
AT&T Practices

DC Power and Grounding-Installation and Acceptance Checklists

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1. About This Document

1.1 Purpose

The purpose of this practice is to standardize power systems acceptance procedures throughout AT&T NCS (Network and Computing Services). This standard shall be used by NCS Power Engineering and the NCS On Site Work Force (OSWF) as a guide to accept equipment installed in the NCS network.

This practice does not contain admonishments.

1.2 Intended Audiences

This document provides AT&T NCS Engineering, OSWF and Installation Suppliers with NCS requirements for power installations.

1.3 Reason for Reissue

This document is reissued to improve the format of information and change the following items.

- Update information in checklists
- Update procedures and responsibilities
- Add references to AT&T practices and Power and Infrastructure Standards
- Add reference to AC design criteria and Building acceptance practices
- Add reference to 'Ask Yourself'
- Remove checklists for standby engines
- Update NSD to NCS
- Update Network Systems to Lucent Technologies.

1.4 Ordering Information

The order number for this document is 790-100-663, Issue 3. To order additional copies of this practice and any associated appendixes please contact:

AT&T Customer Information Center (CIC)
P.O. Box 19901
Indianapolis, IN 46219

Phone: 1-800-432-6600 or 1-317-352-0011

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1.5 How to Comment on This Document

To suggest changes to the information in this document or to notify the authors of errors in this manual, please submit a comment form. The comment form is located at the end of this document. If the comment form is missing, send your comments and recommendations to:

AT&T
NCS Power and Infrastructure Development
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1.6 Related Documentation

The following documents were used in the development of this practice:

- AT&T 154-103-101, "AT&T NCS Alarm Standards Manual", Issue 3, February 1995
- AT&T 154-001-000AC, "Network Power Management", Issue 3, July 1994
- AT&T 154-001-050, "Power and Infrastructure Standards Manual", Issue 1, September 1993
- AT&T 157-601-703, "Lead-Acid Battery—Trouble Conditions (With Color Photos)", Issue 1, January 6, 1983
- AT&T 790-100-655, "Batteries", Issue 3, March 1995
- AT&T 790-100-668, "Network Operations Group Power Systems Engineering Guidelines for AT&T Network Systems", Issue 4, January 1995
- AT&T 800-610-155, "Earthquake and Disaster Bracing for Central Office Equipment", Issue 10, June 1, 1983
- AT&T 802-001-180, "Protective Ground Systems—General Grounding Requirements for Communication Systems in Central Offices, Radio Stations and Other Structures", Issue 10, June 1, 1983
- AT&T 802-005-180, "Assembly and Installation of Power Plant Bus Bar and Wiring", Issue 13, January 1983

- AT&T 803-500-150, "Grounding Practices—Telecommunications Systems Grounding—New Buildings Housing Digital and/or Analog Telecommunications Equipment Requirements and Engineering Information", Issue 1, February 1993
- AT&T 803-500-410, "Grounding Practices—Isolated Ground Planes—Engineering and Application Information", Issue 1, June 9, 1989
- Installation Engineering Handbook 181, "NCS Power Systems Engineering and Installation Standards for AT&T Network Systems", Issue 1, May 8, 1995
- Installation Engineering Handbook 18, "Power Installations", June 5, 1995.

2. Process Overview

2.1 Development

This AT&T Practice is developed by the AT&T NCS Power and Infrastructure Development District to standardize DC power systems acceptance procedures throughout AT&T NCS. The following checklists are established for AT&T OSWF use. Lucent Technology (LT) Installation and alternative suppliers must adhere to these standards unless otherwise specified in individual power orders.

Power Systems Engineering Standards are managed by the AT&T NCS Power and Infrastructure Development District. Any revisions must be approved by the NCS Power and Infrastructure Development District Staff.

This standard is not intended to cover every aspect of acceptance. For items not identified, consult the appropriate AT&T Practices, Power and Infrastructure Standards and LT or NCS engineering and installation documents currently in use.

This document may be superseded by information found in AT&T 154-001-050, "Power and Infrastructure Standards Manual.

This document will be effective on the document issue date. Document issue date is defined as the last day of the month shown on the document cover sheet.

2.2 Superseded Instructions

This document supersedes Issue 2.

2.3 Standards Change Requests

Requests for changes to this document can be submitted to NCS Power and Infrastructure Development Documentation Group. Requested changes are reviewed annually. To facilitate quick response to engineering changes, these documents may be amended by a letter signed by the NCS Power District Manager of DC Power Engineering. AT&T practices, AT&T Power and Infrastructure Standards and letters signed by the NCS Power District Manager are the only recognized means of transmitting NCS DC power policy to AT&T suppliers.

2.4 Acceptance Overview

Acceptance is the process of analysis and verification to assure that all services and equipment contracted for have been provided and that the installation meets AT&T standards and requirements. For DC power, these services include the addition of equipment, removal of equipment, the modification of equipment, relocation of equipment or any combination of these work actions. Power equipment, in this practice, also includes the grounding, cable and racking necessary to provide power to equipment loads.

While the physical portion of the installation is critical, the records portion, both the financial and the engineering records, are equally important. Future work in an office is placed in jeopardy if the records differ from the installed equipment. Delays in providing service to our customers or over-investment in equipment will occur if records are incorrect. Installation suppliers are required to install equipment per the manufacturer's literature, AT&T practices and AT&T approved Handbook sections. LT Handbook Section 181 contains requirements for NCS work that differs from the standard set of LT Handbooks.

2.5 Acceptance Responsibilities

Timely and correct installation of equipment is crucial to the success of AT&T. Equally important is the protection of our employees and the protection of existing services on our network. The installation process requires that these sometimes conflicting goals be accommodated. While AT&T NCS and detail engineering groups strive to produce flawless specifications, problems may be encountered. The installer and the OSWF remain as the last quality check in this process. Failure to install or accept power equipment properly can be costly to AT&T. It is critical that the installer and OSWF work as a team to meet our common goal of flawless execution of service to our customers at a competitive cost.

The ultimate responsibility for the installation of power equipment and the proper accounting entries are the responsibility of the NCS DC Power and Alarms Engineering District. The responsibility of the physical acceptance of the equipment is delegated to the OSWF by DC Engineering. The OSWF is provided with accounting information to properly account for time spent on acceptance.

Final acceptance of the equipment signifies the following items:

- The supplier has provided the proper material
- The material has been installed in accordance with drawings and databases
- All drawings and databases have been updated to reflect changes
- The supplier has provided adequate proof of a quality installation

- Required testing has been completed and documented
- All accounting records have been processed
- Removed materials have been disposed of properly
- ALL equipment alarms have been properly verified (local and remote).

2.6 Acceptance Coverage

AT&T Engineering recognizes that for equipment to be added, removed or modified in the NCS Network, the OSWF must be intimately involved. To accommodate this accounting, monies are provided to cover OSWF time spent on acceptance work. Per corporate guidelines, that portion of the time required for this work should be capitalized with the equipment. Time spent in protecting the network as it exists must not be capitalized.

In today's competitive environment we must seek to maintain the highest level of service with the lowest cost possible. To this end, minute by minute surveillance of the installer is not necessary. General Method of Procedures (MOPs) and the Service Method of Procedure (SMOP) determine the specific times that the OSWF must provide coverage. Other times requiring coverage are less clear. While the installer is usually focused on the current order being worked, the OSWF must be aware of all orders being worked within the office, major events and trouble conditions. Part of this awareness is the importance of each order to AT&T's ability to serve it's customers. This is especially important when maintenance or removal projects interfere with projects required to position AT&T into new markets. Lost time to Installation suppliers is a loss to the bottom line of AT&T and every effort should be made to accommodate installation's efforts. A special emphasis must be placed on keeping commitments to Installation suppliers on scheduled coverage.

Another example of proper coverage would be joint acceptance tests. Most, if not all, power equipment can be joint tested. The OSWF shall participate and/or observe the tests performed by installation prior to turn over. As long as the tests conform to the AT&T practices requirements, these tests are sufficient for acceptance by NCS. Any additional testing over and beyond these tests and the checks within this practice are not part of acceptance and shall not be included in charges to the estimate unless approved by NCS DC Power Engineering.

2.7 Acceptance Quality

While there are many aspects of quality, the final determination of a quality power job is that the engineering is appropriate for the needs of the business, the equipment is installed as engineered, the installation causes no injury or disruption of service, and the cost is consistent with the value received. Workmanship of the

installer, the OSWF and Engineering must blend together to create quality results. The checklists in this document address many of these issues, but there will be issues not covered. Issues not resolved between the OSWF and installation suppliers shall be referred to the appropriate engineering department.

2.8 Performance Tests

A key part of the acceptance process is the initial testing of the equipment prior to turn over. These tests, dictated by manufacturers' literature and AT&T standards, shall be performed and the results of these tests documented. This documentation shall be turned over to the OSWF and shall be retained in the Power Operations Book. AT&T recognizes the need for joint acceptance tests. To avoid repetition of work, the OSWF shall observe and, where needed, assist the installer when such tests are made. The installer must provide written documentation to the OSWF detailing what tests were done, any readings that fall outside the expected range and any corrective action performed. This document will also provide the date and time of test and the name of tester and observer.

The purpose of these checklists is the "in progress" and final verification of power installations. These checklists are to be used by the OSWF, Power Technical Support Group, and DC Power Engineering to establish quality gates for power installations and are designed as a tool to enable the OSWF to verify installation of a power plant as the work is done. The ultimate goal is to reduce re-work and provide defect free engineering, installation and acceptance of power systems to the NCS network.

This document is not intended to dictate any order of installation activity or to establish new installation standards but rather makes reference to existing standards for engineering, installation and acceptance of NCS DC power.

