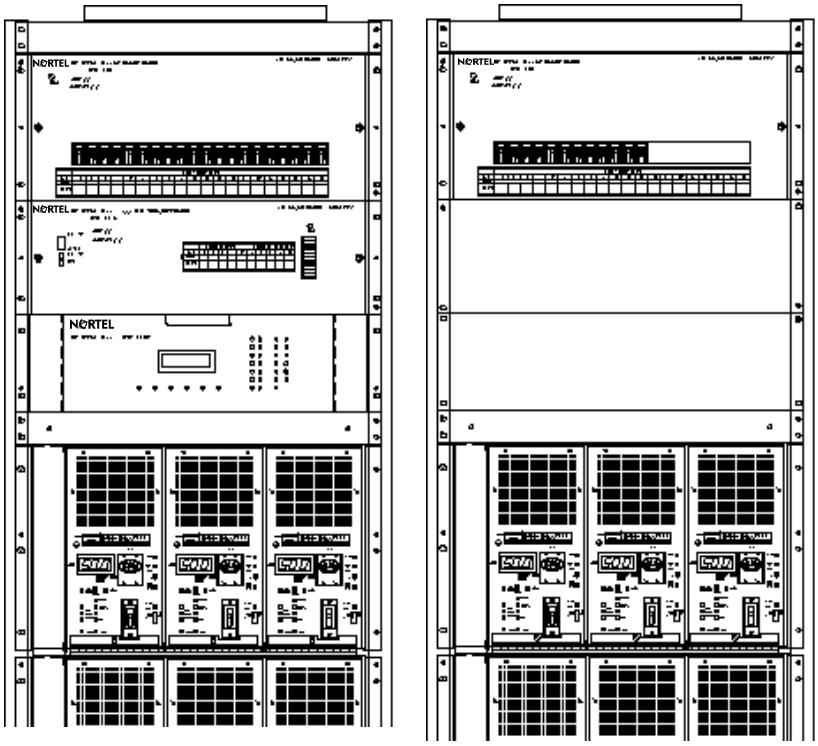
167-9021-111

Meridian 1 applications - HELIOS System 600/48

Description, Installation, Operation and Maintenance Manual

P0815188 Standard 2.0 March 1997 - FOURTH REVIEW



Advanced Power Systems

NORTEL
NORTHERN TELECOM

Meridian 1 applications - HELIOS System 600/48

Description, Installation, Operation & Maintenance

Document Number: 167-9021-111
Product Release: Standard
Document Release: 2.0
Date: March 1997
P0815188

Printed in Canada

Publication history

March 1997

Issue 2.0 Standard. This document includes revisions according to the customer request.

November 1995

Issue 1.0. Standard. This document includes revisions according to comments on the previous issue 1.0 and is now rated Standard.

Contents

List of Figures

List of Tables

List of Procedures

About this document

Purpose of this document

This document provides all the necessary information to install and operate a System 600/48 main and/or supplementary power framework(s) in Meridian 1 applications.

Applicability of this manual

This manual applies to the following configurations of Meridian 1 power systems using one or more System 600/48 frameworks:

- System 600 main framework only
- System 600 main and supplementary frameworks
- System 600 supplementary framework with an MPP600 cabinet
- System 600 supplementary framework with a QCA13 power equipment cabinet

How this manual is organized

This manual is divided into six parts:

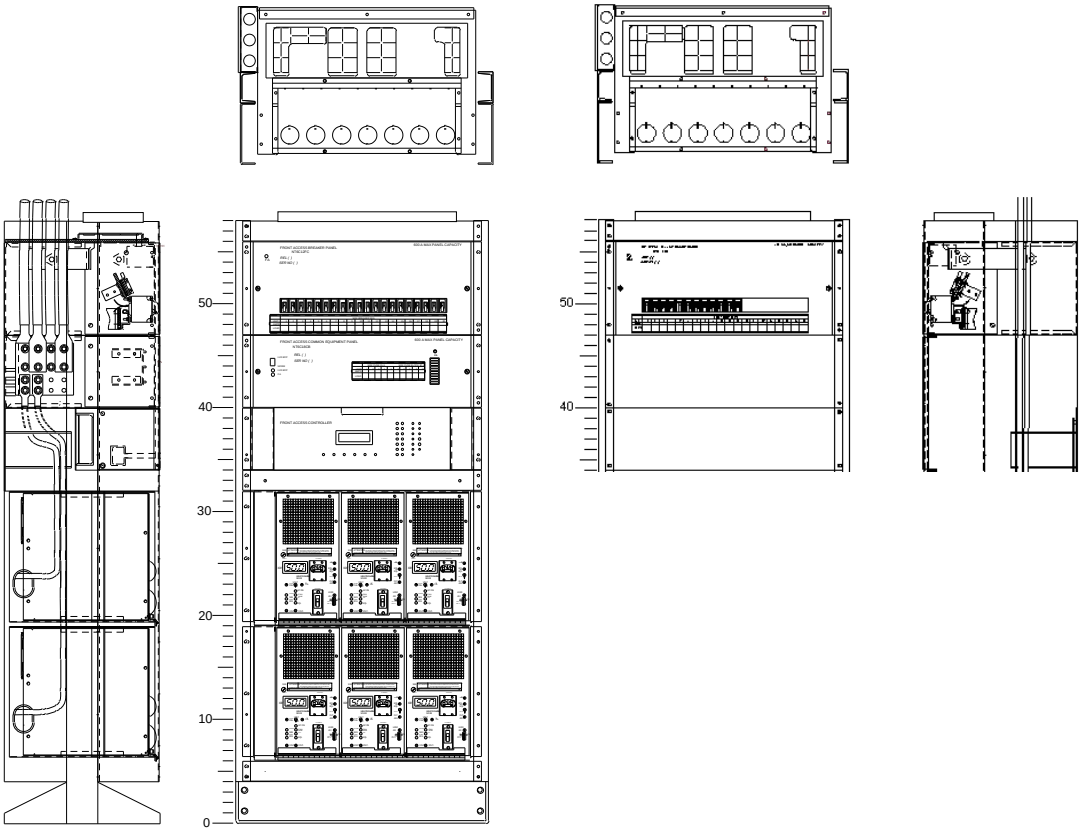
- Introduction
- Specifications
- Installation and start-up
- Operation
- Maintenance
- Appendixes

Introduction

Intent of this document

This document provides description, installation, operation and maintenance information for the NT6C32AD/AE System 600/48 power plant used in Meridian 1 applications. It includes information regarding all configurations of the Meridian 1 - System 600/48 power system.

Figure 1
Typical System 600/48 power plant (main and supplementary bays)



MAIN BAY (NT6C32AD)

Description

The System 600/48 power plant is a positive ground, –48 V dc power plant with a maximum capacity of 600 A.

The main bay (NT6C32AD) provides up to 300 A capacity. It consists of one 58 inch high framework (61 in. with the cover kit extension) equipped with one FACEP-600 front access common equipment panel, one NT6C25FF front access controller, one FACBR-50 front access circuit breaker panel equipped with 10 x 30 A circuit breakers, and two NT5C12AC modular power shelves which support up to six NT5C07AC 50 A plug-in rectifiers. A 3 in. top hat extension is provided to facilitate cabling of the distribution loads in the FACBR-50 distribution panel.

The supplementary bay (NT6C32AE) provides the additional 300 A capacity. It consists of one 58 inch high framework (61 in. with the cover kit extension) equipped with one FACBR-50 front access circuit breaker panel equipped with 8 x 30 A circuit breakers, two blank panels and two NT5C12AC modular power shelves which support up to six NT5C07AC 50 A plug-in rectifiers. Included with the supplementary bay are all the DC cables and signal wires required to connect with the main bay.

> ***Note:*** When a supplementary bay is connected to an MPP600 cabinet, a CEP kit (part number P0816320) is also required to upgrade the low voltage disconnect feature of the plant.

Main features

The system utilizes up to twelve NT5C07AC 50 A rectifiers connected in parallel as building blocks to reach the maximum capacity of 600 A. The rectifiers operate from a 208 V or 240 V single phase 50/60 Hz AC source. The system can operate with or without -48 V dc batteries. If batteries are connected, the rectifiers can operate in the float or equalize mode.

The system is a front access power plant. A minimum of 2 in. space is required behind the System 600/48 for ventilation. All installation, operation and maintenance functions are accessible from the front of the power plant.

The system is intended for seismic applications up to zone 4 (Bellcore), free standing, without requiring any external bracing.

The system provides a variety of monitoring and alarm features, such as high/low float and high/low voltage alarms, high voltage shutdown, fuse and breaker alarms, rectifier failure alarms, low voltage disconnect, as well as an interface with the NT8D22 System Monitor for a subset of these alarms.

The system complies with the requirements for single point grounding.

Equipment applications

The NT6C32AD/AE System 600/48 is designed to operate with Meridian 1 DC-powered systems whose requirements do not exceed 600 A in capacity.

Many existing SL-1 and Meridian SL-1 cabinet types are also supported for Meridian 1 upgrade situations where the NT6C32AD/AE System 600/48 may be used to provide power to both the new Meridian 1 and the existing equipment. Stand alone SL-1 cabinet applications are also supported.

CAUTION

System compatibility

The System 600/48 and the NT5C07AC 50 A rectifiers are not compatible with the earlier SL-1 and Meridian 1 power system rectifiers, such as the NT6D52, QRF12, QRF8, QRF9, or A0354950 (NT6D82).

These systems cannot be operated together, connected in parallel nor attached to the same battery string.

The System 600/48 is intended for new applications and for upgrade situations where the System 600/48 is used to power both the existing and new communication equipment.

The supplementary bay can be used to upgrade existing MPP600 and QCA13 Meridian 1 power systems. A CEP kit is required for the MPP600 upgrade.

In addition, other equipment that requires -48 VDC power may also be powered from the System 600/48 as long as there are sufficient output circuit breakers or auxiliary fuses, the total load does not exceed 600 A and, most importantly, as long as a consistent single point ground topology is maintained for all associated equipment. Also, it is recommended that only auxiliary equipment whose logic and frame grounds are separated be connected to the Meridian 1 and to the System 600/48.

General grounding information may be found in the latest release of the following documents:

- *Meridian 1 installation planning*, 553-3001-120
- *Meridian 1 power engineering*, 553-3001-152
- *Meridian 1 system installation;* 553-3001-210

THIS PAGE IS INTENDED TO BE BLANK

Specifications

Overall power plant specifications

Standards

The NT6C32AD/AE System 600/48 meets the following North American standards:

- UL-1801 and CSA 22.2 (#0.7, #225)
- ANSI Std. C62.41/IEEE Std. 587-1980, Class A and B lightning surge 6000 V, 3000 A, 1.2 x 50 ms impulse, 10 hits per second
- ANSI Std. C82.41 oscillatory surge 2500 V, 0.5 ms impulse, 100 kHz positive/negative oscillating decay
- Bellcore TR-TSY-000947

Mechanical

Table 1
Overall equipment and rack dimensions

Height	58 in. (1473 mm) 61 in. (1549 mm) with cover kit extension
Depth	15 in. (381 mm)
Width	24 in. (610 mm)*
Total weight without rectifiers:	Main bay: 350 lb (159 kg) Supplementary bay: 260 lb (118 kg)
Total weight with rectifiers	Main bay: 482 lb (219 kg) Supplementary bay: 392 lb (178 kg)

* If installed on a raised floor with bottom feed, allow additional space for the AC feeds on the left side and the DC duct on the right side.

Electrical

Refer to the individual component specifications below.

Electromagnetic interference (EMI) compliance

The equipment contained in the power plant complies with the specifications of FCC, Part 15, Subpart B for class A equipment and CSA 108.8 Class A.

ESD immunity

No equipment damage or malfunction shall occur when electrostatic discharge (ESD) voltages of severity level 2 and 4, as specified by IEC-801-2, are applied to exposed parts of the power plant.

