems relationship to the technology is not clearly understood based upon the MOP, approved SMOP, single-line drawings as specified in Power Awareness, Section 3, and the applicable engineering specifications and engineering drawings, the job shall be stopped. Additional information required on engineering specifications or engineering drawings shall be obtained from the engineering organization. It is the responsibility of the OSWF to develop and document any additional information required on single-line drawings. At such time as the relationship of the power system to the technology is clearly understood and documented, work may be re-initiated.

⁵¹ Lucent 3B™ is a trademark of Lucent Technologies, Inc.

⁵² DIF™ is a trademark of Lucent Technologies, Inc.

⁵³ TSI™ is a trademark of Lucent Technologies, Inc.

- The responsibilities of each person associated with the work must be clearly and unambiguously defined and noted on the MOP.
- The walk-through shall occur at the start of each shift for which work is to be performed and whenever personnel changes occur, and shall include all OSWF and installation personnel involved with the work or any related work. In addition, a walk-through may be required at the discretion of OSWF, installation and PTSG if on-site, before implementation of critical Steps in the MOP and also before or during implementation of multiple orders.

12.15 Power Installation- Equipment Labeling

DC Power Labeling

That supplier shall label all AT&T power and equipment bays installed by the supplier with the DC input source. The goal of this labeling is for a person in the office to be able to stand in front of any bay and quickly identify the source or sources of power for that particular bay. In addition, in offices with dual powering arrangements (DCO diversity or Lucent 4ESS™ 'A' and 'B' load diversity) the person should be able to identify by color code, which of the two sources is being provided.

The labeling tape shall be a minimum of 3/8 inch and a maximum of one (1) inch in width.

The supplier for labeling power and communications equipment shall follow the following procedures.

1. Obtain a Brother P-Touch III®⁵⁴ electronic labeling system, Model PT-10, Merlin Lettering Machine®⁵⁵, or equivalent. Color combinations required are:

- Red letters on a white background.
- Blue letters on a white background.
- Black letters on a white background.

2. If equipment is being powered from diverse Red and Blue plants, the labeling of the DC power input source shall be done as follows:

- Equipment bays, including Secondary Distribution Bays (BDFBs and PDFs), powered from the "A" ("red") plant shall have the power input information labeled with red letters on a white background.
- Equipment bays, including Secondary Distribution Bays (BDFBs and PDFs), powered from the "B" ("blue") plant shall have the power input information labeled with blue letters on a white background.
- Equipment bays including Secondary Distribution Bays (BDFBs and PDFs) fed from diverse plants shall have the "red" load input information labeled with red letters on a white background and the "blue" load input information labeled with blue letters on a white background.

3. Switching systems (Lucent 4ESS™, Lucent 5ESS®) that have an "A" and "B" load powering system for diversity should have all A power loads labeled in red with white background and B power loads labeled in blue with white background. This would include offices that do not have diverse 48 and 24-volt power plants.

The loads on the 415A™ power plants and distribution used for Lucent 4ESS™ switches should also be marked with the blue/red convention.

⁵⁴ Brother P-Touch III® is a registered trademark of Brother International Corp.

⁵⁵ Merlin Lettering Machine® is a registered trademark of Varitronic Systems, Inc.

In Lucent 4ESS™ switches, the red and blue cables and markings denote the "0" and "1" side of the switch, not just the presence of dual power plants. If the office 415A™ loads have already been marked using the black on white tape, this is acceptable for existing equipment. Red and blue markings are to be used for any new or rearranged equipment

4. Equipment bays including Secondary Distribution bays (BDFBs or PDFs) powered from non-diverse power plants, other than 415As™, shall have the power input information labeled with black letters on a white background.

A Secondary Distribution Bay may be fed from a GRAY power plant and be designated as a RED or BLUE Secondary Distribution Bay based on the equipment being powered from the bay. In this case the DC input to the Secondary Distribution Bay shall be Black letters on a white background.

The equipment powered from such a Secondary Distribution Bay shall have either RED or BLUE letters on a white background.

5. Labeling of input power information on Secondary Distribution Bays (BDFBs and PDFs), shall be adjacent to the stenciling indicating the bus and shall include the following information (examples shown in parentheses):

- ◆ Power plant feeding the bus (-48V L2MCS01, 1st floor)
- ◆ Power board feeding the bus (Power Board # or FIC)
- ◆ Breaker or fuse number feeding the bus (CB or FS 101.01)
- ◆ Size of the breaker or fuse feeding the bus (400 amp)

If a Secondary Distribution Bay bus is powered from another bus in the same bay, the input marking for that bus shall indicate the preceding bus as the input device and not the breaker that powers the preceding bus. The marking color used shall agree with the color used on the bus fed from the power plant.

No effort shall be made to coordinate marking location with actual DC cable connection except in those cases where a bay consists of several separately powered units. Those equipment bays that have shelves that are individually powered shall either identify which panel the load is feeding OR place the marking adjacent to each panel in the bay.