The NCS Power Engineers and the OSWF will have the largest responsibilities in power acceptance. NCS Power Engineers will be required to document the issues found early in the projects and champion any issues not resolved during installation. The OSWF will be required to follow closely the installation activities, document any defects and, using the check lists, seek to identify any process gaps or inconsistency in the power provisioning process. This section also requires cooperation between the OSWF and installation suppliers. In order to guard against the possibilities of missed service dates, any unresolved problems in this area will require immediate escalation and resolution through the normal processes. This document sets forth the minimum requirements for acceptance testing. Additional procedures and checks may be required by the NCS Engineer or the DC Power Element Manager.

2.9 Checklists

The Checklists within this document are to be used to track the acceptance process. These checklists are time sensitive and correspond to five milestones within the acceptance process. The checklists correspond to the pre-engineering, pre-installation start, in-progress installation, pre-acceptance and final acceptance phases of an installation. Once the final acceptance of the work has been completed, the completed checklists shall be filed in the OSWF job file.

The checklist blocks are defined as follows:

- [Y] This item has been completed
- [N] This item does not meet requirements
- [NA] This item does not apply to this order.

Many items in the checklist may not have been completed by Installation prior to an inspection, these items should be left open until the next checklist is done and verified at that time. These items will not be defects, as defined by this document, unless not completed when the 'Pre-Acceptance' checklist is completed.

3. Pre-Engineering Checklists

A proper assessment of local site conditions and an understanding of the equipment being installed contribute to a trouble free installation. The DC Power Engineer must be able to document and plan for any special condition within the facility. The identification of possible road blocks, the creation of an issues checklist, the assignment of responsibility for each issue, the establishment of a time table for additional checkpoints, and a sanity check of the preliminary plan are important goals of this checklist.

3.1 Information Sources

For major power rearrangements or additions at critical offices, the NCS Power Engineer shall utilize the expertise of the following individuals or groups as required:

- NCS Power Planning
- NCS Power Implementation
- NCS Central Office Planning
- NCS Building Engineer
- NCS Power Technical Support Group (PTSG)
- NCS On Site Work Force (OSWF)
- NCS OSWF District Power Representative
- Supplier's Local Installation Work Force
- Supplier's Detail Cabling Engineer
- Supplier's Detail Power Engineer

3.2 Documentation Issues

Documentation required to properly plan the power work will include, but is not limited to:

- Site Specific Power plan
- Preliminary Floor plan
- Existing Office T drawings and/or INFOBANK reports
- A list and summary of all power work in progress or due to start in the office
- Equipment diversity and drain requirements

- Project Letter
- AC Power Electrical Distribution Drawings.

The following sections contain lists of issues that should be addressed before orders are placed. Any issue that will require action must be documented as an item on an "Issues List". This list is to be distributed to all affected participants and each item shall be assigned to a person for resolution. The list shall also provide tentative completion dates for each item.

The decision to visit an office shall be based on the scope of the work required and the quality of the office records. Installation of power plants in new areas of a building and or major DC transition work would require an on site visit by the DC engineer and/or Supplier's Detail Engineer. The addition of a single rectifier or a like for like battery replacement do not generally require an on site visit.

3.3 Floor Space Issues

- [Y] [N] [NA] Is the floor space available per the preliminary floor plan? If not, what means will be used to coordinate the removal of existing equipment and the addition of the new equipment? Will the floor space be available by the order start date?
- [Y] [N] [NA] Is there adequate floor space for the initial installation and for future growth?
- [Y] [N] [NA] Are the building environmentals adequate for the equipment and operating personnel (air handling, heating)?
- [Y] [N] [NA] Are 'stumble lights ' provided for emergency egress? Verify that sufficient DC Emergency lighting has been provided for egress from power areas during 'AC Off' conditions. (AT&T 790-400-400)
- [Y] [N] [NA] Are there local building safety or environmental codes that will require special operations, documentation or construction?
- [Y] [N] [NA] Is there sufficient ceiling height?
- [Y] [N] [NA] Is the ceiling height excessive, so as to present a cabling or racking problem?
- [Y] [N] [NA] Can the cable racking be supported from the ceiling?
- [Y] [N] [NA] Will the raised floor, if required, be below grade?
- [Y] [N] [NA] Will water detectors be required under the raised floor?

- [Y] [N] [NA] Will any part of the raised floor or area above a false ceiling be used as a plenum? If the space is used as a plenum, how will cabling be protected?
- [Y] [N] [NA] Is the floor space within moderate distance (100-200 ft.) to the area that will be served by the power equipment?
- [Y] [N] [NA] Is the floor loading adequate for the equipment?
- [Y] [N] [NA] Will three tier battery stands be required due to space requirements or earthquake bracing requirements?
- [Y] [N] [NA] How will this installation affect future plans for this building?
- [Y] [N] [NA] Are there building structures or equipment that will interfere with the installation?
- Areas of build up around columns
 - Fluid (water, natural gas etc.) pipes within the area
 - Air Plenums crossing the area
 - Rough or un-even floors
 - Lighting fixtures at rack heights
 - AC or DC Bus ducts in the area
 - PDSCs, Smoke alarms, Alarm or Control panels
 - Will 'stand pipes' be required for fire protection
 - If stand pipes are required, can they be maintained 'dry'
 - Does the area have asbestos removal or other environmental issues?
- [Y] [N] [NA] Is there ample room for all equipment doors to open and is there sufficient clearance from new equipment to existing equipment? Doors on AC cabinets shall have sufficient room to be opened fully and three foot working space provided at access panels. (National Electric Code 110-16)

3.4 AC Power Issues

- [Y] [N] [NA] Will AC lighting need to be installed at ceiling level? If lighting exists in the area, is it on the Essential AC bus and is it sufficient to allow installation to start?
- [Y] [N] [NA] Is there adequate AC power available for the power equipment without major AC additions?

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- [Y] [N] [NA] Can the AC power for DC power plants be obtained from two separate sources?
- [Y] [N] [NA] What AC power will be provided? (208VAC or 480VAC)
- [Y] [N] [NA] What will the AC Fault Current be at the input to each PDSC? What AIC rating will be required for the PDSC and the breaker installed?

3.5 Cabling Issues

- [Y] [N] [NA] Are cable paths available and easily identified?
- [Y] [N] [NA] Are there 'Choke' points in cable paths?
- [Y] [N] [NA] Will building problems create long cable runs?
- [Y] [N] [NA] Cable runs over 310 feet are to be avoided if at all possible due to escalating cabling costs.
- [Y] [N] [NA] Is there space for separate red and blue cable paths?
- [Y] [N] [NA] Will cable routes allow for maximum growth on racks?
- [Y] [N] [NA] Do the cable paths pass through administration areas or areas belonging to other Companies?
- [Y] [N] [NA] Do the cable paths cross areas above false ceilings or under raised floors that could be considered plenums.

3.6 Installation Issues

- [Y] [N] [NA] Is there space available to store, unpack and assemble equipment?
- [Y] [N] [NA] Is there adequate aisle space to provide access to the new area for moving equipment into the new area?
- [Y] [N] [NA] If equipment area is not on the ground floor, is there a way to either raise or lower equipment to the equipment area?
- [Y] [N] [NA] What orders or activities in the building are in progress or will start prior to the start of this work. Will co-ordination of orders be required.

- [Y] [N] [NA] Request that the LT Installation Manager verify and correct, as necessary, the 'Building Factor for Installation' for the location.
- [Y] [N] [NA] What special protection requirements will be required to protect working equipment.
- [Y] [N] [NA] Will there be special requirements to provide temporary enclosures (barriers) to prevent dust infiltration or noise abatement?
- [Y] [N] [NA] Are there local electrical or building codes that require additional work or that the work be done in a manner different from AT&T standards?

3.7 Grounding Issues

- [Y] [N] [NA] Is there a C.O. ground system in the office?
- [Y] [N] [NA] Does the building have vertical C.O. ground risers?
- [Y] [N] [NA] Will all equipment bays be within 100 ft. of C.O. ground riser and within 200 ft. actual cable run?
- [Y] [N] [NA] If two or more vertical risers exist, are there horizontal equalizers on every third floor?
- [Y] [N] [NA] Is there an Isolated ground system in the area?
- [Y] [N] [NA] Will an 'Isolated Ground' be required?

3.8 Alarm Issues

- [Y] [N] [NA] Does the office have a local and a remote alarm system and is there sufficient capacity to accommodate new equipment alarms?
- [Y] [N] [NA] If alarm equipment is to be added, who will place the order and co-ordinate the orders?
- [Y] [N] [NA] What type of local and remote alarm system is in the office and will it be replaced prior to completion of this work?

3.9 OSWF Issues

- [Y] [N] [NA] Is there adequate emergency communications available in the power area?
- [Y] [N] [NA] Building Engineering must provide a preliminary "Building Occupancy Date" (BOD) for scheduling purposes.
- [Y] [N] [NA] Have all issues been identified, documented and assigned to appropriate owners? An issues list must be prepared for review on 'Pre-Installation Start' checklist.
- [Y] [N] [NA] Will training be required for the OSWF in order to accept, operate or maintain the equipment?
- [Y] [N] [NA] Will the OSWF or Installation need training and/or IDs on a new Database system.
- [Y] [N] [NA] Review the steps in the "Ask Yourself" checklist.
- [Y] [N] [NA] What type of equipment is being installed or relocated?
- [Y] [N] [NA] Have all security issues been addressed?
- [Y] [N] [NA] Have all the OSWF requests or issues been addressed?
- [Y] [N] [NA] Has the OSWF had input into placement of equipment?