Environmental

Operating

- Temperature: 32° to 122°F (0° to +50°C)
- Humidity: 0 to 95% non-condensing
- Altitude: Sea Level to 7000 ft (2100 m)

Transportation (do NOT ship with rectifiers installed)

During transportation, the equipment may be subjected to the following conditions without damage:

- Temperature: –58° to +167°F (–50° to +75°C)
- Humidity: 0 to 95% (non-condensing) 4 kPa max. WVP for 10 days
- Vibration: TR-EOP-000063 Section 5.4.4 Transportation Vibration (packaged equipment)
- Shock: TR-EOP-000063 Section 5.4.1 Handling Drop Tests and TR-NWT-000063 Section 5.4.3 Installation Shop Tests

Storage

- Temperature: –58° to +167°F (–50° to +75°C)
- Humidity: 0 to 95% (non-condensing) 4 kPa max. WVP for 10 days

Heat dissipation

An NT6C32AD/AE System 600/48 rack fully equipped with twelve 50 A rectifiers will dissipate a maximum of 4,560 watts or 15,570 Btu/hr.

Floor and point loading

Table 2
Floor and point loading

Bay	Floor lb/sq ft (kN/sq m)	Point lb/sq in. (N/sq cm)
Main Supplementary	64.3 (3.1) 52.2 (2.5)	27.2 (18.8) 22.1 (15.3)

The floor loading is based on a fully loaded system and an area of 7.5 sq ft which includes an aisle depth of 30 inches.

The point loading is based on a fully loaded system resting over four shims, each with an area of 4.43 sq in.

Individual component specifications

Framework

Mechanical

Table 3
Mechanical specifications of the framework

Rack type	Height	Depth	Width	Weight
Seismic	58.0 in. * 1473 mm *	15.0 in. 381 mm	24.375 in. 619 mm	100 lb 45.5 kg
Note 1: Refer to Figure 1 for typical views of frameworks with equipment. ***Note 2:*** * 61 in. (1549 mm) with the cover kit extension				

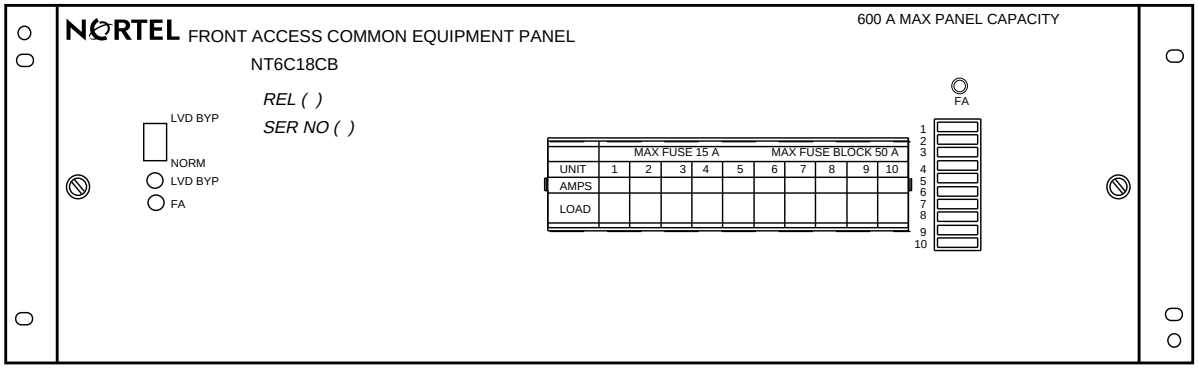
NT6C18CB Front Access Common Equipment Panel (FACEP-600)

Mechanical

Table 4
Mechanical specifications of the FACEP-600

Figure	Height	Depth	Width	Weight
2	6.96 in. 177 mm	15.00 in. 381 mm	23.00 in. 584 mm	40 lb 18 kg

Figure 2
Front view of the FACEP-600



Electrical

- Charge battery bus bar capacity: 700 A
- Discharge battery busbar capacity: 600 A
- Battery return busbar capacity: 700 A
- Shunt rating (50 mV drop): 800 A
- LVD contactor capacity: 800 A

Other equipment

- Ten (10) position GMT fuse block: .180 A to 15 A (block rating: 50 A). The unit is shipped equipped with 1-1/3 A fuses.
- LVD Control and Bypass circuit pack

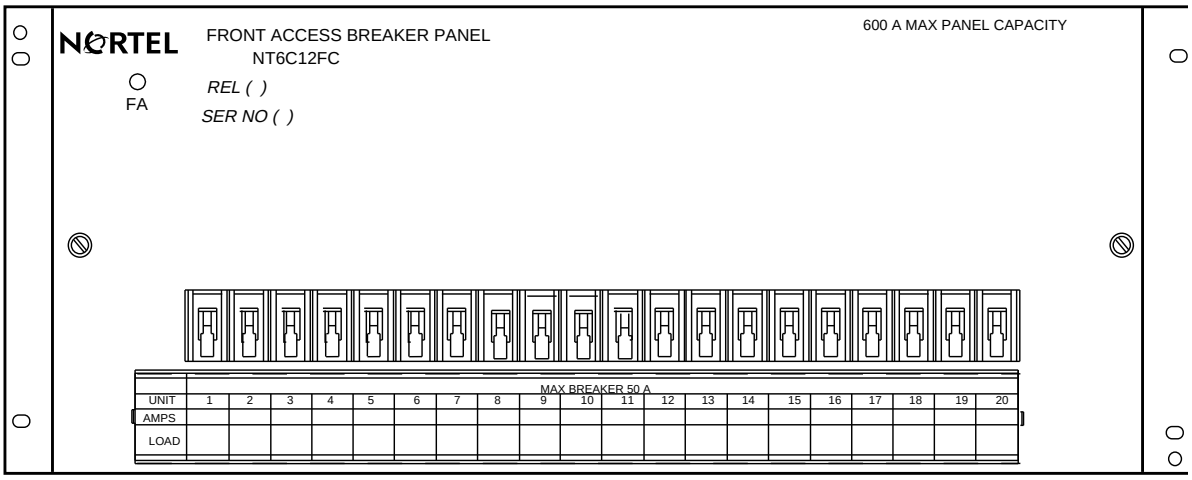
NT6C12FB Front Access Circuit Breaker panel (FACBR-50)

Mechanical

Table 5
Mechanical specifications of the FACBR-50

Figure	Height	Depth	Width	Weight
3	9.00 in. 229 mm	15.00 in. 381 mm	23.00 in. 584 mm	25 lb 11.3 kg

Figure 3
Front view of the FACBR-50



Electrical

- Discharge battery busbar capacity: 600 A
- Battery return busbar capacity: 600 A (20 positions)
- Circuit breakers (mid-trip): 10 x 30 A (main bay)
8 x 30 A (supplementary bay)
- Maximum cable gauge: No. 2 AWG

Note: The FACBR-50 accepts circuit breakers with up to 50 A capacity.

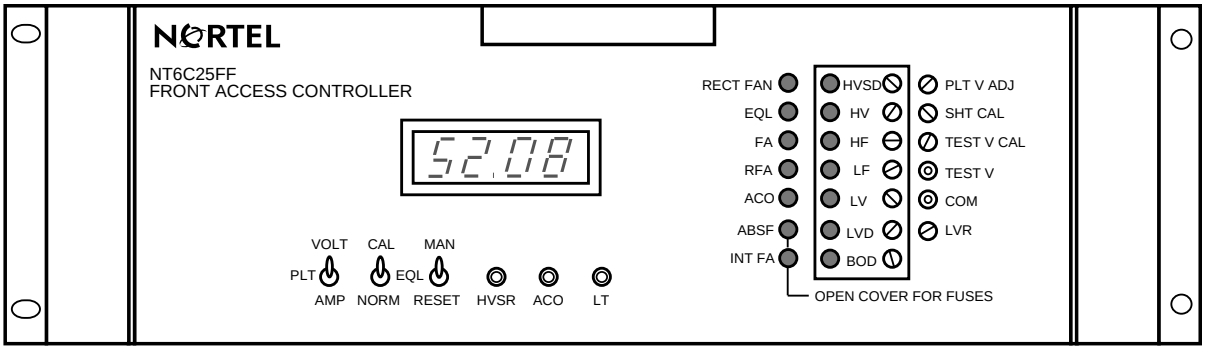
NT6C25FF Front Access Controller

Mechanical

Table 6
Mechanical specifications of the NT6C25FF controller

Figure	Height	Depth	Width	Weight
4	5.96 in. 151 mm	8.16 in 207 mm	23.00 in. 584 mm	16.5 lb 7.5 kg

Figure 4
Front view of the NT6C25FF controller



Electrical

The nominal operating voltage is –48 V dc. Refer to the “Overall power plant specifications” section above and the “Operation” Chapter for a detailed list of the electrical operating parameters and features.

NT5C12AC power shelf (MPS150)

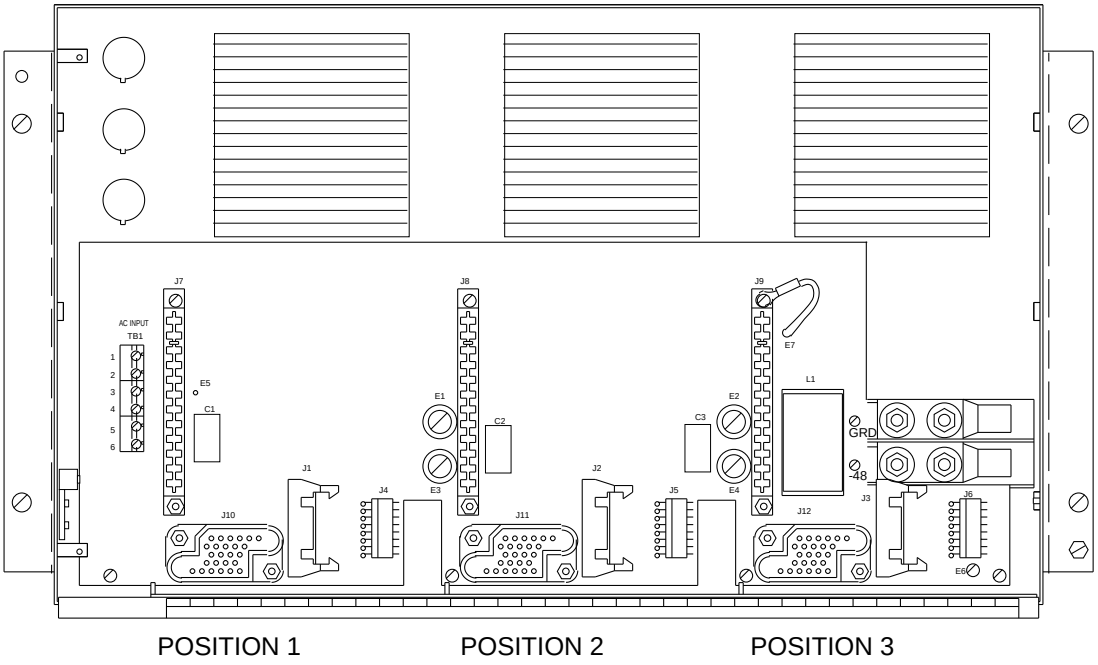
Mechanical

Table 7
Mechanical specifications of the MPS150 power shelf

Figure	Height	Depth	Width	Weight
5	13.00 in. 330 mm	14.25 in. 362 mm	23.00 in. 584 mm	33 lb 15 kg

Each MPS150 shelf can support up to three (3) plug-in rectifiers.

Figure 5
Front view of the MPS150 Power Shelf (shown empty)



Electrical

The total output capacity of a shelf is 150 A.

Each rectifier position provides interconnection points for AC input (208 or 240 V nominal), DC output (–48 V nominal) and control and alarm signals.