The marking of input power for equipment bays shall include the following information: (examples are shown in parentheses and at end of this section).

- ◆ Power Source (A, B, or -)
- ◆ Voltage of power input (-48 Volt)
- ◆ Secondary Distribution Bay (BDFB or PDF) or equipment fed directly from the Power Plant shall be marked with Power Plant and Power Plant floor (i.e., L2MCS01 1st floor)
- ◆ FIC or bay number of bay and type of bay feeding the equipment (i.e., BDFB 0100010.01)
- ◆ Secondary Distribution Bay (BDFB or PD) bus (A, B, C, or D, etc.)
- ◆ Breaker or fuse number feeding the equipment (CB or FS 101)
- ◆ Size of the breaker or fuse feeding the equipment (60 amp)

If the labeling is hard to read due to color of the bay or lighting, the installer may outline the information in another color tape. Do not use red or blue tape for this border or outline.

Labeling Examples

1. Secondary Distribution Bay (BDFB, ABC, OR PDF)

BUS A POWER SOURCE
-48V L2MCS01
PBD 022001.01
CB 110.01, 400 amp

"A" load Secondary Distribution Bay (BDFBs or PDFs) and switch load "A" use red letters.
"B" loads Secondary Distribution Bay (BDFBs or PDFs) and switch load "B" use blue letters.
Non-diverse Secondary Distribution Bay (BDFBs and PDFs) (except Lucent 4ESS™) use black letters.

2. Equipment Frame (Single Load, Non-Diverse Plant)

(black letters on white)
POWER SOURCE
-48V BDFB 050500.01
BUS A FS A12, 60 amp

3. Equipment Frame, Two Loads on Diverse Plants

(red letters on white)

A LOAD
POWER SOURCE
-48V BDFB 040300.01
BUS A, FS A10, 60 amp

(blue letters on white)

B LOAD
POWER SOURCE
-48V BDFB 040100.03
BUS B, FS B10, 60 amp

4. Equipment Frame, Multiple Loads on Diverse Plants

(This example is for a DACS IV frame)

(red letters on white)

A LOAD

POWER SOURCE
Load A, -48V
BDFB 022111.01
BUS A, FS A1, 45 amp

Load B, -48V
BDFB 022111.01
BUS B, FS B1, 45 amp

Load E, -48V
BDFB 022001.01
BUS E, FS E1, 10 amp

(blue letters on white)

B LOAD

POWER SOURCE
Load C, -48V
BDFB 022001.01
BUS A, FS A1, 45 amp

Load D, -48V
BDFB 022001.01
BUS B, FS B1, 45 amp

5. Lucent 4ESS™ or Lucent 5ESS® Equipment Frame, "A" and "B" Loads based on Switch Diversity

(red letters on white)

A LOAD
POWER SOURCE
-48V PD 00
BUS C, FS C10, 30 Amp

(blue letters on white)

B LOAD
POWER SOURCE
-48V PD 00
BUS D,FS D10, 30 AMP

AC Power Labeling

Labeling and Stenciling Requirement for PDSCs

The supplier shall label all PDSCs per the following requirements.

The marking shall be on the front of the equipment bay at eye level or at some other conspicuous location to be approved by the OSWF.

Marking shall be done in a manner that is clear, legible, and readable from eye level by personnel standing in front of the equipment bay.

Marking shall be done using a Merlin®, Brother®, or equivalent labeling system.

Each AC distribution bay or panel shall be marked with a description of the panel and the loads it serves.

The following information shall be included.

- ◆ Name or number of PDSC (i.e., PDSC H5)
- ◆ Voltage (i.e., 480 Volts AC)
- ◆ Phase (i.e., 3-phase)
- ◆ Number of wires (i.e., 4 wires)
- ◆ Frequency (i.e., 60 Hz)
- ◆ Type service (i.e., essential, non-essential, or protected)
- ◆ Equipment Grounding System (i.e., isolated or integrated)
- ◆ Location of input protection device. This information may be obtained from OSWF. Use FIC code if available. If FIC is not available, use panel designation (i.e., MSB01). For AC Bus duct, use nearest building column to locate breaker (i.e., Bus A near Column H12) Designation and size of input fuse or breaker (i.e., CB 12 300 amps).

NOTE: In some cases the tape used may adhere poorly to some painted surfaces.

The use of a 'topcoat' of clear tape is recommended. Prior to attaching tape to the bay, the area shall be spot cleaned with a commercial degreaser.

Labeling and Stenciling Requirements for Equipment Bays

All telecommunications equipment bays requiring AC power (i.e., other than miscellaneous bay outlets) shall be marked with AC source information as follows:

- Type of AC service (i.e., PROTECTED or ESSENTIAL).
- Voltage, phase, and frequency (i.e., 120 V AC, 1 ph, 60 Hz).
- Name or number of PDSCs feeding bay (i.e., PDSC 02).
- AC source device and designation (i.e., CB2, 15 amp).