4. OSWF Job File

4.1 General

Communication between the OSWF and Engineering is critical to the success of any installation activity. Information capture and maintenance of records help to ensure that proper engineering occurs. The OSWF adds validity to engineering decisions by providing data as to actual conditions within the offices.

The Job File serves as a tracking method and information source on installation activities within the office. On major orders the NCS Power Engineer shall consult with the OSWF prior to the issuance of orders. This affords the OSWF with the opportunity to provide additional information concerning office conditions. This communication may take the form of an office visit, conference call or written correspondence.

The job file shall be started by the OSWF at the first communication of planned installation activity. This "Installation and Acceptance Job File" shall contain all references to the work to be done and activities log. The file should be retained on the job site as long as the equipment is active. Subsequent work on the same plant shall be included or referenced within the file. The following checklist shall serve as a guide to what should be included in the Job File. Other Information may be added at the discretion of the OSWF.

4.2 Job File Checklist

- | | |
|--------------|---|
| [Y] [N] [NA] | Records and documentation of methods used to notify and communicate to the OSWF that power activity is being planned. |
| [Y] [N] [NA] | Records of Pre-Installation meetings, conference calls or communication. |
| [Y] [N] [NA] | An Issues List developed from issues identified at any stage of the installation. The list shall include dates, proposed resolutions, issue resolution, responsibility assignment, and final disposition of all issues. |
| [Y] [N] [NA] | A copy of the order issued by NCS Engineering and any supplements to the order. |
| [Y] [N] [NA] | A copy of any related order or any order that will require coordination with the order to be worked. |

- [Y] [N] [NA] The time reporting information required to track the time used to accept the installation. Documentation of the hours allowed by engineering for Installation and Acceptance.
- [Y] [N] [NA] Documentation of the accounts to be used for Installation and Acceptance time.
- [Y] [N] [NA] A log to track time required for Installation and Acceptance of this order.
- [Y] [N] [NA] An acceptance time log or WMS record for recording hour incurred and charged to the installation order.
- [Y] [N] [NA] A copy of current emergency contact list.
- [Y] [N] [NA] An Installation and Acceptance Contact list contains, but is not limited to:
- NCS OSWF
 - NCS Power Implementation
 - NCS Power Planning
 - NCS Order Management
 - NCS Central Office Planning Engineer
 - NCS Building Engineer
 - NCS PTSG
 - NCS OSWF District Power Process Leader
 - Installation suppliers Supervisor
 - Installation suppliers Manager
 - Detail Power Engineer
 - Detail cabling Engineer
 - Electrical Design Consultants
 - Heating/Ventilating/Air Conditioning (HVAC) Design Consultant
 - Electrical, Mechanical, HVAC or other contractor
 - Local Exchange Company or any directly affected customer.
- [Y] [N] [NA] Lists and locations of all AT&T Practices, LT Handbook Sections, Product manuals, Manufacturers Operation Instructions, wiring lists, office 'T' drawings, standard drawings (T, CD, H, SD, and ED) related to this order.

- [Y] [N] [NA] Lists of materials, test equipment, and tools that will be required for this order.
- [Y] [N] [NA] A copy of each specific 'Installation and Acceptance Quality Checklist' for each component of equipment to be installed.
- [Y] [N] [NA] A copy of the 'Detailed Specification' and/or suppliers bid package.
- [Y] [N] [NA] Records of the detailed Specification/Bid package review.
- [Y] [N] [NA] A copy of the 'General Method of Procedures (MOP)' developed in partnership with Installation suppliers.
- [Y] [N] [NA] A copy of the 'Service Method of Procedure (SMOP)' and 'Detailed Method of Procedures (MOP)' to be used in the various work activities.
- [Y] [N] [NA] A copy of Network Events associated with the installation work.
- [Y] [N] [NA] A copy of all equipment and alarm test results related to the order.
- [Y] [N] [NA] A copy of all job drawings, ADPs, Product Manuals, Operating Instructions, etc. or an explanation of where they are.
- [Y] [N] [NA] A record of exceptions to joint testing requirement.
- [Y] [N] [NA] A copy of any pertinent 'Change Notice (CN)' or service bulletin for the equipment being installed.
- [Y] [N] [NA] A copy of the final 'Job Completion Report'.

5. Pre-Installation Checklist

5.1 General

The "Pre-Installation checklist" is used prior to the start date of the installation and after the detail specifications and drawings have been issued. The key participants will be the OSWF and the supplier's Installation representatives. Depending on the size of the order and the number of issues identified at the pre-engineering stage, members of the pre-engineering team may also be required to participate. The OSWF representatives should be the persons that will do the physical checks required throughout the process and do the final acceptance on the order. The supplier's Installation representation should include, but is not limited to, the lead installer for the order.

This conference date will be established by the OSWF and supplier's Installation representatives. Every effort must be made by all parties to avoid any delay of the order or special scheduling of personnel. This conference can be an on site meeting or a conference call.

5.2 Pre-Installation Checklist

Review the Issues List developed during the Engineering Planning meeting. If that meeting was not held or there is not an issues list, then the items in section three must be reviewed by the OSWF at this time. Refer all engineering concerns to the appropriate NCS engineer for resolution.

- [Y] [N] [NA] Have all items identified on the issues list, developed in the Pre-Engineering planning process, been addressed?
- [Y] [N] [NA] Will those items not completed delay the start or completion of the work?
- [Y] [N] [NA] The OSWF shall document items not cleared using WMS tickets and refer to responsible engineering department.
- [Y] [N] [NA] All previously identified, but unanswered items shall be escalated to the level above the original issue owner.
- [Y] [N] [NA] A decision must be made at this time either to continue the order and expect the unresolved issues to be resolved or request that the order be extended. There may be those situations that would require the NCS Power Engineer to place the order on hold and in some cases the order may be canceled.

- [Y] [N] [NA] The team shall compare the detail specification and drawings to the initial Telephone Equipment Order (TEO) and input data used in the pre-engineering process. Any differences should be addressed as to any affect on the purpose of the order and office conditions.
- [Y] [N] [NA] The supplier's Installation representatives shall verify that all equipment on the order has shipped or that material not shipped but promised will not delay the order if received by the promised date. The installation supplier shall follow up on non shipment or late shipment of material and keep NCS order management apprised of the order status.
- [Y] [N] [NA] A physical survey of the equipment area will be required to determine if additional problems have surfaced since the Pre-Engineering process.
- [Y] [N] [NA] The OSWF shall verify that they have possession of the practices or standards required to properly do acceptance, equipment documentation and maintenance.
- [Y] [N] [NA] The OSWF shall verify that they have the proper accounting codes to charge the OWSF's installation and acceptance time.
- [Y] [N] [NA] Once the order has started, the OSWF and the Installation team shall set tentative dates for an 'Inspection and Verification Prior to Cabling' conference and a 'Pre-Acceptance ' conference.
- [Y] [N] [NA] A tentative MOP, SMOP and Network Events schedule shall be created. This schedule would identify the requirements for MOPs or SMOPs and adhere to requirements found in AT&T 154-001-000AC. Included in the schedule will be dates the work is to be done and the dates the MOPs or SMOPs are to be completed. Details, concerning the time of day work activities will be allowed, must be part of this scheduling process. To be effective, both the OSWF and the Installation team must have a clear understanding of what the order does and what services could be affected by the order.
- [Y] [N] [NA] The OSWF must review the work and determine if changes to the "Office Restoration Plan" or the "Emergency Contact List" are required.
- [Y] [N] [NA] The OSWF must determine if the following will be impacted by the installation and if changes in local procedures will be required:
- DC Power Plants

- AC Stand by Engines
 - Inverter Plants
 - UPS Plants
 - Converter Plants.
- [Y] [N] [NA] The OSWF must determine if proper test equipment is available for the installation, acceptance and maintenance of any new equipment added on this order.
- [Y] [N] [NA] Will the OSWF be required to enter into maintenance contracts with outside suppliers after the installation of this order? If so, with what companies and at what cost?
- [Y] [N] [NA] Are all parties aware and in agreement concerning:
- Safety requirements
 - Environmental requirements
 - Fire Protection requirements
 - House Keeping requirements
 - Restricted areas and passageways
 - Turn down (Lockout/Tagout) procedures
 - Personnel qualifications
 - Provision of permits and Licenses.
- [Y] [N] [NA] Are all parties in agreement that cable openings between floors and through fire walls will be closed and fire stopped? These cable holes shall be closed if cable work will not be resumed within eight hours. Temporary closure of cable openings is authorized so long as the temporary closure provides a minimum of a one (1) hour fire barrier and work is to be resumed within 96 hours. (AT&T 770-350-100)
- [Y] [N] [NA] Has the OSWF established a local job file per section four of this practice and local instructions for information on this order?
- [Y] [N] [NA] Have all drawings (office T and INFOBANK reports) for the order been received and are they the latest issue? Is there agreement as to how drawings are to be corrected and how corrected drawings are to be received by the OSWF?
- [Y] [N] [NA] Does the new equipment have current "AT&T Corporate Routines" or manufacturer routines established? If not, contact the PTSG to initiate the process to develop these routines.

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- [Y] [N] [NA] Have all parties agreed to perform a “walk through” process if any one of the parties request a walk through? Walk through’s are required at the beginning of each shift.
- [Y] [N] [NA] Do all parties agree to do joint acceptance of all equipment and to eliminate redundant testing?
- [Y] [N] [NA] Do all parties agree on procedures for resolution of defects, exceptions and the completion of the order?
- [Y] [N] [NA] Review the steps in the “Ask Yourself” checklist.

The OSWF shall document all unresolved items identified on this checklist and, using WMS or other electronic means, refer items to the appropriate team member for resolution.