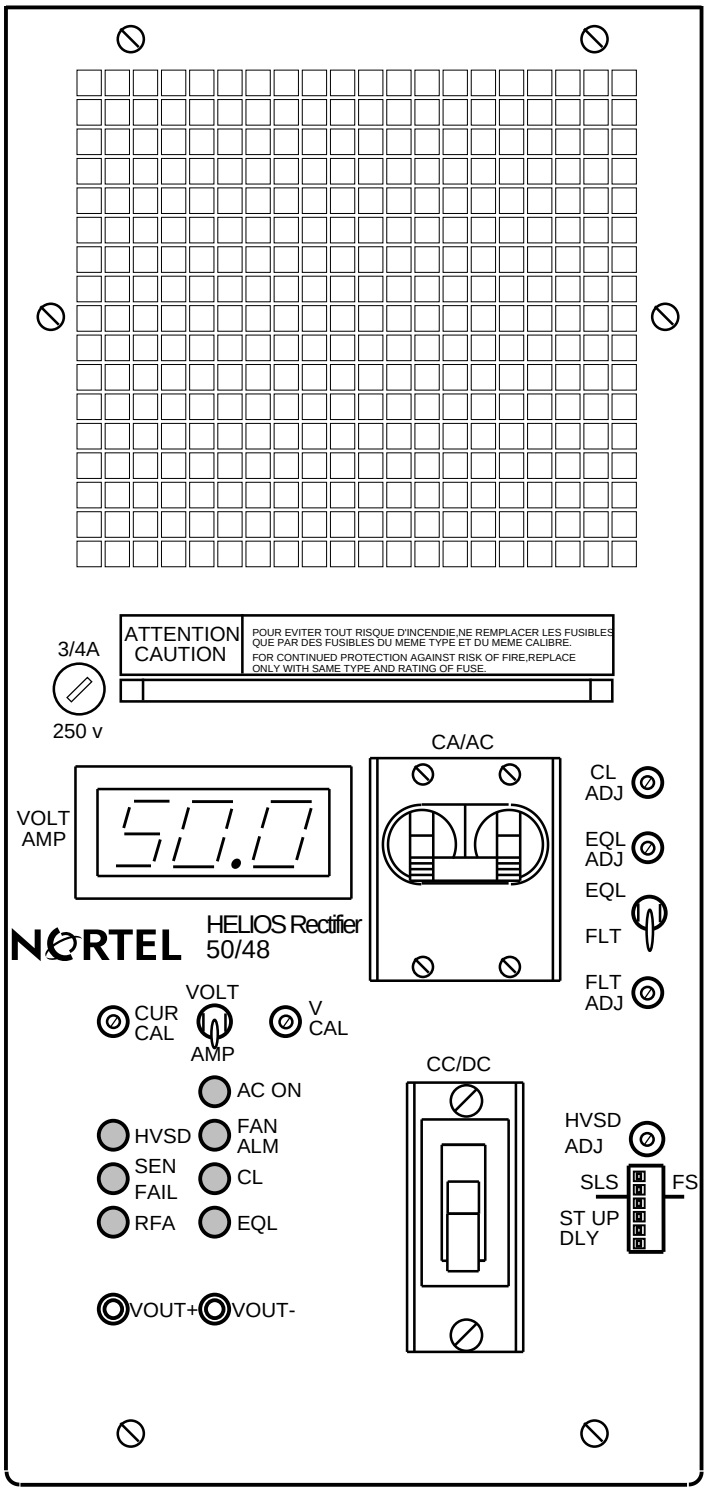
NT5C07AC 50 A Switch Mode Rectifier

Mechanical

Table 8
Mechanical specifications of the 50 A rectifier

Figure	Height	Depth	Width	Weight
6	12.25 in. 311 mm	13.00 in. 330 mm	6.00 in. 152 mm	22 lb 10 kg

Figure 6
Front view of the 50 A rectifier



Electrical

Table 9
50 A rectifier electrical specifications

Input Voltage Rating:	Nominal 208/240 V ac single phase, 47-63 Hz. Input Voltage Range 176 to 264 V ac.
Input Current Rating:	15 A nominal at 208 V ac input and –56 V dc, 50 A output
Recommended AC Service Breaker:	Two 20A fuses (one on each line) or two 20A circuit breakers (one on eah line) per rectifier at the AC service panel ***Note 1:*** If two individual single phase circuit breakers are used side by side, they still have to be rated at 30 A, 250 V. ***Note 2:*** Refer to NTP 553-3001-120 for the AC service panel requirements.
Output Voltage Rating:	Float: –46 V dc to –59.5 V dc Equalize: 0 - 4 V above float Maximum: –59.5 V dc
Output Current Rating:	50 A per rectifier. 150 A for an NT5C12AC Power Shelf
Input Protection:	A two pole circuit breaker on the rectifier opens both lines for 208/240 V ac service. (20 A)
Output Protection:	The rectifier contains an adjustable output current limiting circuit for protection against damage from overloads. This circuit is factory set to limit the output current to 52.5 A, however, it is adjustable to less than 25 A. A single pole 60 A circuit breaker is connected in series with the negative output lead in the rectifier.
Output Regulation:	At point of regulation: within ±0.5% of the selected value for all specified input and output variations and within ±1% for any combination of specified input, output and environmental conditions.
Heat dissipation:	380 Watts (1298 Btu/hr)

The rectifier also meets the following international standards:

- IEC-950, VDE EN 60950, EN41003

Installation and start-up

Installation overview

This chapter contains detailed installation procedures for installing and commissioning the NT6C32AD/AE System 600/48 power plant. The following is a suggested sequence for the installation and start-up procedure. The sequence may change according to job and site conditions.

- Obtain the recommended tools and test equipment.
- Read the "Precautions and preparation" section carefully.
- Have all the equipment and material delivered.
- Proceed with the physical installation of the framework.
- Install the cover kit extension on top of the framework.
- Install and connect the AC input cabling.
- Install and connect the DC cabling for the main bay, supplementary bay and grounding as required.
- Install and connect the external alarm and monitoring wiring as required.
- Insert the rectifiers in the power shelves.
- Verify and adjust the complete system.
- Connect the Meridian 1 loads to the power plant as required
- Balance the rectifiers with the actual system load
- Install the batteries

Tools and Test Equipment

The following tools and test equipment are recommended:

- safety goggles
- dolly truck
- screwdriver, flat blade, 3/8 in. (10 mm)
- screwdriver, flat blade, 3/32 in. (2 mm)
- electricians knife
- wire stripper
- Allen key set
- hammer drill

- 8 mm (5/16 in.) and 19 mm (3/4 in.) concrete bits
- Hilti HSD6 and HSD10 anchor setting tools
- cable cutters (up to 750 MCM)
- linesmen pliers
- open end and box end wrench sets
- socket set (1/2 in. drive)
- ratchet set (1/2 in. drive)
- torque limiting wrench (1/2 in. drive)
- hydraulic crimper and die set (up to 750 MCM)
- canvas sheets, 4 ft x 6 ft (1 m x 2 m)
- hacksaw
- vacuum cleaner
- anchor load tension tester, OSA IR 26.6
- 4-1/2 digit, digital multimeter, Fluke 8060A or equivalent
- dry load bank (5 kW minimum - to accept 100 amperes), where a system load is not available to verify the adjustments of the rectifiers

Precautions and preparation

The following precautions shall be followed at all time when installing power equipment:

WARNING

Prevent electrical shock

When wiring the AC input of the rectifiers, insure that the associated AC breakers in the AC service panel are in the OFF position and that a warning tag clearly indicates that these breakers are to remain off until AC wiring is completed.

CAUTION

Prevent short circuits

When working on live equipment, use properly insulated tools and cover any live busbars with a canvas sheet to prevent short circuits caused by falling tools and/or parts.

CAUTION
Health and equipment protection
Power equipment is heavy (preassembled frames, rectifiers and batteries). Use a dolly truck or fork lift or hoist whenever possible when handling and moving the equipment. If a fork lift is used, do not remove the shipping crates before the equipment has been moved near its final installation location. If a dolly truck is used, the shipping packages may be removed at the point of receiving.

CAUTION
Building protection
Protect the floors and walls against damage when handling the equipment. Use sheets of plywood or cardboard.

CAUTION
Prevent equipment failure
Do not over torque nuts and bolts. Over torquing causes the thread to strip or the bolt to break. Refer to each section for the appropriate torque values.

CAUTION
Prevent equipment failure
To optimize service life of this equipment, it must be located in a dry, well ventilated room, with no obstructions in front of the ventilation openings.

Receiving the material

The NT6C32AD main bay and the NT6C32AE supplementary bay are shipped as preassembled power frames. The rectifiers are shipped separately. Other material such as cable, wire, connecting material, fuses, mounting hardware, etc. are also shipped separately.

Upon receiving an NT6C32AD or NT6C32AE framework, or both, remove the packaging and inspect the equipment for damage. Verify that all other material ordered is received and is in good condition. Report any missing or damaged items to your Northern Telecom representative.

Physical installation

The physical installation of the System 600/48 consists of leveling, aligning and securing the main and/or supplementary frameworks.

CAUTION
Equipment protection
System 600/48 frameworks are heavy and may have a high center of gravity. These **MUST** therefore be secured to the floor with appropriate anchoring assemblies.

Installation of the batteries is also part of the physical installation.

Installation of the System 600/48 main bay

Install the main bay as described in the following Procedure.

Note 3: This Procedure assumes that the framework will be installed on a concrete floor.

Note 4: If the concrete floor has no covering, it must be sealed to prevent dust contamination.

Note 5: As a general practice, it is recommended that 50% of the anchor bolts shall be load tested to 3344 lb (1517 kg) in tension at the job site, in accordance with OSA IR 26.6. If any one anchor fails, all the expansion anchors should be tested.

Note 6: The System 600/48 is seismic qualified when properly anchored to a 3000 psi (2.11 kg per sq mm) concrete floor. The seismic qualification is not valid otherwise.

Note 7: Zone 4 seismic rating of the power system cannot be guaranteed on floors other than concrete.

Note 8: The isolation kit option is required when there is reason to believe that the floor is ground conductive

Procedure 1
Leveling, aligning and securing of the main bay

Step	Action
1	Determine where the framework is to be located by referring to the floor plan. Make sure that there will be at least two inches between the rear of the power plant and the wall. This will allow air circulation behind the rectifiers.
2	Draw a line on the floor to represent where the front of the power bay will be placed.
3	Draw a second line perpendicular to the line in step 2. This line should indicate where one side of the frame is to be located.
4	Slide the frame into position using the two lines drawn on the floor as a reference.
5	Mark the frame anchoring holes on the floor using the base of the frame as a template. Refer to Figure 7 for the floor anchoring patterns.
6	Slide the frame out of position so that the markings for the anchoring holes are easily accessible.
7	Drill the holes in the floor using a hammer drill. Use a 3/4” (19 mm) concrete bit. The holes must be the length of the anchor plus the thickness of the floor covering (if any) plus 1/8” (3 mm) . Note that the anchors can be installed in a bottomless hole.
8	Use a vacuum cleaner to remove the dust in and around the holes.
9	Set the floor anchors in the drilled holes. Use a setting tool (Hilti HSD10 or equivalent). The anchors are 13 mm (1/2 in.).
10	Install the isolation kit option P0736042 if required (Refer to Figs. 7 and 8, and note 8)
11	Slide the frame back into position over the anchoring holes.
12	If required, level the frame using properly sized incompressible shims.
13	Install the floor anchoring hardware. Refer to Figure 8 for the anchoring assembly stackups.
14	Torque the bolts to 25 ft-lb (33 Nm) for standard installations. Torque the bolts to 50 ft-lb (67 Nm) for seismic installations.
	—end—