As the installation proceeds, the OSWF person is to use the checklists in section 6, 7 and the appendixes as in-progress checklists for the order. These lists may not exactly reflect the order of installation. All items found not to be within compliance shall be documented. Those items not corrected within 72 hours shall be documented using a WMS trouble ticket and referred to the responsible party.

6. Installation In-Progress Checklist

6.1 General

Once the power bays have been bolted to the floor, the batteries have been placed on the stands and the cable racks installed, the "Installation In-Progress" checklist shall be completed. This inspection may be scheduled by the OSWF based on input from the supplier's installation forces concerning the progression of the work. Based on anticipated problems, other team members may be required to participate.

Items checked at this time will include:

- [Y] [N] [NA] Any problems with the layout or cabling.
- [Y] [N] [NA] Has the equipment (bays, cable rack etc.) been installed per the drawings? If not, have the differences been addressed to proper engineering contact for drawing corrections?
- [Y] [N] [NA] Will the changes, if any, cause problems in the cabling of the circuits?
- [Y] [N] [NA] Will additional material be required to compensate for the changes?
- [Y] [N] [NA] If additional material is required, has the material been ordered?
- [Y] [N] [NA] The check lists prior to this section should have been completed and shall be verified at this meeting.
- [Y] [N] [NA] All items not in compliance have been documented using the check lists in this practice and in WMS.

6.2 Installation Checklist

- [Y] [N] [NA] Inspect equipment for physical damage prior to installation.
- [Y] [N] [NA] Verify that equipment is being installed per specification and drawings.
- [Y] [N] [NA] Do bay numbers agree with floor plan and INFOBANK records?
- [Y] [N] [NA] Are all cable racks shown on drawings?

- [Y] [N] [NA] Are diverse cable racks marked for diversity paths both on drawings and, if required, physically on racks?
- [Y] [N] [NA] Verify that all bays are installed with at least two floor anchors per bay of equipment. Locations in Earthquake Zones two or higher may require more anchors. (AT&T 790-100-668 and AT&T 800-610-155)
- [Y] [N] [NA] Verify that the physical arrangement allows room for all equipment doors to open fully and that there is sufficient clearance from new equipment to existing equipment for maintenance purposes.
- [Y] [N] [NA] Verify that all doors on AC cabinets have sufficient room to be opened fully and allow three foot working space provided at access panels. (National Electric Code 110-16)
- [Y] [N] [NA] Verify that all electrical connections are tight, properly torqued and made in a manner that does not present a safety or service hazard. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that there is sufficient equipment lighting above or in the power plant area to allow maintenance of the equipment and that these lights are on the Essential AC bus. (AT&T 790-400-400)
- [Y] [N] [NA] Verify that equipment is properly braced for appropriate earthquake zone per AT&T standards. (AT&T 800-610-155)
- [Y] [N] [NA] Verify that the correct type and capacity fuses have been provided (including spares), and that they are clean, properly marked and properly installed.
- [Y] [N] [NA] Verify that adequate insulating protection has been provided on cable rack straps, stringers, threaded rods, auxiliary framing, and other metallic objects where power cable makes contact with sharp surfaces. (AT&T 802-005-180)
- [Y] [N] [NA] Verify that all power cables, that have been run, are free of insulation damage. If not, has adequate protective actions been taken? (AT&T 802-005-180)
- [Y] [N] [NA] Verify that the detail specification, equipment installed and PQRS agree.
- [Y] [N] [NA] Document and refer to Installation suppliers any workmanship related issues.

6.3 Power Control and Distribution Checklist

- [Y] [N] [NA] Verify that all equipment of the control bay is correctly marked and identified per drawings and/or specifications.
- [Y] [N] [NA] Verify that all control circuit fuses/circuit breakers are correct and are located as shown on the equipment and office drawings.
- [Y] [N] [NA] Verify that all control features called for in the office drawings and TEO have been provided (e.g. remote access, efficiency algorithm, shunt monitors).
- [Y] [N] [NA] Verify that required spare controller circuit packs have been provided for each feature provided. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that all control bays and/or frameworks are properly bonded to the frame grounding system. (AT&T 802-001-180)
- [Y] [N] [NA] Verify that all bus bars, joints, and terminating connections to bus bars are correctly torqued. (AT&T 802-005-180)

6.4 PDSC and Rectifiers Checklist

- [Y] [N] [NA] Verify that rectifiers are properly assembled per the rectifier 'J' drawing and local office 'T' drawing. L2000 four hundred amp rectifiers shall have both side panels and rear panel installed on all rectifiers. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that the conduit from the AC pull box to the PDSCs has been installed per AT&T standards. If flexible conduit is used, has it been properly supported? (AT&T 790-100-668)
- [Y] [N] [NA] If the PDSC feeds L2000 400 Amp rectifiers operated at 208V AC each rectifier uses a 100 amp breaker. If the KS 22088 floor mounted PDSC is specified, this PDSC requires that each 100 amp breaker be separated by three filler panels for ventilation purposes. (Power Data sheet KS 22088)
- [Y] [N] [NA] Verify that rectifiers and PDSCs have been marked in accordance with engineering standard and instructions in the TEO (AT&T 790-100-668)

- [Y] [N] [NA] A supplier installing a PDSC must mark, clearly and legibly:
- the PDSC's FIC
 - the input voltage
 - the phases
 - the number of wires
 - the frequency
 - the type of service
 - the type grounding
 - the location of the PDSC's input device
 - the capacity and designation of the PDSC's input device.
(AT&T 790-100-668)



NOTE:

Three types of service are defined for this marking; they are:

Non-Essential - - - - Fed from Commercial AC only.

**Essential - - - - - Fed from Commercial but 'backed-up'
by a Standby Engine.**

**Protected- - - - - Fed from a UPS or Inverter 'backed-up'
by Essential AC and Battery Plant.**

- [Y] [N] [NA] The OSWF is required to insure that PDSCs are marked with input breaker size, location and identification. (AT&T 790-100-668)
- [Y] [N] [NA] Rectifiers must be marked with FIC code and G number. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that AC power connections are made in accordance with engineering instructions (e.g. proper transformer taps, wire sizes). (AT&T 790-100-668)
- [Y] [N] [NA] On plants with two PDSCs, a PDSC should only feed those rectifiers in the same line as that PDSC. (AT&T 790-100-668)
- [Y] [N] [NA] Three Phase Power Plant Floor Mounted PDSCs dedicated to DC Power Plants shall not be used to power single phase office equipment. (AT&T 790-100-668)

- [Y] [N] [NA] Each L2000 PDSC shall have its own pull box and conduit run back to the AC Switch Board. (AC PWR—003)
- [Y] [N] [NA] The 415A power plant J spec PDSC will have two separate pull boxes and conduit run back to the AC Switch Board.
- [Y] [N] [NA] DCO power plants shall have two PDSCs. A and B (24V and 48V) 4ESS power plants shall have a single PDSC per plant. (AT&T 790-100-668 and DC PWR—001)
- [Y] [N] [NA] Verify that required spare rectifier circuit packs have been provided. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that rectifier and PDSC bays and/or framework have been properly bonded to the Central Office (CO) grounding system. (AT&T 802-001-180)
- [Y] [N] [NA] Verify that Rectifier Control cables are run on a separate rack or on stand-offs. Do not run control cables within the same rack with rectifier's DC output cables. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that the fault current rating (AIC) for PDSCs and breakers in single floor buildings is 25K or greater. Multi-floor buildings shall have PDSCs and breakers with a fault current rating of 40K or greater. These ratings shall be at the PDSC operating voltage. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that all breakers installed to feed rectifiers are equipped with individual 'Lockout' device. All AC protection devices shall have a lockout device. (AT&T 790-100-668)

6.5 Battery Stands and Batteries Checklist

- [Y] [N] [NA] Verify that cable rack distance between bus bar assembly (usually mounted on 'A' stand) and Controller Bay is equal to or less than the cable length shown in office drawing from "A" battery stand to Control bay and/or Return bar. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that all cables associated with the battery stand (i.e., inter-cell, inter-row and from battery to bus bars) are sized and properly terminated per the office drawings and engineering instructions. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that the battery plant bus bar is installed in accordance with load requirements and office drawings.

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- [Y] [N] [NA] Verify that new battery straps, bolting material, new spark arresting vents and plastic covers for vents have been provided for new or relocated reused cells. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that four battery straps (two straps per post) are provided between all KS 20472 L-1S cells on all battery strings. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that all battery strap bolts are properly tested, the tests are documented, and that 'no oxide' has been applied to the connections. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that all L508 or L-1S battery strings have four 4/0 AWG cables in the following locations (AT&T 790-100-668, T82603-31 FIG.H3,H4):
- From bus bar to negative end of battery string
 - From bus bar to positive end of battery string
 - For all inter-tier and inter-row connections requiring flexible connections.
- [Y] [N] [NA] Verify that GU-41 battery cells use a minimum of three 350 kcmil or four 4/0 cables for inter-cell, inter-row and connection to bus bars above the battery stand (AT&T 790-100-668).
- [Y] [N] [NA] Verify that cabling to supplemental battery stands meet the following requirements:
- Cables larger than 4/0 (0000) are not to be terminated directly on battery cells. If cables other than 4/0 (0000) are used for connection to a supplemental battery stand, supplemental bars must be provided on that stand.
 - Installed cable rack distances must be equal to or less than the distances shown for cable in INFOBANK or cable running list.
 - Battery stands with cable rack distances over 40 feet from the initial battery stand (usually the "A" stand) must use supplemental bars and calculated cables to the initial battery stand.

⇒ NOTE:

If required, appendix A may be used to calculate cable size required. For the purposes of this calculation, the normal discharge amperage available in the circuit will be:

- Each KS 20472 L-1S battery string = 320 amps

- Each GU-41 Battery string = 740 amps.

⇒ NOTE:

Contact Power Engineer if other type battery cells or bus bars are used on the power plant. The voltage drop is documented in table A on the Wiring List and Block Schematic office drawing (TXXXX-065X or Infobank TXXXX-XXX-99).

- [Y] [N] [NA] Verify on L2000 plants that the cables from cell 1 on the battery strings are terminated on charge ground section and not discharge section of bus bar assembly above initial stand.(SEE POWER FLASH PWR005-01/92 AND T82603-31 FIG.H2, H5)
- [Y] [N] [NA] Verify that in those areas requiring earthquake bracing, that bracing was provided for battery stands per AT&T standards. (AT&T 790-100-668 and AT&T 800-610-155)
- [Y] [N] [NA] If battery stand is to be earthquake braced for zone 2 (above first floor), 3, or 4, verify that KS20780 L-1 locks are provided and installed for each cell. (J85504A-1 note 61)
- [Y] [N] [NA] Does the specification provide three tier battery stands? Three tier stands should be limited to those locations with severe space problems or for certain earthquake bracing conditions. Three tier stands used for earthquake bracing purposes shall not have battery cells installed on the third tier. Contact NCS Power Engineer with questions on this issue. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that batteries and battery stands are clearly and properly marked or identified in accordance with engineering instructions and Supplier Installation handbooks. This applies to items such as voltage, string designation, individual cell number, and "pilot" cell. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that batteries and connectors are free of the following defects (AT&T 157-601-703 and AT&T 790-100-655):
 - Cracking
 - Needle Growth
 - Cover Rise
 - Lead Sulfate Crystals
 - Crazing
 - Shipping plugs not removed
 - Bulging
 - Explosion-proof vents missing

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- Post Rise
 - Explosion-proof vents damaged
 - Positive Plate Growth
 - Strap Growth
 - Plate Bowing
 - Loose connections
- [Y] [N] [NA] Verify that electrolyte level indicators are properly marked on cells and that the electrolyte is within level indicators. (Handbook 18)
- [Y] [N] [NA] Verify that the battery cells are oriented so that electrolyte level indicators are readily seen.(Handbook 18)
- [Y] [N] [NA] Verify that all required battery records (manufacturer, date of manufacture and initial charge) are available for all cells. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that neutralizing agents and protective equipment have been provided. (AT&T 790-100-668)
- The supplier shall provide and mount thermometers, hydrometers, and hydrometer holders.
 - The supplier shall provide a plastic drip cup to replace the glass drip cup that is shipped with the hydrometer holder. (AT&T 790-100-668)
 - The OSWF shall provide gloves, eye wash bottles, apron, goggles, eye shields and neutralizing agent at turnover of battery. Materials required prior to turnover i.e neutralizing agents or safety materials are the responsibility of the supplier. (AT&T 154-001-000AC)
- [Y] [N] [NA] Verify that metal battery stands have been properly bonded to the CO grounding system and properly anchored to the floor. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that there is continuity between all metal sections of a metal battery stand. (AT&T 790-100-668)

6.6 Grounding Checklist

- [Y] [N] [NA] Verify that all DC power plants have a connection to Central Office (CO) ground for reference of plant. (AT&T 803-500-150)

- On existing power plants, CO Ground Connection is made either to the External Return Bar located above the Controller Bay or to a Ground Window assembly mounted at the entrance to an area designated as being on isolated ground. There should be only one connection from the CO ground to plant return ground bars
- Power plants engineered after January of 1995 and having bus bar assemblies above the battery stands shall have the grounding conductor connection made at the discharge return bar located above the battery stand (AT&T 790-100-668)
- The connection to CO ground shall be made using green wire. This wire shall be run separately from other leads
- See AT&T 790-100-668; AT&T 803-500-410 Par. 5.04, 6.01; AT&T 802-001-180 Par.4.16 and T82603-31 FIG. H1, H2, H5 for additional references.

- [Y] [N] [NA] Verify that all equipment cabinets, bays or frames have a connection to the 'Frame Ground System'. All frame ground connections should be clean and free of paint in contact area. (AT&T 803-200-150)
- [Y] [N] [NA] Two hole, circumferential, crimp type lugs are to be used for all ground connections unless otherwise specified by the equipment manufacturer. (AT&T 803-200-150)
- [Y] [N] [NA] Verify that the Office Principle Ground Point (OPGP) meets the following standards:
- The OPGP is made of copper (either a bar or water pipe).
 - If the OPGP is a copper bar and used as a Central Office Ground Bar (COGB), then it should be mounted on insulators.
 - All connections on the OPGP are tight and free from corrosion.
 - All conductors terminated on the OPGP are equipped with location tags at both ends.
 - Connections on the OPGP are equipped with "Do Not Disconnect" tags. (Exception: Exothermically welded and brazed connections) (AT&T 803-200-100 Par. 2.17; AT&T 790-100-668 Par. 3.51)
 - Stranded conductors are connected to the OPGP with two-hole compression lugs or exothermic welds.
 - Solid conductors are connected to the OPGP with two-hole exothermic lugs or exothermic welds.

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- Ground conductors run to the OPGP in metallic conduit are bonded to the conduit at both ends with at least a No.6 AWG cable.
- Ground conductors run to the OPGP are not completely encircled by metallic supports or fittings. (AT&T 803-200-100)

[Y] [N] [NA] The following, if required, must be properly bonded to the OPGP. (AT&T 803-200-100)

- Interior Ring Ground
- Exterior Ring Ground
- Service Entrance Ground
- Cable Entrance Ground Bar(s) (CEGB)
- Central Office Ground Bar(s) (COGB)
- Central Office Water Pipe (COWP)
- Battery Plant Discharge Ground or Return (RTN) Bar

[Y] [N] [NA] Verify that all connections to ground systems are made with two hole compression lugs or thermo-weld process. Screw type, mechanical connectors are not allowed on any ground connection. (AT&T 803-200-100)

[Y] [N] [NA] Connections to a Cable Entrance Ground Point (CEGP) and a Central Office Ground Bar (COGB) must meet same requirements as an OPGP. (AT&T 803-200-100)

[Y] [N] [NA] Verify that all lightguide cables, including LEC's, are equipped with 2400LG grounding enclosures (or equivalent). These enclosures must be properly bonded to the CEGB.

⇒ NOTE:

Bonds between the grounding enclosure and the CEGB should be made as close as possible to the point of cable entrance. (AT&T 803-200-100)

[Y] [N] [NA] Verify that all equipment connected to the COGB is within 100 feet of the bar and less than 200 ft. cable length. (AT&T 803-200-150)

[Y] [N] [NA] If the COGB is connected to a vertical riser, verify that the 750 kcmil cable that is run to riser is less than 20 feet long. (AT&T 802-001-192)

[Y] [N] [NA] If office requires an external ring ground, refer to appendix B for additional grounding items.

[Y] [N] [NA] If office is using a 'Ground window', refer to appendix C for additional grounding items.

6.7 Diversity Checklist

[Y] [N] [NA] Verify that red and blue distribution from diverse plants to BDFBs or PDFs are run on dedicated racks from the power board and the equipment area. The racks shall only carry one color (either blue or red), but blue and red racks may be run side by side or above one another. Ground, alarm or control cables may be run on stand-offs but not within the rack itself. (AT&T 790-100-668, DC PWR—001)

[Y] [N] [NA] Verify that on orders with diversity paths (such as CCS7), that the paths are followed exactly. In some cases physical protection, a raceway or protective covering, will be required. (AT&T 790-100-668, DC PWR—001)

[Y] [N] [NA] Are the 'A' and 'B' BDFBs separated from each other by a minimum of six feet and twenty feet where possible? Any deviation requires concurrence of the detail engineer and correction of drawings. (AT&T 790-100-668, DC PWR—001)

[Y] [N] [NA] Drop cables into equipment bay shall match the color of the main cable run, provided the drop cables were not factory installed.

[Y] [N] [NA] Factory installed drop cables shall be marked with tape or plastic sleeves to match Red or Blue cables on main cable runs. Main cable runs utilizing gray cable do not require additional color code taping or marking at the equipment. (DC PWR—001)

[Y] [N] [NA] Verify that if the plant being installed is a 'BLUE' diverse plant for a Digital Central Office and the existing plant will be the 'RED' DCO plant, that the cables and drawings for the related 'RED' plant have been properly marked. (AT&T 790-100-668, DC PWR—001)

[Y] [N] [NA] Verify that all elements (Power Boards, Rectifiers, PDSCs, Batteries) of diverse power plants are separated by six feet. (DC PWR—001, DC PWR—002)

[Y] [N] [NA] Verify that when an existing plant will be the 'RED' DCO plant, that the BDFBs or PDFs and the respective drawings have been properly marked as 'RED'. (AT&T 790-100-668, DC PWR—001)

[Y] [N] [NA] Red and Blue distribution cables from a BDFB or PDF may be run on the same rack. In these cases are the colors segregated and bundled? (AT&T 790-100-668, DC PWR—001)

[Y] [N] [NA] Verify that the cables used between the power plant and the BDFB or PDF are the correct color (matching).

⇒ NOTE:

Some applications use a grey power plant and dedicated red and blue BDFBs or PDFs. These bays will have red or blue cabling on the distribution side but shall use gray color cable from the power plant to the BDFB or PDF.

⇒ NOTE:

Some other applications (4ESS, 5ESS) use PDFs with both red and blue loads.