Figure 7
Floor anchor pattern with typical isolation pad

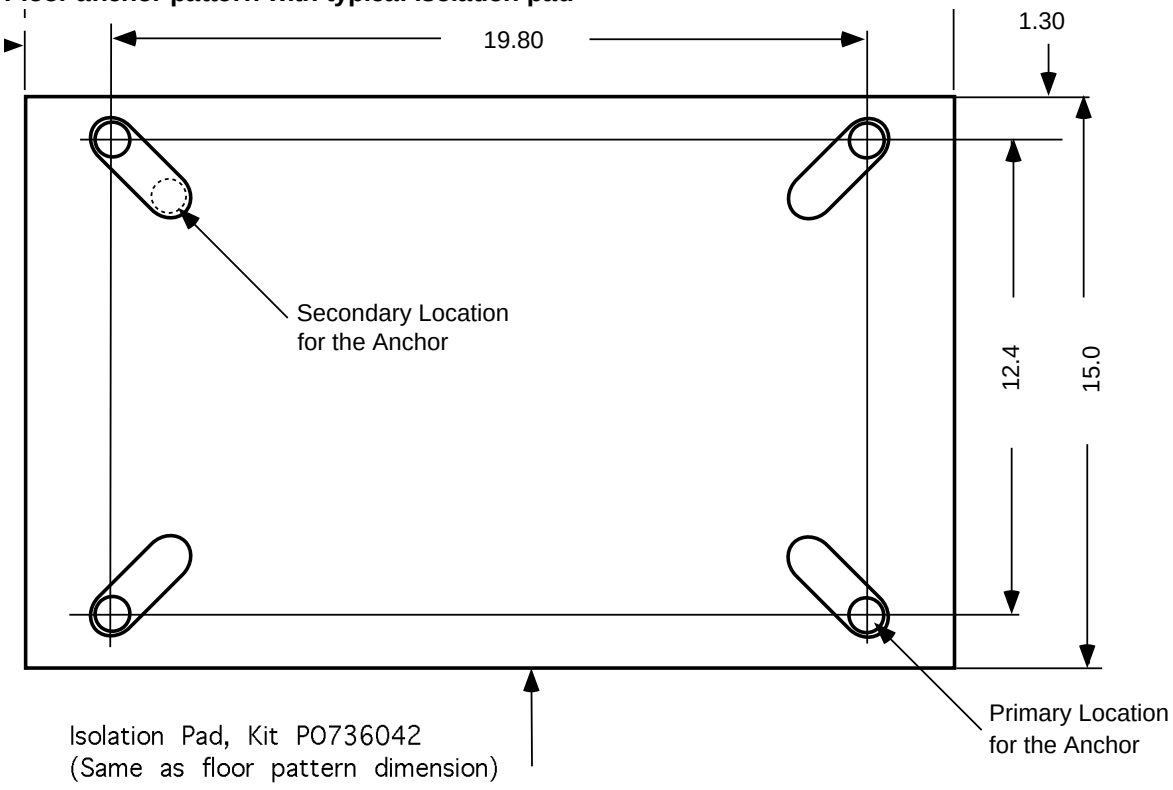
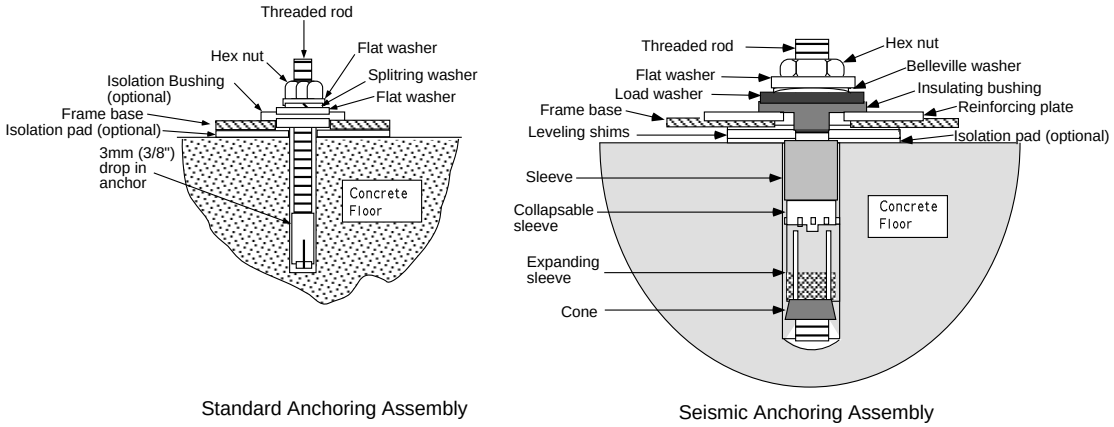


Figure 8
Floor anchor assemblies and isolation pad installation



Standard Anchoring Assembly

Seismic Anchoring Assembly

Note: The isolation kit consists of one isolation pad and four isolation bushings. The isolation kit may be installed with either the standard or seismic anchors.

Installing the cover kit

Install the cover kit on top of the framework as described in the following Procedure (refer to Figures 1 and 9).

Procedure 2
Installing the cover kit

Step	Action
1	Inspect the P0820991 cover kit to make sure that it is not damaged and that no material is missing. The kit contains the following items: • one P0808786 conduit cover • one P0820987 face plate • six P0210231 PHM screws • two P0124483 PHM screws • six P0387748 HS lock washers • six P0284157 flat washers • six P0220756 hex nuts
2	Place the cover, with the large opening towards the front, on top of the insulating cover at the top of the bay.
3	Align the mounting holes in the cover with those in the insulating cover. Make sure that the slots in either end of the cover do not touch the frame bracing bar or interfere with the ground lug.
4	Insert the six P0210231 screws, head at the top, into the mounting holes.
5	Place the flat washer, the helical spring lock washer and the hex nut onto each screw from under the insulating cover.
6	Tighten the screws (be carefull not to over tighten).
7	Place the two P0124483 screws into the front of the conduit cover to receive the face plate.
8	Place the face plate into position on the two screws and tighten lightly.
	—end—

Note: The face plate of the cover extension and the top 2-1n. panel on the framework can be removed later for ease of access while installing the distribution wiring.

Installation of the System 600/48 supplementary bay

IMPORTANT NOTE
Specific requirements apply to the supplementary bay
Whether it is added to a System 600/48 main bay, to an MPP600, or to a QCA13 power cabinet, the supplementary bay must be installed within 20 cable feet of the main bay.

Observing the above rule, install the System 600/48 supplementary bay as described in Procedure 1 and as shown in Figures 7 and 8. All notes in the "Installation of the main bay" Section also apply.

Battery installation with a System 600/48 main bay

A System 600/48 can operate with or without batteries (this statement may not apply when only a supplementary bay is added to another type of power cabinet).

If batteries and battery racks are provided for your project, these are installed externally to the power system. Up to four (4) battery strings can be connected to the System 600/48 main bay. Locate the batteries as shown on the floor plan. Install the batteries according to the manufacturer's instruction manual. When installing large cells, use a hoist of appropriate capacity to lift the cells onto the rack. A platform type hoist may be used to install and remove cells.

Refer to the Cabling and wiring Section below to cable the batteries to the System 600/48 main bay.

CAUTION
Protect the equipment against electrical damage.
Do not connect the batteries to the System 600/48 before being instructed to do so in the "DC cabling" section of this practice.

Cabling and wiring

Conductor sizing and minimum requirements

It is very important that the properly sized conductors be installed between the AC source, the power plant, the batteries and the loads. The protective circuits in the equipment, the performance and the overall safety of the equipment depend on the proper amperage and an acceptable voltage drop. Refer to NTP 553-3001-152 for DC conductor sizing. The AC conductors should be sized per the National or Canadian Electrical Code.

The conductor insulating material must be rated at 105°C and meet 94-V0 rating when tested according to Underwriters Laboratories standard 94.

Power plant wiring

All internal wiring between the equipment in the System 600/48 is factory installed, including DC and control wires from the rectifier shelves to the NT6C25FF controller and to the distribution panels. Cables between the frameworks and/or cabinets and to the AC supply, the external batteries and the Meridian 1 equipment are installed on site.

Once the rack and the equipment are firmly secured, proceed with the system wiring and configuration as described in the following sections.

IMPORTANT NOTE

Use the appropriate procedure for your specific application.

The cabling procedure is different whether the System 600/48 supplementary bay is added to a System 600/48 main bay, to an MPP600, or to a QCA13 power. Select the procedure below that applies to your specific application.

CAUTION

Protect the personnel against electrical shocks.

The power plant wiring should be performed by qualified personnel in accordance with local and national electrical codes.

Input voltages to the rectifiers and rectifier shelves are at a dangerous level. Ensure that the circuit breakers are locked in the OFF position at the AC service panel before attempting to work on the power plant. Dangerous voltages may still be present at the terminals even if the rectifiers are OFF. Use a voltmeter to verify for the presence of such voltages. Do not switch circuit breakers ON until the entire system is assembled and that you are instructed to do so in the appropriate procedure.

Improper wiring can cause personal injury and equipment damage. Verify for proper polarity of the battery leads before connecting them to the power plant, by clearly identifying the positive lead and the negative lead.

AC input wiring for the rectifiers

The System 600/48 frameworks are totally front access. For this purpose, they are provided with an AC duct which allows AC wiring of the rectifiers from the top with rigid or flexible conduit, or from the bottom with flexible conduit. The AC leads are then run through the enclosed duct along the side of the bay and connected to the rectifier shelves as shown in Procedure 3 and Figures 9 and 10. However, if more practical and if total front access is not mandatory, the rectifiers may be cabled from the rear of the framework with flexible conduit as shown in Procedure 4 and Figures 11 and 12.

Note 9: It is recommended that AC be installed initially for all rectifier positions even if the initial system is only partially equipped.

Note 10: When a three phase 208/240 V ac source is being used, it is preferable to distribute the rectifiers evenly among the three phases.

AC wiring through the AC duct

Proceed as shown in Procedure 3 and Figures 9 and 10 to cable the AC input of the rectifiers through the AC duct.

Procedure 3
Wiring the AC input of the rectifiers through the AC duct

Step	Action
1	Install the required number and type of circuit breakers at the AC service panel. Refer to the “Specification” Chapter for the required breaker ratings.
2	Turn off and lock the breakers for the rectifiers at the AC service panel.
3	Determine the length of rigid or flexible conduit required to bring the AC from the service panel to the AC duct entrance at the top or bottom of the power frame (and to the rectifier positions if cable is used). Provide pull box(es) as required to facilitate cable running.
4	Cut the conduit to the required length using a hacksaw or cable cutters. Install the rigid conduit or run and dress the flexible conduit between the AC service panel and the System 600/48 power plant. Flexible conduits should be tied to cable racking with tie wraps, while conduit should be attached to the wall or ceiling with brackets.
5	Attach the conduit to the AC duct entrance at the top or bottom of the frame. Conduit or cable connectors will be required. The type and size of connector will depend upon the type of cable or conduit that is used
6	Run the AC leads in the conduit from the AC service panel to the junction box closest to the System 600/48 framework. Ensure that these AC leads are long enough to reach the rectifier shelf positions.
	—continued—

Procedure 3
Wiring the AC input of the rectifiers through the AC duct

Step	Action
7	Remove the AC duct cover by loosening the two screws and sliding the cover upward to allow access for pulling wires through the entrance (see Figure 9).
8	Remove the blank panels at the front of the rectifier shelves. Use a flat blade screwdriver to loosen the retaining bars (the screws are captive).
9	Feed a fish tape through the factory installed plastic bushings in the rectifier shelf, through the AC duct and to the nearest AC pull box. Attach the fish tape to the AC leads and pull the fish tape back trough the conduit, the AC duct and to the power shelf. Refer to Figure 9.
10	Make the power and ground connections inside the shelf first. Refer to Figure 10. NOTE: If the 6 ferrite cores are contained in the kit, it should discard the unnecessary ferrite cores.
11	Then, make the power and ground connections at the AC service panel.
12	Replace the blank panels at the front of the shelves until the rectifiers are to be installed.
13	Replace the AC duct cover.
—end—	

Figure 9
AC duct cabling

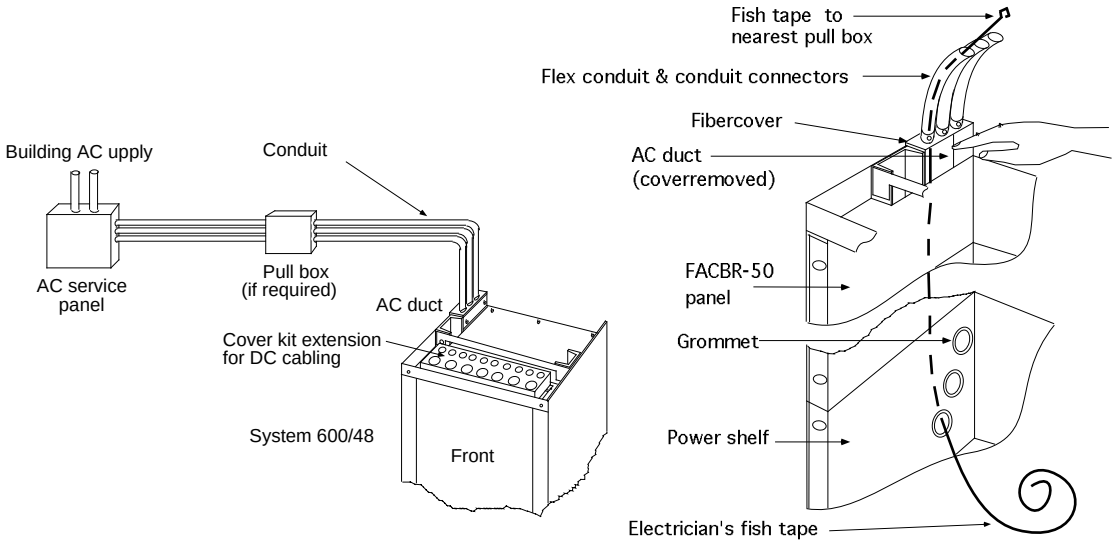
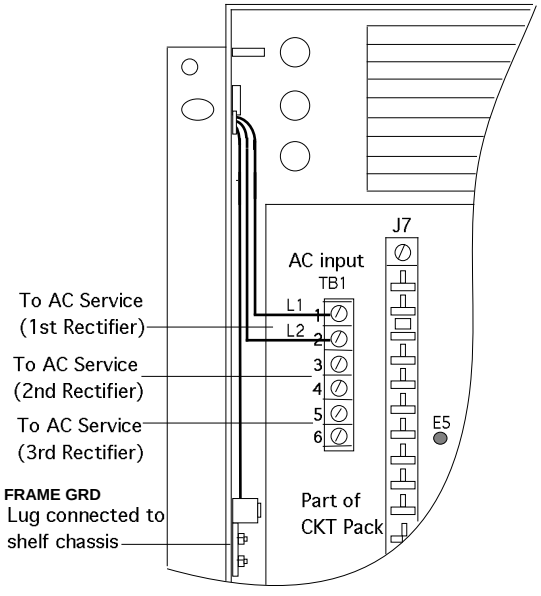


Figure 10
AC connections in the power shelf (from the AC duct)



BACK PANEL OF MPS 150 SHELF
FOR 50 A RECTIFIERS

AC wiring from the rear of the framework

Proceed as shown in Procedure 4 and Figures 11 and 12 to cable the AC input of the rectifiers from the rear of the framework.