6.8 Converter Checklist

[Y] [N] [NA] Verify that converter plant equipment is assembled in accordance with engineering instructions and drawings. (AT&T 790-100-668)

[Y] [N] [NA] Verify that converter plant equipment is stenciled or identified in accordance with engineering instructions. (AT&T 790-100-668)

[Y] [N] [NA] Verify that the rating of the spare converter is equal to or greater than any other converter in the plant. (AT&T 790100-668)

[Y] [N] [NA] Verify that the correct type and capacity converter input and control circuit fuses have been provided (including spares). Use manufacturers manual and equipment specification to confirm.

[Y] [N] [NA] Verify that converter plant bays and/or framework are properly bonded to the CO grounding system. If the converters are fed from a plant associated with an isolated ground switching system (e.g. 4ESS), the DC input ground connection should be isolated from the converter plant framework.

[Y] [N] [NA] Verify that the converters are not fed from another converter plant. (AT&T 790-100-6680)

6.9 Inverter Checklist

- [Y] [N] [NA] Verify that inverter/UPS plant equipment is assembled in accordance with engineering instructions and drawings.
- [Y] [N] [NA] Verify that inverter/UPS plant equipment is stenciled or identified in accordance with engineering instructions.
- [Y] [N] [NA] Verify that all distribution fuses are smaller than or equal to the plant capacity. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that the capacity of the plant is adequate to carry the peak load. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that the correct type and capacity input and control circuit fuses have been provided (including spares) and properly installed.
- [Y] [N] [NA] Verify that Inverter/UPS plant bays and/or framework are properly bonded to the CO grounding system. If the inverter is fed from a plant associated with an isolated ground switching system (e.g. 4ESS), the DC input return connection should be isolated from the plant framework.
- [Y] [N] [NA] Verify that a maintenance bypass switch has been installed in such a way that the inverter may be removed as required. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that the neutral bar in the by-pass switch and inverter is isolated from the plant framework.
- [Y] [N] [NA] Verify that the neutral bar and ground bar in PDSCs downstream from the inverter/UPS plant are not tied together.
- [Y] [N] [NA] Verify that only those circuits authorized for 'protected power' are attached to the inverter. (AT&T 790-100-668 and ACPWR-003)

7. Pre-Acceptance Checklists

7.1 General

- [Y] [N] [NA] Prior to final acceptance tests, the OSWF representative and the supplier's installation representative shall go through all check lists and check status of items found unacceptable in previous checks. Review the steps in the "Ask Yourself" checklist. Refer any issues to the responsible party. The order is not to be accepted until all issues are resolved. Any items found defective are to be documented using WMS. The completed checklists may be filed with on site Power plant records at the acceptance of the order.

7.2 Installation Checklist

- [Y] [N] [NA] Verify that all electrical connections, installed since last checkpoint, are tight, properly torqued and made in a manner that does not present a safety or service hazard. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that all power cables, installed since last checkpoint, are free of insulation damage. If not, has adequate protective actions been taken? (AT&T 802-005-180)
- [Y] [N] [NA] Verify that there is sufficient DC Emergency lighting to provide for egress from power areas during 'AC off' conditions.
- [Y] [N] [NA] Verify that the correct type and capacity fuses have been provided (including spares). These fuses must be clean, properly marked and properly installed. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that spare fuse holders are properly mounted and marked.
- [Y] [N] [NA] Verify that adequate cable protection has been provided on cable rack straps, stringers, threaded rods, auxiliary framing, and other metallic objects where power cable makes contact with sharp surfaces.
- [Y] [N] [NA] Verify that all alarms required by the "AT&T Alarm Standards Manual", AT&T 154-100-401, have been engineered and installed, and they operate properly. Check local alarms to all local panels and remote alarm operation to alarm monitoring location.

[Y] [N] [NA] Verify that all equipment provided on the order has been entered into Core Integrated Environment (CIE/bar code) system.

[Y] [N] [NA] Document and refer to supplier any workmanship related issues.

7.3 Power Control and Distribution Checklist

[Y] [N] [NA] Verify that all fuses/circuit breakers are correct and are located as shown on the equipment and office drawings.

[Y] [N] [NA] Verify that all meters are calibrated and properly adjusted.

- The supplier shall calibrate meters
- The OSWF shall document calibration with a stick on label on or near the meter.

[Y] [N] [NA] Verify that the battery float voltage is correct. Check after meter calibration and adjustment.

[Y] [N] [NA] Verify that required spare controller circuit packs have been provided and properly optioned for use in the installation.

[Y] [N] [NA] Verify that all control features called for in the office drawings have been provided, and operate properly (e.g. remote access, efficiency algorithm, shunt monitors).

⇒ NOTE:

AT&T 790-100-668 contains detailed information on the default settings for the Galaxy controllers used in the AT&T network. Some of these settings differ from the factory installed settings and must be changed by the installer. The OSWF shall verify these settings prior to acceptance. If office conditions or the power plant application require any deviation from the AT&T standard settings, that information shall be included by the NCS engineer, in the order, to the supplier.

[Y] [N] [NA] Verify that the capacitor charge circuit and fuse alarm circuit operates properly for all distribution circuit breakers.

[Y] [N] [NA] Verify that "Spare Fuses" are provided, and are located and designated on, or near, the battery plant. (AT&T 790-100-668)

[Y] [N] [NA] Verify that Bus bars, joints, and terminating connections to bus bars are free of excessive heat (use thermal scanner).

7.4 PDSC and Rectifiers Checklist

[Y] [N] [NA] Verify that the minimum acceptable number and size cables have been provided for rectifier charge (DC output) on L2000. (See Below):

- 400 amp rectifier 4-350 kcmil (2 BAT, 2 GRD)
- 200 amp rectifiers 2-350 kcmil (1 BAT, 1 GRD)
- 125 amp rectifiers 2-2/0 AWG (1 BAT, 1 GRD)
- 100 amp rectifiers 2-1/0 AWG (1 BAT, 1 GRD)
(T82603-31 AND EIMP90DJ0001).

[Y] [N] [NA] Verify that the rectifiers and PDSCs have been marked in accordance with engineering standards and drawings.

[Y] [N] [NA] A supplier installing a PDSC must mark, clearly and legibly on the PDSC:

- the PDSC's FIC
- the input voltage
- the phases
- the number of wires
- the frequency
- the type of service
- the type grounding
- the location of the PDSC's input device
- the capacity and designation of the PDSC's input device.
(AT&T 790-100-668)

⇒ NOTE:

Three types of service defined for this marking are:

Non-Essential - - - - Fed from Commercial AC only.

**Essential - - - - - Fed from Commercial but 'backed-up'
by a Standby Engine.**

**Protected- - - - - Fed from a UPS or Inverter 'backed-up'
by Essential AC and Battery Plant.**

- [Y] [N] [NA] The OSWF is required to provide information on input breaker, size and location to a supplier installing a PDSC.
- [Y] [N] [NA] Rectifiers must be marked with FIC code and G number. The OSWF shall verify that the marking agrees with the marking on the PDSC. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that each rectifier's meters are accurate and properly adjusted.
- [Y] [N] [NA] Verify that each rectifier's "Rectifier Failure" alarm operates properly.
- [Y] [N] [NA] Verify that "Current Limit" feature operates on each rectifier, and is adjusted to the proper level.
- [Y] [N] [NA] Verify that individual rectifier's "High Voltage Shutdown" feature operates properly.
- [Y] [N] [NA] Verify that each rectifier's output is stable (no hunting).
- [Y] [N] [NA] Verify that each rectifier is capable of operating at full load.
- [Y] [N] [NA] Verify that spare circuit packs have been provided, are operational and strapped properly.
- [Y] [N] [NA] Verify that each rectifier will automatically restart when the AC Power is removed and re-applied.
- [Y] [N] [NA] Verify that Rectifier Control cables are run on a separate rack or on stand offs. Do not run control cables on same rack with rectifier's DC output cables. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that the total rectifier capacity, minus one unit (equal to the largest unit on plant), is capable of floating the battery and carrying the peak load expected on the plant.
- [Y] [N] [NA] Verify that the total rectifier capacity, including the spare, is greater than or equal to 120% of the peak metered load.

7.5 Battery Stands and Batteries Checklist

- [Y] [N] [NA] Verify on L2000 power plants that there is sufficient 750 kcmil cables run between the bus bar assembly on first battery stand to the control bay. If shunt size is greater than 2600 amps, six 750 kcmil should be run. If shunt is 2600 amps or less and less than six (6) cables were run, calculate the number of cables required using Appendix C for voltage drop calculations. Use the shunt size (if less than 2600A) for the amperage in the circuit, the actual footage of the cable run and the voltage drop documented on the office "T" drawing, usually TXXXX-065X to complete calculation. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that the same number of cables are run for the battery and return leads associated with the battery.
- [Y] [N] [NA] Verify that all battery distribution cables are sized and properly terminated per office drawings and engineering instructions.
- [Y] [N] [NA] Verify that Battery Plant bus bar is installed in accordance with load requirements and office drawings.
- [Y] [N] [NA] Are battery returns terminated on the charge return bar and not on discharge return bar? (SEE POWER FLASH PWR005-01/92 AND T82603-31 FIG. H2, H5)
- [Y] [N] [NA] Verify that batteries and battery stands are clearly and properly marked or identified in accordance with engineering instructions and drawings. Items to be included are voltage, string designation, individual cell number, and "pilot" cell. (AT&T 790-100-668)
- Verify that required battery records (manufacturer, date of manufacture and initial charge) is available for all cells.
 - Have neutralizing agents and protective equipment been provided?
 - The supplier shall provide and mount thermometers, hydrometers, and hydrometer holders.
 - The supplier shall provide a plastic drip cup to replace the glass drip cup that is shipped with the hydrometer holder.
 - The supplier shall provide eye wash bottles, so that no cell is more than 12 feet from an eye wash bottle or station.
 - Gloves, apron, goggles, eye shields and neutralizing agent are to be provided by the OSWF.

- [Y] [N] [NA] Check battery operation and inter-cell connections by placing the plant on discharge. Verify that each battery string carries its portion of the load, according to its ampere-hour rating.
- [Y] [N] [NA] Verify that the return bars within the power plant are marked as 'RTN' and not 'GRD'. (AT&T 790-100-668)
- [Y] [N] [NA] Individual cell voltages are within limits. Record readings on Battery Form and place form in DC Power Operation Book.
- [Y] [N] [NA] Verify that the engineered battery reserve time (BHR) posted in PQRS equals or exceeds that required by NCS engineering guidelines. Verify that calculated BHR in PQRS equals or exceeds the engineered BHR posted in PQRS.
- [Y] [N] [NA] Verify that the battery stand is properly anchored. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that metal battery stands have a connection to central office ground. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that there is continuity between all sections of metal battery stands. (AT&T 790-100-668)

7.6 Grounding Checklist

- [Y] [N] [NA] Verify that any grounds installed since last checkpoint are in agreement with checklist in section 6.6 of this practice.

7.7 Diversity Checklist

- [Y] [N] [NA] If the plant is being installed under 4ESS or DCO Diversity guidelines, were colored cables ordered and installed as required by diversity guide lines? (AT&T 790-100-668 and DC PWR—001)
- [Y] [N] [NA] If colored cables are used, were the battery return cables provided as tracer cable? (AT&T 790-100-668 and DC PWR—001)
- [Y] [N] [NA] On orders with diversity paths (such as CCS7), were the paths followed exactly? Any deviation requires concurrence of the detail engineer and correction of drawings. In some cases physical protection, a raceway or protective covering, will be required. (AT&T 790-100-668)

- [Y] [N] [NA] Verify that all tap downs for BDFBs or PDFs cabled under diversity guidelines are made using correctly colored cable. (AT&T 790-100-668)

7.8 Converter Checklist

- [Y] [N] [NA] Verify that all distribution fuses are smaller than or equal to the plant size. For example, a plant with two 5-ampere converters is a 5-ampere plant. No fuses larger than 5A should be used in this example.
- [Y] [N] [NA] Verify that the total capacity of the plant, minus the spare, is adequate to carry the peak load.
- [Y] [N] [NA] Verify that all meters are calibrated and properly adjusted.
- [Y] [N] [NA] Verify that all meters have been properly labeled noting calibration date.
- [Y] [N] [NA] Verify that the input and output voltages are correct. Check after meter calibration and adjustment.
- [Y] [N] [NA] Verify that the correct type and capacity converter input and control circuit fuses have been provided (including spares) and properly installed.
- [Y] [N] [NA] Verify that all alarms required by the "AT&T Alarm Standards Manual", AT&T 154-100-401, have been engineered and installed, and they operate properly. Check local alarms to all local panels and remote alarm operation to alarm monitoring location.
- [Y] [N] [NA] Verify that all converter control functions (e.g., current limit, High Voltage Shutdown (HVSD)) operate properly. Test only if service will not be affected.
- [Y] [N] [NA] Verify that a separate DC supply has been provided for the Alarm Battery Supply (ABS).

7.9 Inverter Checklist

- [Y] [N] [NA] Verify that the AC and DC input supplies are correct per the manufacturer's manual.

- [Y] [N] [NA] Verify that the capacity of the plant is adequate to carry the peak load.
- [Y] [N] [NA] Verify that all meters are calibrated and properly adjusted.
- [Y] [N] [NA] Verify that the output voltage and frequency are correct. Check after meter calibration and adjustment.
- [Y] [N] [NA] Verify that all meters are labeled indicating a calibration date.
- [Y] [N] [NA] Verify that the correct type and capacity input and control circuit fuses have been provided (including spares) and properly installed.
- [Y] [N] [NA] Verify that all alarms required by the "AT&T Alarm Standards Manual", AT&T 154-100-401, have been engineered and installed, and they operate properly. Check local alarms to all local panels and remote alarm operation to alarm monitoring location.
- [Y] [N] [NA] Verify that a separate DC supply has been provided for the ABS.
- [Y] [N] [NA] Verify manual transfer of the plant load to the secondary source (by-pass) of power. All transfer and monitor (alarm) functions shall operate properly. Verify that output voltage and frequency are correct while on the secondary source.
- [Y] [N] [NA] Verify automatic transfer of the inverter from battery operation to by-pass AC operation.
- [Y] [N] [NA] Verify that maintenance by-pass has been installed so that the load equipment sees no power interruptions during operation and verify its proper operation.
- [Y] [N] [NA] Verify that all loads being fed by the plant require 'Protected' (uninterrupted) power. (AC PWR—003, AT&T 154-001-050)

7.10 Distribution Checklist

- [Y] [N] [NA] Verify that all distribution fuses/circuit breakers are of the correct capacity, and are located as shown on the equipment and office drawings or INFOBANK. On DC distribution circuits, the ampacity of the smallest cable or the ampacity of the smallest parallel cables in the circuit should equal or be greater than the size of the protection device feeding the circuit. Compare the breaker or fuse size to the ampacity of cables being run for main feeder.

■ Cable size / Ampacity -----	Cable size / Ampacity
■ 12 AWG 20 amps	0 AWG 170 amps
■ 10 AWG 30 amps	00 AWG 195 amps
■ 8 AWG 55 amps	0000 AWG 260 amps
■ 6 AWG 75 amps	350 kcmil 350 amps
■ 4 AWG 95 amps	500 kcmil 430 amps
■ 2 AWG 130 amps	750 kcmil 535 amps

(This table is based on RHH-RHW cable and National Electric Code (NEC) table 310-16)

⇒ NOTE:

The situation may arise on short cable runs that voltage drop requirements can be met using a cable of insufficient ampacity for protection device. Both voltage drop and ampacity requirements must be met for the main feeder cable.

⇒ NOTE:

The ampacity of the cables that 'Drop' or 'tap down' into equipment bays are determined using tap rules as set forth in the National Electric Code (NEC) and may not meet the requirements shown above. The ampacity of the tap or drop cables shall not be less than one third of the protection device. (NATIONAL ELECTRIC CODE section 240)

[Y] [N] [NA] Verify that distribution fuses and circuit breakers are correctly alarmed, and the alarm circuitry operates properly. Verify both local and remote alarms.

[Y] [N] [NA] If circuits are to be re-cabled, the L-1 (metered) load must be measured. This L-1 load must be less than 53% of the new fuse size or 63% of new breaker size (KS breakers). On 415A power plants, the L-1 load on breakers are allowed to be 75% of the capacity of the breaker size. (AT&T 790-100-668)

[Y] [N] [NA] On AC circuits, verify that the fuse or breaker size is appropriate for the size wire run.

■ Breaker/Fuse size	Minimum Wire Size
■ 15 AMP	14 AWG
■ 20 AMP	12 AWG
■ 30 AMP	10 AWG
■ 35 AMP	10 AWG
■ 40 AMP	8 AWG

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- 45 AMP 8 AWG
 - 50 AMP 6 AWG
 - (NATIONAL ELECTRIC CODE table 310-16)
- [Y] [N] [NA] Verify that each BDFB bus has a separate protection device (fuse/breaker) at the Power Board. This device is to be approximately 400% of the largest fuse used or 150% of measured load of the BDFB bus, which ever is larger.
- [Y] [N] [NA] Verify that BDFB or PDF loads using a 225 amp fuse or breaker are limited to 50 amps in order to maintain a 4 to 1 ratio for fuse coordination. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that BDFBs or PDFs that are using insulated external return bars do not have a connection to CO ground from these bars. If a connection to CO ground exists, contact power engineer prior to removal of connection. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that all battery return cables have appropriately marked designation tags at both ends of the cable. (Handbook 18)
- [Y] [N] [NA] Verify that the BDFBs are clearly and legibly marked with information on the location and the size of the breakers feeding the bay. (AT&T 790-100-668)
- [Y] [N] [NA] Verify that office 'T' base drawings correctly reflect the equipment installed.
- [Y] [N] [NA] Verify that AC raceways, using isolated ground, are isolated from raised floors that are on building (integrated) ground. Check positioning of flexible cables and relationship to floor tiles and supports carefully. (AT&T 790-100-668)

8. Final Acceptance Checklist

The following are items that are key to the successful installation of power in the NCS network.

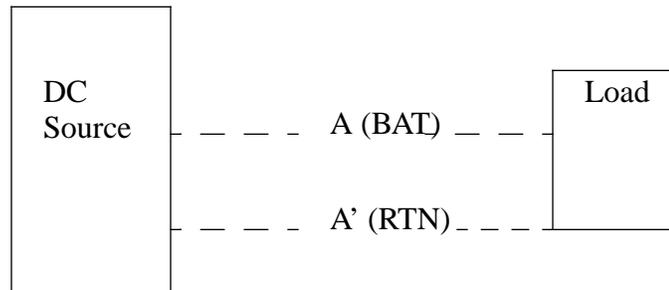
- [Y] [N] [NA] Have all items on pre-installation, pre-cabling and pre-acceptance check lists been checked, documented and resolved?
- [Y] [N] [NA] Verify that all office 'T' drawings are correct as per installed equipment. Fuse assignments, fuse block locations and FIC codes must match information in drawings or INFOBANK.
- [Y] [N] [NA] Verify that all fuses and breakers are clearly and correctly marked. This marking must agree with wiring lists and/or INFOBANK reports.
- [Y] [N] [NA] Verify that all alarms, local and remote, operate properly and are tested, designated properly and verified received at the proper location.
- [Y] [N] [NA] Verify that all meters are properly adjusted, calibrated and marked with calibration date.
- [Y] [N] [NA] Verify that the battery float voltage is correct.
- [Y] [N] [NA] Verify that adequate spare fuses have been provided and properly located near power plant.
- [Y] [N] [NA] Verify that all power cables are protected from sharp edges and are free from physical damage. If not, has appropriate action been taken to provide protection?
- [Y] [N] [NA] Verify that the total rectifier capacity, including the spare rectifier, is equal to or greater than 120% of the measured load.
- [Y] [N] [NA] Verify that sufficient AC lighting has been provided for power area and that the lighting is protected by a stand-by engine when available.
- [Y] [N] [NA] After acceptance and turn up of plant, a one hour discharge test of the plant shall be done to verify proper operation. During this test the battery straps and cable connections should be tested for tightness and quality of connections. This can be done with a milli-ohm meter, or if there is sufficient load, a thermal scanner or milli-volt meter. Battery strings shall be tested for load sharing during this test. The current provided by all strings shall be within 15% of each other.