Procedure 4
Wiring the AC input of the rectifiers from the rear of the framework

Step	Action
1	Install the required number and type of circuit breakers at the AC service panel. Refer to the “Specification” Chapter for the required breaker ratings.
2	Turn off and lock the breakers for the rectifiers at the AC service panel.
3	Determine the length of the flexible conduits required to bring the AC from the service panel to the rectifier shelves.
4	Cut the flexible conduits to the required length using a hacksaw or cable cutters. Run and dress the flexible conduits between the AC service panel and the System 600/48 power plant. Provide pull box(es) as required to facilitate cable running. The flexible conduits should be tied to cable racking with tie wraps.
5	Remove the blank panels at the front of the rectifier shelves. Use a flat blade screwdriver to loosen the retaining bars (the screws are captive).
6	Remove the knockouts and install isolation bushings for the three AC inputs at the rear of the shelf. ***Note:*** Isolation bushings are permitted per exception 250-75 of the National Electrical Code.
7	Attach the flexible conduits to the rear of the rectifier shelves using strain relief connectors as shown in Figure 11. Use a flat blade screwdriver to tighten the flexible conduits in the strain relief connectors.
8	Run the AC leads in the flexible conduits between the AC service panel and the rectifier shelves.
9	Make the power and ground connections inside the shelf first. Refer to Figure 12.
10	Make the power and ground connections at the AC service panel.
11	Replace the blank panels at the front of the shelves until the rectifiers are to be installed.
	—end—

Figure 11
AC wiring at the rear of the framework

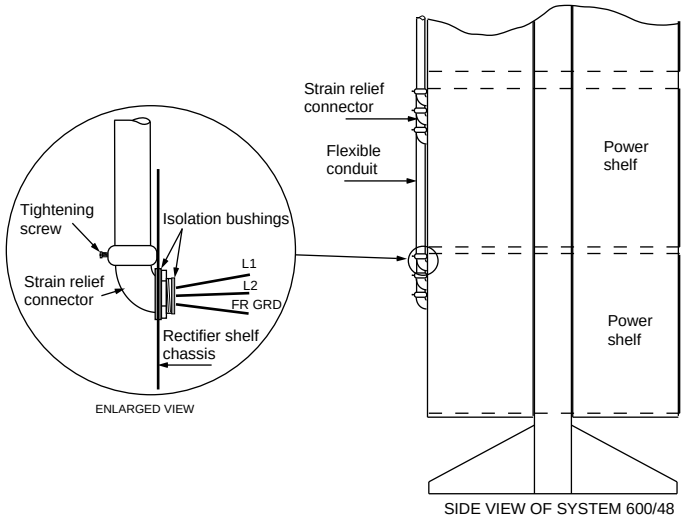
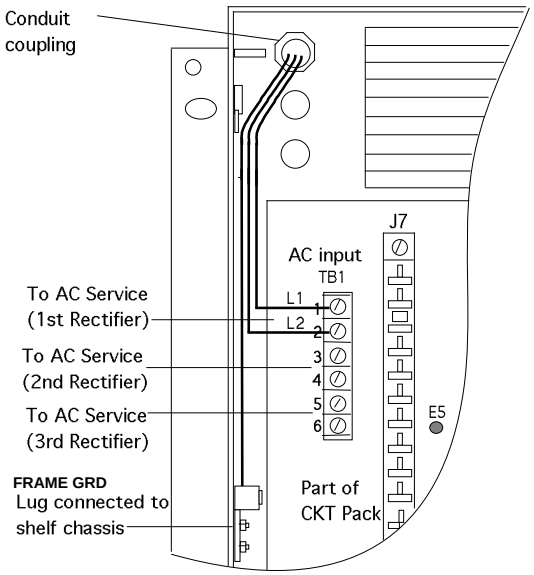


Figure 12
AC connections in the power shelf (from the rear of the framework)



BACK PANEL OF MPS 150 SHELF
FOR 50 A RECTIFIERS

DC cabling

The DC cabling is divided into four Sections:

- connecting a System 600/48 supplementary bay to a main bay or cabinet. This section is divided into three sub-Sections:

— cabling a System 600/48 supplementary bay to a System 600/48 main bay

— cabling a System 600/48 supplementary bay to a QCA13 cabinet

— cabling a System 600/48 supplementary bay to an MPP600 cabinet

Note: A specific cabling procedure applies to each of these three options. It is very important to follow the appropriate procedure which applies to your specific application to prevent any malfunction of the equipment.

- install the optional DC duct (P0614658)
- connecting the safety frame ground leads
- connecting the Meridian 1 loads
- connecting the batteries to the FACEP-600

Note: It is preferable to do the DC cabling in the above sequence. If one Section does not apply to your project, proceed to the next one.

Cabling a System 600/48 supplementary bay to a main bay or cabinet

IMPORTANT NOTE

Use the appropriate procedure for your specific application.

The cabling procedure is different whether the System 600/48 supplementary bay is added to a System 600/48 main bay, to an MPP600 cabinet, or to a QCA13 power cabinet. Select the procedure below that applies to your specific application.

Cabling a System 600/48 supplementary bay to a System 600/48 main bay

Proceed as shown in Procedure 5 and Figures 13 to 17 to do the cabling between a System 600/48 supplementary bay and a System 600/48 main bay.

Note 11: The following Procedure assumes that the physical installation and the AC wiring were completed for both System 600/48 bays.

Note 12: Although this Procedure can be completed with the System 600/48 powered up, it is recommended that the System 600/48 be powered down and the AC power removed, if possible.

Procedure 5
Cabling a System 600/48 supplementary bay to a System 600/48 main bay

Step	Action
1	On the NT6C14PE signal interface circuit card, ensure that the six miniature switches on the SW1 DIP switch module are all closed (pushed down towards the left).
2	Install and secure the P0821096 signal cable between the NT6C14PE signal interface circuit card in the supplementary bay and the NT6C25FF controller panel on the main bay.
3	In the supplementary bay, plug the two connectors at this end of the P0821096 signal cable into the J8 and J9 jacks on the NT6C14PE signal interface circuit card, and the individual wire to chassis ground (bottom mounting screw for the card). Refer to Figure 13.
4	In the NT6C25FF controller, plug the two connectors at the other end of the P0821096 cable into the J12 and J16 jacks, and the individual wires to TB9-4 and chassis ground. Refer to Figure 13.
5	Run and connect the black wire of the shielded force load cable between terminal E6 in the bottom right end corner of the upper MPS150 power shelf on the main bay and terminal E6 in the bottom right end corner of the upper MPS150 power shelf on the supplementary bay. Connect the shield at both ends, using the nearest mounting screw for the back plane circuit pack. Refer to Figure 15.
6	Run two 2/0 cables labelled (+) and two 2/0 cables labelled (–) between the MPS150 power shelves on the supplementary bay and the –CHG BAT and +BAT RTN charge busbars in the FACEP-600 panel on the main bay. Refer to Figure 14.
7	Using the appropriate lugs, connect the two 2/0 cables labelled (+) between the GRD terminal in both power shelves (see Figure 15) and the +BAT RTN busbar (on the left side) in the FACEP-600 (see Figure 16).
8	Using the appropriate lugs, connect the two 2/0 cables labelled (–) between the –48 terminal in both power shelves (see Figure 15) and the –CHG BAT busbar (on the right side) in the FACEP-600 (see Figure 16).
	—continued—

Procedure 5
Cabling a System 600/48 supplementary bay to a System 600/48 main bay

Step	Action
9	Run two 2/0 cables labelled (+) and two 2/0 cables labelled (–) between the FACBR-50 panel on the supplementary bay and the FACBR-50 panel on the main bay. Refer to Figure 14.
10	Using the bolts and “L” brackets supplied with the supplementary bay, install one bracket on each of the right rear busbar (+BAT RTN) and left rear busbar (–DISCH BAT) inside the FACBR-50 panel on the supplementary bay. Refer to Figure 17.
11	Repeat the above Step for the FACBR-50 panel on the main bay. Refer to Figure 17.
12	Using the appropriate lugs, connect the two 2/0 cable labelled (+) to the “L” bracket on the +BAT RTN and the two 2/0 cable labelled (–) to the “L” bracket on the –DISCH BAT battery busbars in the FACBR-50 distribution panel on the supplementary bay. Refer to Figure 17.
13	Using the appropriate lugs, connect the two 2/0 cables labelled (+) from the “L” bracket on the +BAT RTN busbar in the FACBR-50 distribution panel on the supplementary bay to the “L” bracket on the left rear busbar (+BAT RTN) in the FACBR-50 panel on the main bay. Refer to Figure 17.
14	Using the appropriate lugs, connect the two 2/0 cables labelled (–) from the “L” bracket on the –DISCH BAT busbar in f the FACBR-50 distribution panel in the supplementary bay to the “L” bracket on the right rear busbar (–DISCH BAT) in the FACBR-50 panel in the main bay. Refer to Figure 17.
	—end—

Figure 13
1 Connections for the signal cable on the signal interface circuit card

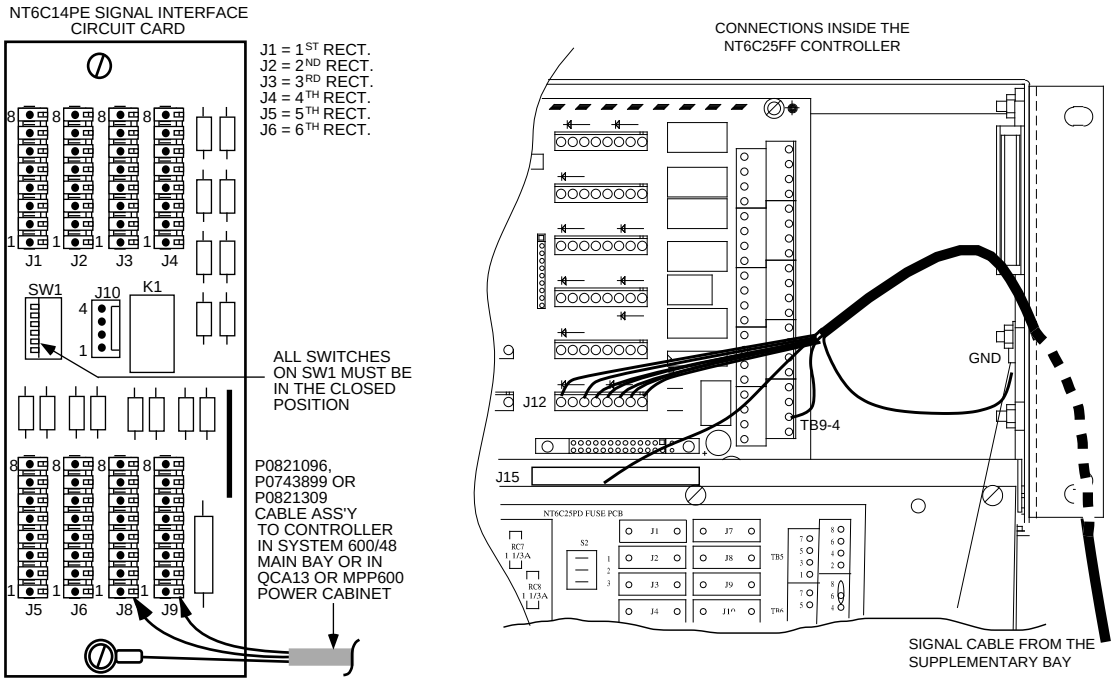


Figure 14
Cabling a System 600/48 supplementary bay to a System 600/48 main bay

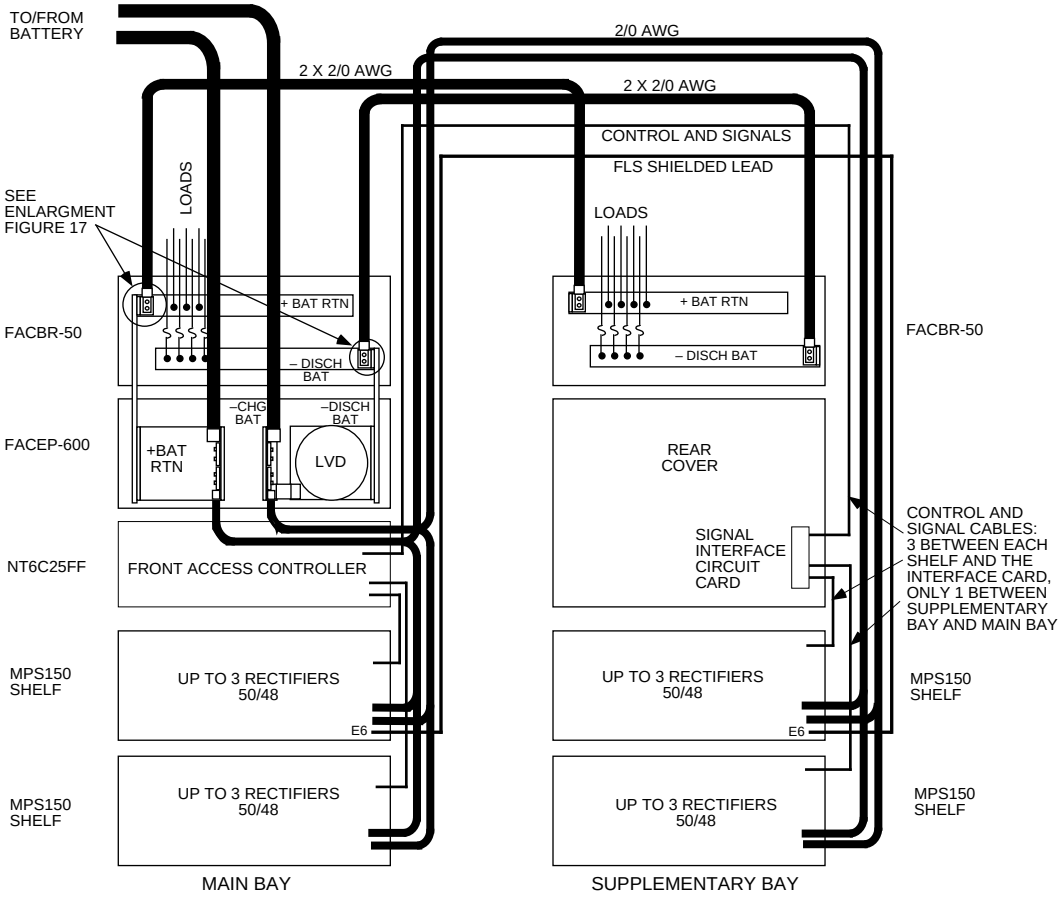


Figure 15
Connecting the force load share lead and the output cables inside the MPS150 shelf

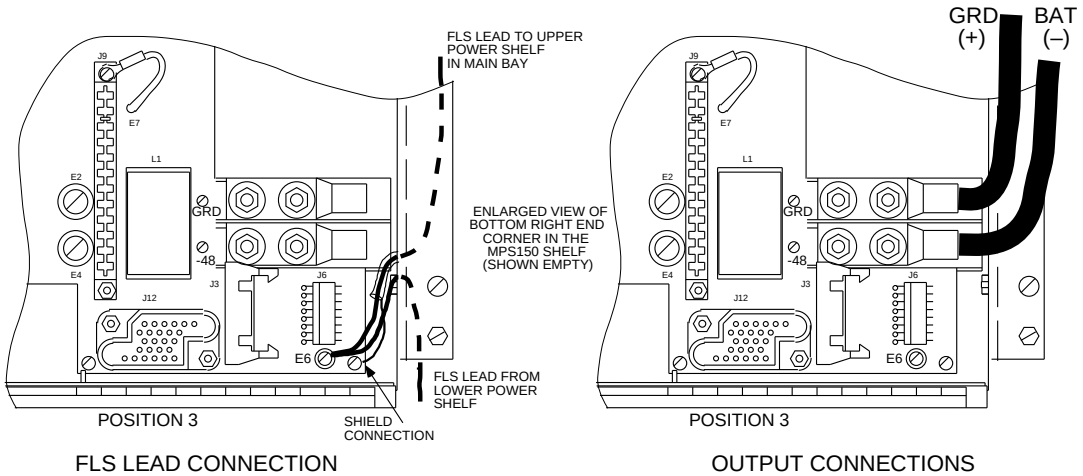


Figure 16
Connecting the rectifier shelves inside the FACEP-600 panel

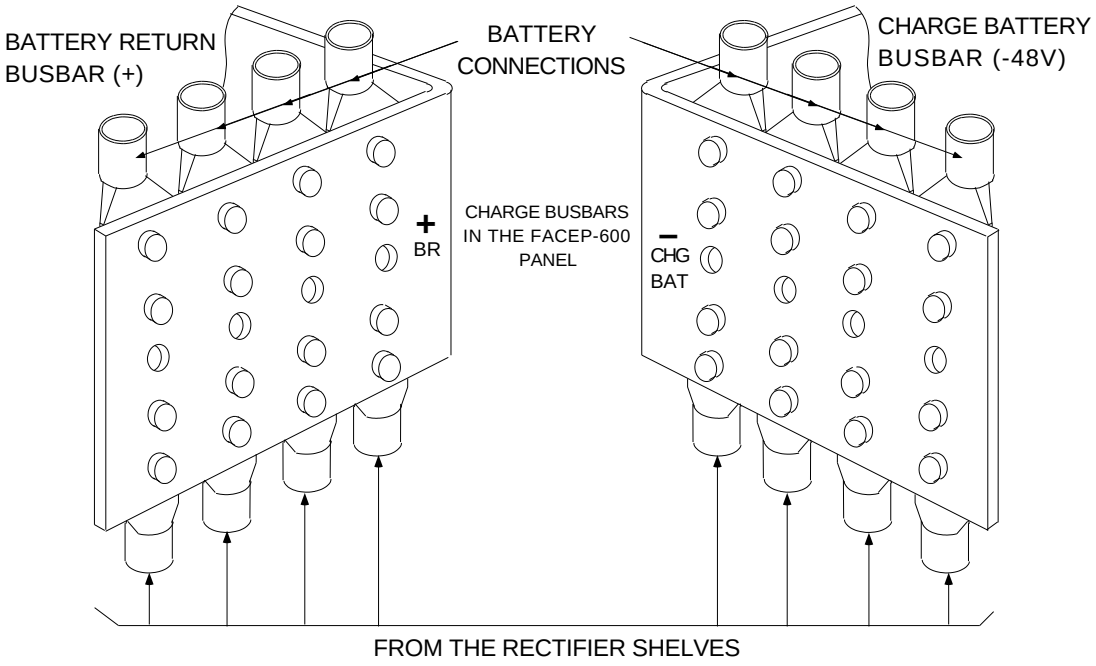
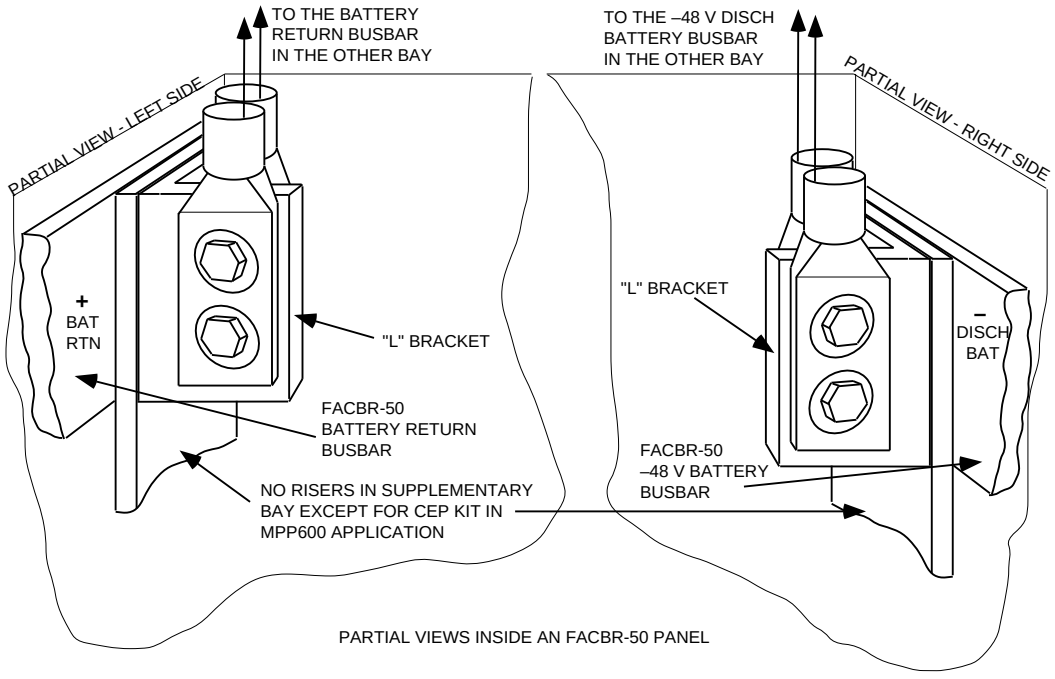


Figure 17
Mounting of and connecting to the "L" brackets inside the FACBR-50 panel



Cabling a System 600/48 supplementary bay to a QCA13 power cabinet

Proceed as shown in Procedure 6, Figures 13, 15 and 17 to 19 and Table 10 to install the cabling between a System 600/48 supplementary bay and a QCA13 power cabinet.

Note 1: The following Procedure assumes that the physical installation and the AC wiring were completed for the System 600/48 supplementary bay.

Note 2: Although this Procedure can be completed with the QCA13 powered up, it is recommended that the QCA13 be powered down and the AC power removed.

Procedure 6
Cabling a System 600/48 supplementary bay to a QCA13 power cabinet

Step	Action
1	Verify that the sense leads are installed on terminals 44 (VR+) and 46 (VR-) of the TSA connection strip in the J2412 controller in the QCA13 cabinet (see Figure 19). If not, install these leads now.
2	On the NT6C14PE signal interface circuit card, ensure that the six miniature switches on the SW1 DIP switch module are all closed (pushed down towards the left).
3	Install and secure the P0743899 signal cable between the NT6C14PE signal interface circuit card in the supplementary bay (connectorized end) and the QCA13 cabinet (individual wires end).
4	In the System 600/48 supplementary bay, plug the two 4 pin connectors at this end of the P0743899 signal cable into the J8 and J9 jacks on the NT6C14PE signal interface circuit card, ensuring that pin #1 on both connectors are aligned with pin # 1 on both jacks. Connect the individual wire to chassis ground (bottom mounting screw for the card). Refer to Figure 13.
5	In the QCA13 cabinet, connect the eight individual wires from the P0743899 signal cable according to Figure 19 and Table 10.
6	Run two 2/0 cables labelled (+) and two 2/0 cables labelled (–) between the MPS150 power shelves in the supplementary bay and the CHG+ and CHG– busbars in the QCA13 cabinet (upper left side of cabinet). Refer to Figure 18.
7	Using the appropriate lugs, connect the two 2/0 cables labelled (+) between the GRD terminal in both power shelves (see Figure 15) and the CHG+ busbar in the QCA13 cabinet (see Figure 18 - use empty positions).