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- [Y] [N] [NA] Verify that adequate egress lighting has been provided in the power plant area.
- [Y] [N] [NA] All connections shall be physically checked for hand tightness.
- [Y] [N] [NA] Battery rooms must be equipped with proper safety equipment:
- A thermometer for each battery string
 - Gloves, for cleaning and for high Voltage work
 - Hydrometers and hydrometer holders (with plastic drip cup)
 - Either one eye wash bottle or one wash station within 12 ft. of any cell
 - Acid resistant apron
 - Eye shields and goggles
 - Neutralizing agent (minimum amount required for one cell)
 - Battery log book
 - Power Plant log book
 - Hand held DC lanterns for emergency work.
- [Y] [N] [NA] Verify that routines have been established in WMS.
- [Y] [N] [NA] Verify that the Power Plant Log Book contains a single line drawing showing plant configuration including the AC power sources for the power plant PDSCs.
- [Y] [N] [NA] Verify that there is some type of emergency communications system available adjacent to the power plant.
- [Y] [N] [NA] Verify that all documentation (drawing, product manuals, battery charge records etc.) have been turned over to the OSWF.

Appendix A — Voltage Drop Calculations



$VD(A)$ = 'one way' voltage drop.

$VD(A) + VD(A')$ = 'loop' voltage drop.

EXAMPLE: "One way" calculation from "A" battery stand to main Control bay or Power Board (PBD)

"K" is a constant. For copper wire the constant is 11.1.

"I" is the amperage expected in the circuit. For these calculations it is the List 2 engineered load expected to be in the circuit. The control bay is designed for 2600 amperes. The shunt size may be used for this value. ----- $I = 2600$ amp (typical)

L is the actual length of cable run. For 'one way' calculations it would be the distance from the battery stand to the control bay. For loop calculations, the length of the return path is added. ----- $L = 15$ feet (typical, one way)

"VD" is the voltage drop. This can be found on the TXXXX-065-099 drawing. It has the following components and typical loop voltages:

Battery Stand 'A' and Controller bay (PDB), ----- 0.2

Battery Stand 'A' and Supplemental Battery stand, ----- 0.1

PBD and equipment ----- 1.65

or

PBD and BDFB ----- 1.40

BDFB and equipment ----- 0.25

From "T" drawing voltage drop from controller bay to Battery stand "A" bus bar--
 ----- one Way VD = $\frac{\text{loop vd}}{2} = \frac{0.2}{2} = 0.1$

$$\text{Circular MIL (cmil) required} = \frac{(K)(I)(L)}{VD}$$

$$\text{cmil required} = \frac{(11.1)(2600)(15)}{0.1} = \frac{432,900}{0.1} = 4,329,000 \text{ cmil}$$

To determine number of cables to run, divide the circular mil required by the size cable to be run.

$$\text{Number of cables} = \frac{\text{circular mil required}}{\text{circular mil of cable}} = \frac{4,329,000}{750,000} = 5.77 \text{ (750 kcmil cables)}$$

This plant would require a minimum of six (6) 750 kcmil cables to the power board for the battery leads and six (6) 750 kcmil cables for the return leads. These twelve cables would originate at the bus bar assembly mounted on the first battery stand (usually the 'A' battery stand). Six would run to the L2000 control bay (battery) and six would run to the Return bar assembly mounted above the L2000 control bay.

The following calculates the number of cables needed from a supplementary battery stand to the "A" battery stand on a L2000 power plant.

- The battery stand is designed to hold only one string of batteries
- The batteries are KS 20472 L-1S cells. These cells produce 320 amperes at a rate of 3 hours

- The cable path between the two battery stands is 40 feet
- The loop voltage drop is 0.1 volts. The one-way drop is 0.05 volt.

$$cm = \frac{(11.1)(320)(40)}{0.05} = \frac{142,080}{0.05} = 2,841,600$$

⇒ NOTE:

0000 AWG cable has a circular mil of 211,600.

$$\text{Number of cables} = \frac{\text{circular mil required}}{\text{circular mil of cable}} = \frac{2,841,600}{211,600} = 13.5 \text{ (0000 AWG cables)}$$

or

$$\text{Number of cables} = \frac{\text{circular mil required}}{\text{circular mil of cable}} = \frac{2,841,600}{750,000} = 3.8 \text{ (750 kcmil cables)}$$

This circuit would require that fourteen (14) 0000 AWG battery cables and fourteen (14) 0000 AWG return cables be run between the two battery stands. By equipping the supplemental battery stand with a bus bar assembly, 750 kcmil cables could be used. Four (4) 750 kcmil battery cables and four (4) return cables would be required.

Appendix B — Internal or External Ring Ground

- [Y] [N] [NA] Verify that, if required, an interior ring grounding (IRG) system has been provided.
- [Y] [N] [NA] Verify that all equipment bays in the IRG area are bonded to the interior grounding system with a No. 6 AWG cable.
- [Y] [N] [NA] Verify that all metal objects within 6 feet of the interior or external grounding system are bonded to the interior grounding system with a No. 6 AWG cable.
- [Y] [N] [NA] Verify that all splices are made with compression fittings or are exothermically welded.
- [Y] [N] [NA] Verify that Waveguide Hatches are bonded to the IRG system inside the building.
- [Y] [N] [NA] Verify that all conductor turns in the IRG system have a minimum radius of 8 inches (i.e., no sharp turns).
- [Y] [N] [NA] Verify that, if required, an exterior ring grounding (ERG) system has been provided.
- [Y] [N] [NA] Verify that the ERG is a minimum No. 2 AWG bare, solid, tinned conductor.
- [Y] [N] [NA] Verify that the ground rods are a minimum 5/8" x 8' copper clad steel or stainless steel (302 or 304 Series).
- [Y] [N] [NA] Verify that the ground rods are spaced between 10' and 15' on center.
- [Y] [N] [NA] Verify that all buried conductors are solid, tinned copper prior to covering.
- [Y] [N] [NA] Verify that all buried connections are exothermically welded.
- [Y] [N] [NA] Verify that all above ground connections involving solid conductors are made with exothermic welds or two-hole exothermic lugs.
- [Y] [N] [NA] Verify that all above ground connections between stranded conductors are made with exothermic welds or compression fittings (i.e., no mechanical fittings).
- [Y] [N] [NA] Verify that all Waveguide Hatches are bonded to the ERG system on the outside of the building.

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[Y] [N] [NA] Verify that the tower legs have been exothermically welded to the
ERG system with No. 2 AWG bare solid tinned conductors.

Appendix C — Isolated Ground

- [Y] [N] [NA] Verify that the Main and Supplemental Ground Bars are made of copper.
- [Y] [N] [NA] Verify that the ground window is within one floor of the ESS equipment.
- [Y] [N] [NA] Verify that the conductor between the ground window and the central office ground bar is a minimum No. 0 AWG cable (750 kcmil for older systems).
- [Y] [N] [NA] Verify that all connections to the ground window are made with two-hole compression fittings.
- [Y] [N] [NA] Verify that all connections to the ground window are tight and free from corrosion.
- [Y] [N] [NA] Verify that all conductors terminated on the ground window are equipped with location tags at both ends.
- [Y] [N] [NA] Verify that all conduits entering the ESS ground plane are bonded to the ground window before entering and insulated from contact with building ground afterwards. This includes AC feeds from inverters, UPS, and essential power panels.
- [Y] [N] [NA] Verify that any green wire grounds in the above item are also bonded to the ground window.
- [Y] [N] [NA] Verify that the PD Frame Ground Bars (splice plates) are connected to the ground window.
- [Y] [N] [NA] Verify that PD Frame ground bars (splice plates) are made of copper.
- [Y] [N] [NA] Verify that Discharge Ground Return feeders run from PD frames or isolated ground plane power plants to equipment on the integrated ground plane are connected to the ground window.
- [Y] [N] [NA] Verify that frame and aisle lighting is isolated from contact with the ESS equipment, except for a No. 6 AWG connection to the ground window.
- [Y] [N] [NA] Verify that frame and aisle lighting AC distribution panels are connected to the ground window with a No. 6 AWG cable.
- [Y] [N] [NA] Verify that frame AC receptacles equipment grounds are connected to the No. 6 AWG framework conductor.

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- [Y] [N] [NA] Verify that all ESS equipment bays are connected to the No. 6 AWG framework conductor.
- [Y] [N] [NA] Verify that all objects that are part of the isolated ground plane are insulated from the integrated ground plane.
- [Y] [N] [NA] Verify that fluorescent lighting fixtures have their AC ground conductor terminated at the ballast.
- [Y] [N] [NA] Document and refer to Installation Supplier management any workmanship related issues.