—continued—

Procedure 6
Cabling a System 600/48 supplementary bay to a QCA13 power cabinet

Step	Action
8	Using the appropriate lugs, connect the two 2/0 cables labelled (–) between the –48 terminal in both power shelves (see Figure 15) and the CHG– busbar in the QCA13 cabinet (see Figure 18 - use empty positions).
9	Run two 2/0 cables labelled (+) and two 2/0 cables labelled (–) between the FACBR-50 panel in the System 600/48 supplementary bay and the +BAT RTN and –DISCH BAT busbars in the QCA13 cabinet (upper right side of cabinet). Refer to Figure 18. ***Note 1:*** The +BAT RTN busbar is also referred to as the GROUND WINDOW in the Meridian 1 documentation.
10	Using the bolts and “L” brackets supplied with the supplementary bay, install one bracket on each of the right rear busbar (+BAT RTN) and left rear busbar (–DISCH BAT) inside the FACBR-50 panel on the supplementary bay. Refer to Figure 17.
11	Using the appropriate lugs, connect the two 2/0 cables labelled (+) between the “L” bracket on the +BAT RTN busbar in the FACBR-50 distribution panel in the supplementary bay and the +BAT RTN battery return busbar in the QCA13 cabinet. Refer to Figure 18.
12	Using the appropriate lugs, connect the two 2/0 cables labelled (–) between the “L” bracket on the –DISCH BAT busbar in f the FACBR-50 distribution panel in the supplementary bay and the –DISCH BAT battery busbar in the QCA13 cabinet. Refer to Figure 18.
	—end—

Figure 18
Cabling the System 600/48 supplementary bay to a QCA13 power cabinet

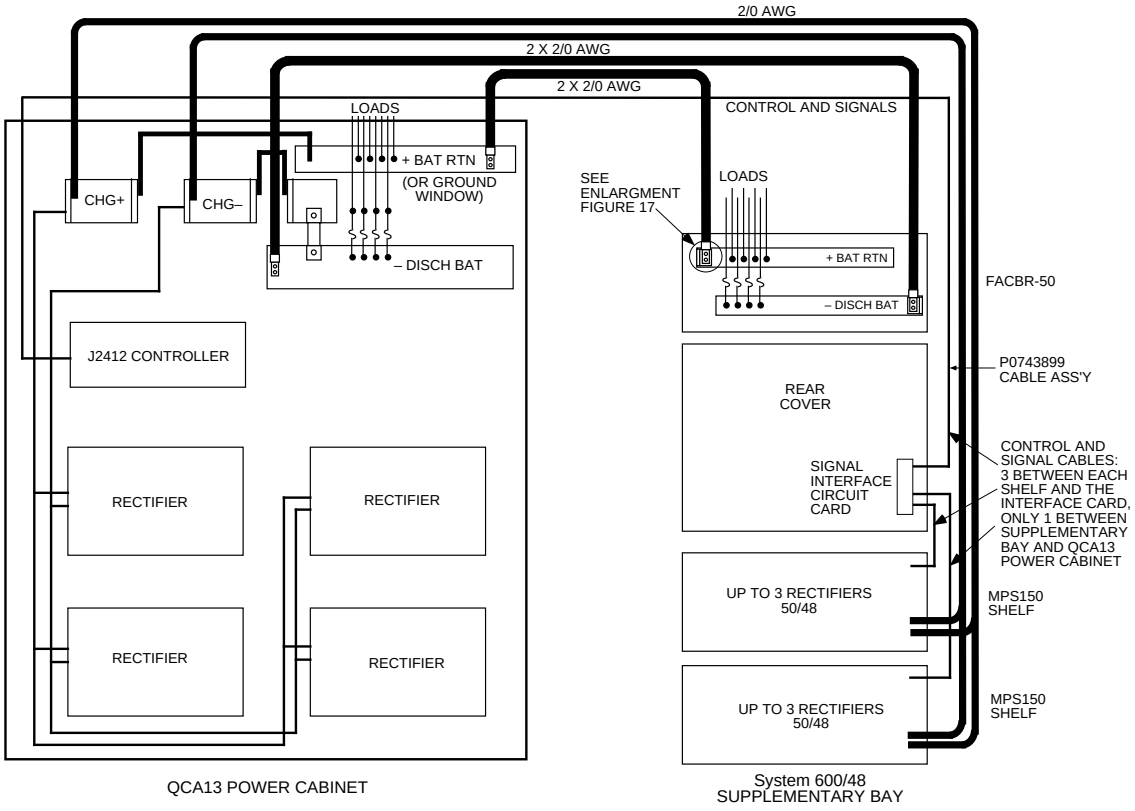


Figure 19
Pin assignment of the TSA connecting strip in the J2412 controller

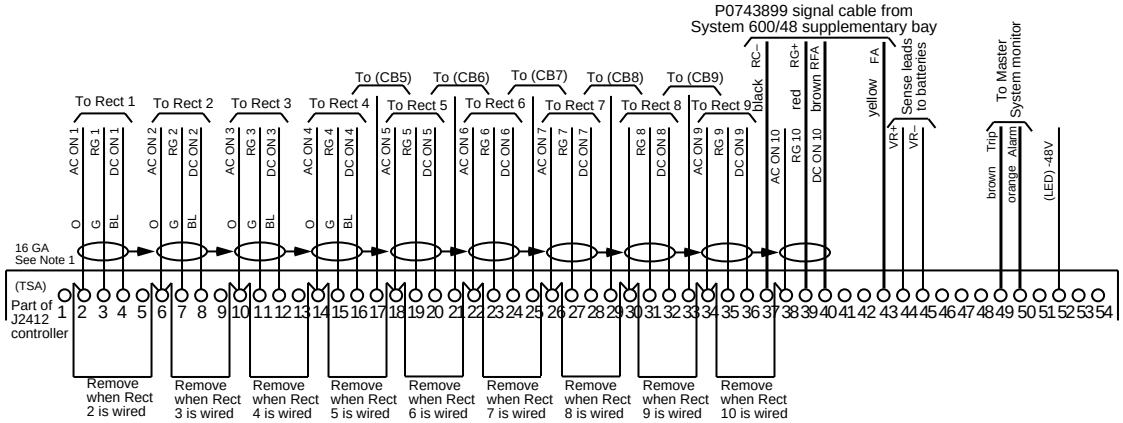


Table 10
Connecting assignment of P0743899 signal cable

From System 600/48 supplementary bay	J2412 controller in the QCA13 cabinet	Color	Designation
P8-1	N.C.	Green	EQL
P8-2	TSA 39	Black	RG +
P8-3	TSA 37	Red	RC –
P8-4	N.C.	Blue	Fan alarm
P9-1	N.C.	Orange	LVD signal
P9-2	TSA 43	Yellow	Bkr - fuse alarm
P9-3	N.C.	White	BR
P9-4	TSA 40	Brown	RFA

Cabling a System 600/48 supplementary bay to an MPP600 power cabinet

Proceed as shown in Procedure 7 and Figures 13, 15, 17 and 20 to 23 to do the cabling between a System 600/48 supplementary bay and an MPP600 power cabinet.

Note 1: The following Procedure assumes that the physical installation and the AC wiring were completed for the System 600/48 supplementary bay.

Note 2: Although this Procedure can be completed with the MPP600 powered up, it is recommended that the MPP600 be powered down and the AC power removed.

Procedure 7
Cabing a System 600/48 supplementary bay to an MPP600 power cabinet

Step	Action
1	Remove the 6 in. and 7 in. blank panel below the FACBR-50 distribution panel on the System 600/48 supplementary bay.
2	Remove the front cover of the FACBR-50 panel by turning the 1/4 turn captive screws counterclockwise.
3	Remove the 7 in. rear cover immediately below the FACBR-50 panel.
4	Install the new CEP panel immediately below the FACBR-50 panel.
5	Install the 10 inch BR busbar riser supplied with the CEP kit and one “L” bracket supplied with the supplementary bay on the left side of the FACBR-50 panel as shown in Figure 21.
	—continued—

Procedure 7
Cabing a System 600/48 supplementary bay to an MPP600 power cabinet

Step	Action
6	Install the 5 inch –DISCH BAT busbar riser and one “L” bracket on the right side of the FACBR-50 panel as shown in Figure 22.
7	Uncoil the yellow lead on the LVD relay in the CEP kit panel and install the connector pin into position 1 of connector J10 on the signal interface circuit card in the 8” rear cover. Refer to Figure 23.
8	On the NT6C14PE signal interface circuit card, ensure that the six miniature switches on the SW1 DIP switch module are all closed (pushed down towards the left).
9	Install and secure the P0821309 signal cable between the NT6C14PE signal interface circuit card in the System 600/48 supplementary bay and the NT6C14GI controller panel in the MPP600 power cabinet.
10	In the System 600/48 supplementary bay, plug the two connectors at this end of the P0821309 signal cable into J8 and J9 jacks on the NT6C14PE signal interface circuit card, and the single wire to chassis ground (bottom mounting screw for the card). Refer to Figure 13.
11	Inside the NT6C14GI controller on the MPP600 power cabinet, plug the connectors at the other end of the P0821309 signal cable into J8 and J9 jacks on the NT6C14PF circuit pack, and the single wire (shield) to chassis ground (nearest mounting screw).
12	Run and connect the shielded force load cable between terminal E6 in the bottom right end corner of the upper MPS150 power shelf on the MPP600 cabinet bay and terminal E6 in the bottom right end corner of the upper MPS150 power shelf on the supplementary bay. Connect the shield at both ends, using the nearest mounting screw for the back plane circuit pack. Refer to Figure 15.
13	Run two 2/0 cables labelled (+) and two 2/0 cables labelled (–) between the MPS150 power shelves and the +BAT RTN and –CHG BAT busbars inside the MPP600 power cabinet. Refer to Figure 20.
14	Using the appropriate lugs, connect the two 2/0 cables labelled (+) between the GRD terminal in both power shelves (see Figure 15) and the +BAT RTN busbar in the MPP600 power cabinet (see Figure 20).
15	Using the appropriate lugs, connect the two 2/0 cables labelled (–) between the –48 terminal in both power shelves (see Figure 15) and the –CHG BAT busbar in the MPP600 power cabinet (see Figure 20).
	—continued—

Procedure 7
Cabing a System 600/48 supplementary bay to an MPP600 power cabinet

Step	Action
16	Run two 2/0 cables labelled (+) and two 2/0 cables labelled (–) between the FACBR-50 panel in the System 600/48 supplementary bay and the +BAT RTN and –DISCH BAT busbars on top of the MPP600 power cabinet. Refer to Figure 20..
17	Using the appropriate lugs, connect two 2/0 cables labelled (+) between the “L” bracket on the +BAT RTN busbar in the FACBR-50 distribution panel on supplementary bay and the +BAT RTN battery return busbar in the MPP600 power cabinet. Refer to Figure 20.
18	Using the appropriate lugs, connect the two 2/0 cables labelled (–) between the –CHG BAT busbar in the CEP kit on the System 600/48 supplementary bay and the –DISCH BAT battery busbar in the MPP600 power cabinet. Refer to Figure 20.
	—end—

Figure 20
Cabling the System 600/48 supplementary bay to an MPP600 power cabinet

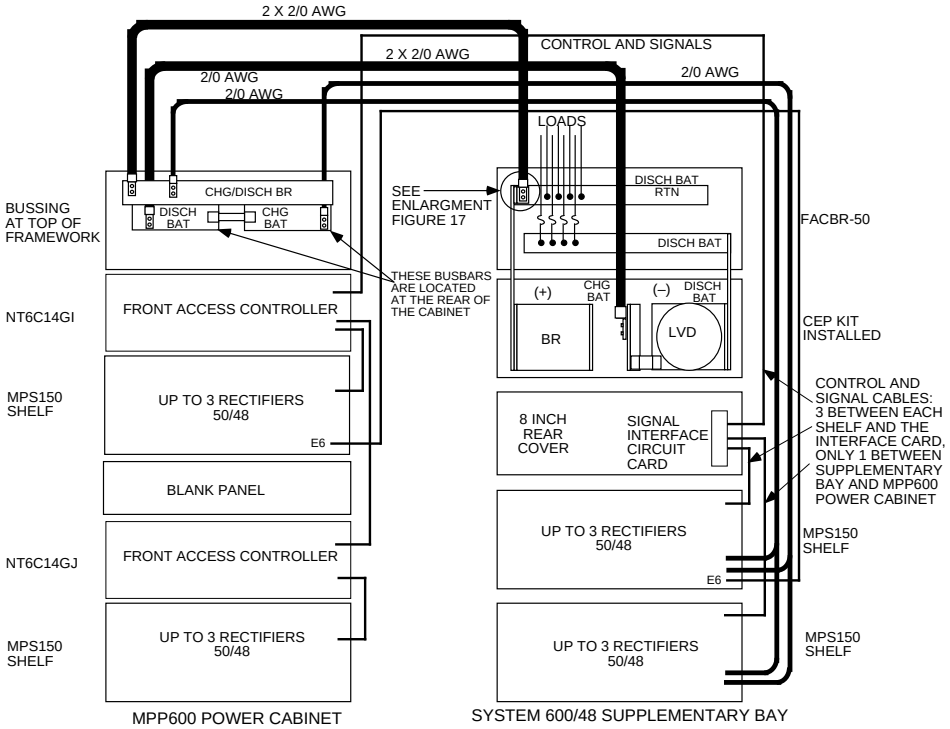


Figure 21
Details of BR busbar riser and "L" bracket assembly (left side)

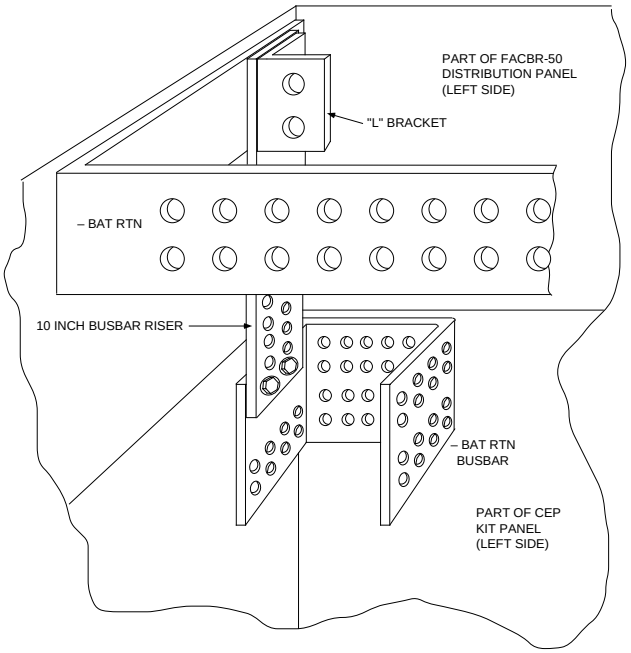


Figure 22
Details of CHG BAT busbar riser and "L" bracket assembly (right side)

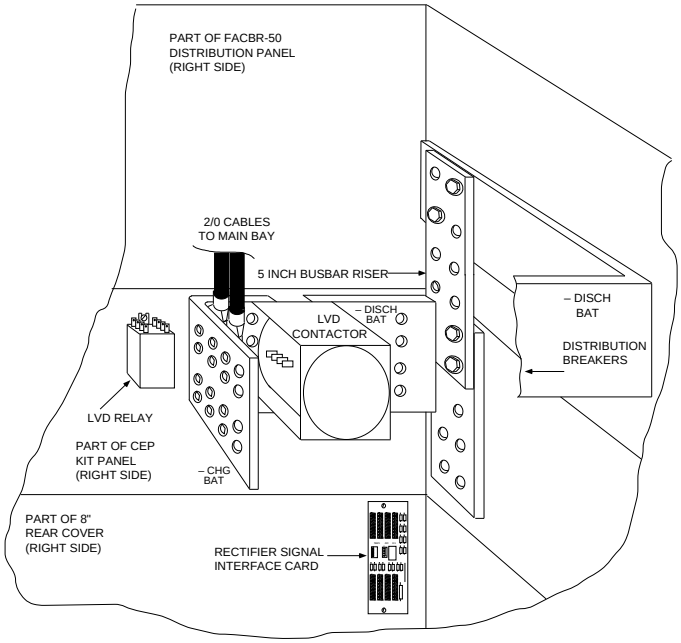
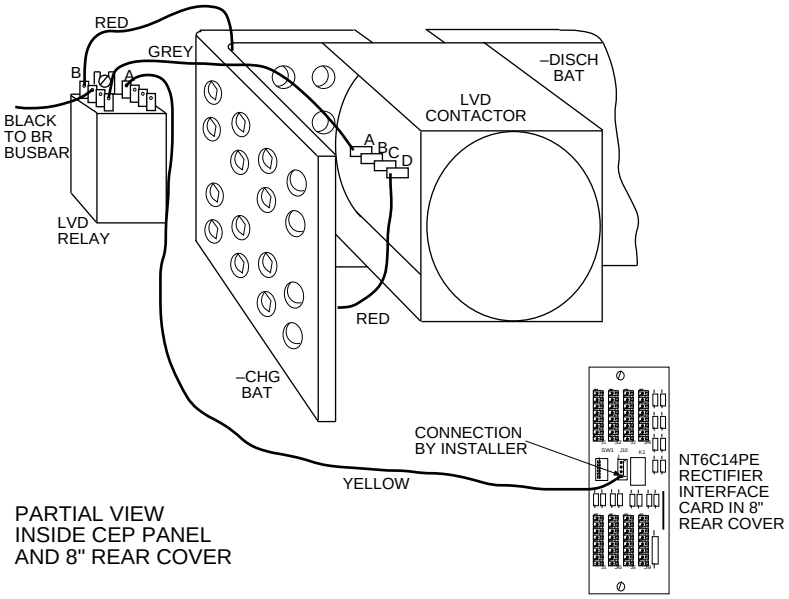


Figure 23
Wiring details of the LVD relay and contactor



Connecting the safety frame ground and battery/logic return reference leads

CAUTION
Safety ground requirement
The framework should be grounded ONLY to the ACEG (AC equipment ground).

Even though the green wire in the AC conduits is considered as an acceptable safety frame ground, it is common practice in telecommunications to install an additional frame ground. This ground will provide continued protection should the AC leads be disconnected for any reason.

When installing a complete new System 600/48,

- loop the frame ground of the main bay to the ACEG in the AC service panel (refer to Figure 24),
- run and connect install and connect a battery/logic return reference lead (#6 AWG or larger) between the +BR busbar in the main bay and the ACEG busbar in the AC service panel (refer to Figure 24), and
- loop the frame ground of the supplementary bay (if provided) to that of the main bay.

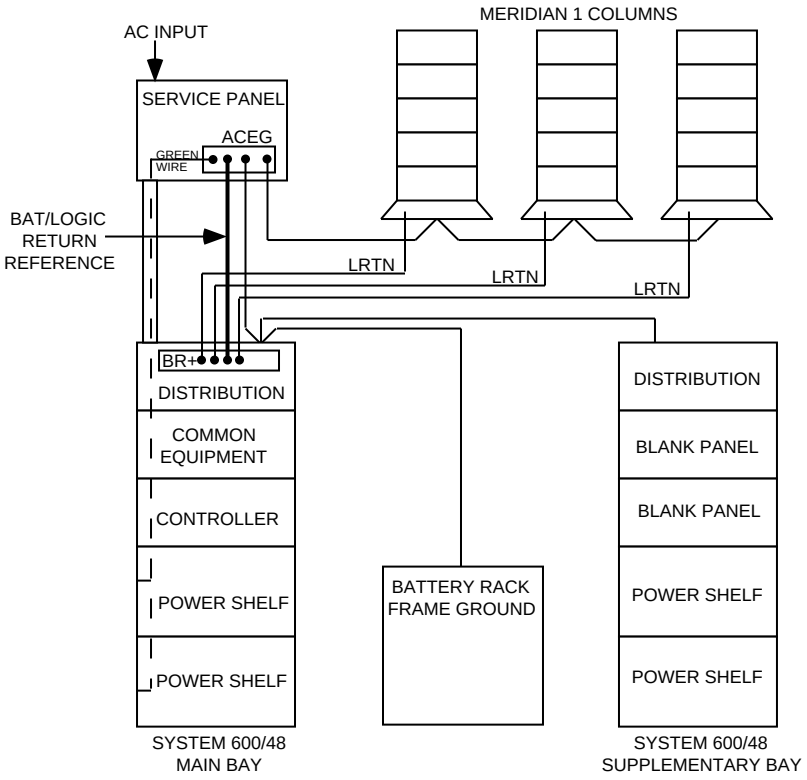
When adding a System 600/48 supplementary bay to a QCA13 or MPP600 power cabinet,

- loop the frame ground of the supplementary bay to that of the power cabinet, or
- to the closest Meridian bay, or
- directly to the ACEG in the AC service panel, whichever is more practical.

Note: The safety frame ground should not be confused with the logic return ground (LRTN). The safety frame ground is used for personnel protection, while the logic return ground provides a logic reference point for the –48 V.

Use # 6 AWG cable for the safety frame ground. A # 6 lug is supplied with and bolted to the top of every framework. Figure 24 shows a typical safety frame ground and batt/logic return reference layout in a Meridian installation.

Figure 24
Typical safety frame ground layout in a Meridian 1 installation



Connecting the Meridian 1 loads

The System 600/48 uses FACBR-50 breaker type distribution panels. The breakers used with the System 600/48 are midtrip. A standard breaker will send an alarm every time it is shut off. A midtrip breaker will not send an alarm when it is manually shut off. It will only send an alarm when electrically tripped (the toggle switch is in the mid position when an alarm is being sent).

The FACBR-50 circuit breaker panel comes equipped with 30 A circuit breakers (10 in the main bay and 8 in the supplementary bay), but can accommodate circuit breakers with capacity up to 50 A.

The FACEP-600 panel is also equipped with a 10 position GMT fuse block to supply miscellaneous small loads. Breakers and fuses are accessible by removing the front covers of the panels (1/4 turn captive screws).

Note: The top 2-in. flush mount panel can temporarily be removed for ease of access.

Installing circuit breakers

The System 600/48 comes equipped with the distribution circuit breakers, but if it becomes necessary to add a circuit breaker in the field, refer to Procedure 8 and Figure 25 below to install the breaker.

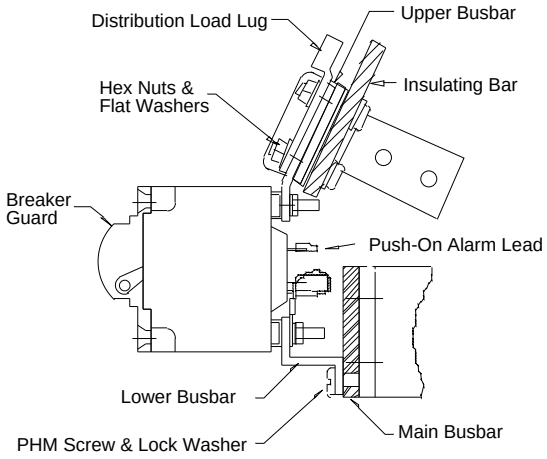
Procedure 8
Installing circuit breakers in the FACBR-50

Step	Action
1	Remove the front panel from the circuit breaker panel. Use a flat blade screwdriver to loosen the 1/4 turn captive screws.
2	Remove the black filler plate from the front panel. Use a socket wrench to loosen the hex nuts. Set the front panel and filler plate aside.
3	Push the alarm lead from the power plant onto the alarm pin of the breaker being installed (the upper pin at the rear of the breaker).
4	Fasten the breaker to the busbar inside the breaker panel. Refer to Figure 25.
5	Fasten the breaker to the insulating bar inside the breaker panel.
	—continued—

Procedure 8
Installing circuit breakers in the FACBR-50

Step	Action
6	Connect the load cables as described in the present Chapter.
7	Remove the appropriate number of filler positions from the black filler plate. Re-attach the filler plate to the front panel. Re-attach the front cover to the circuit breaker panel.
	—end—

Figure 25
Cross section of a circuit breaker kit - installed



Wiring GMT fuses

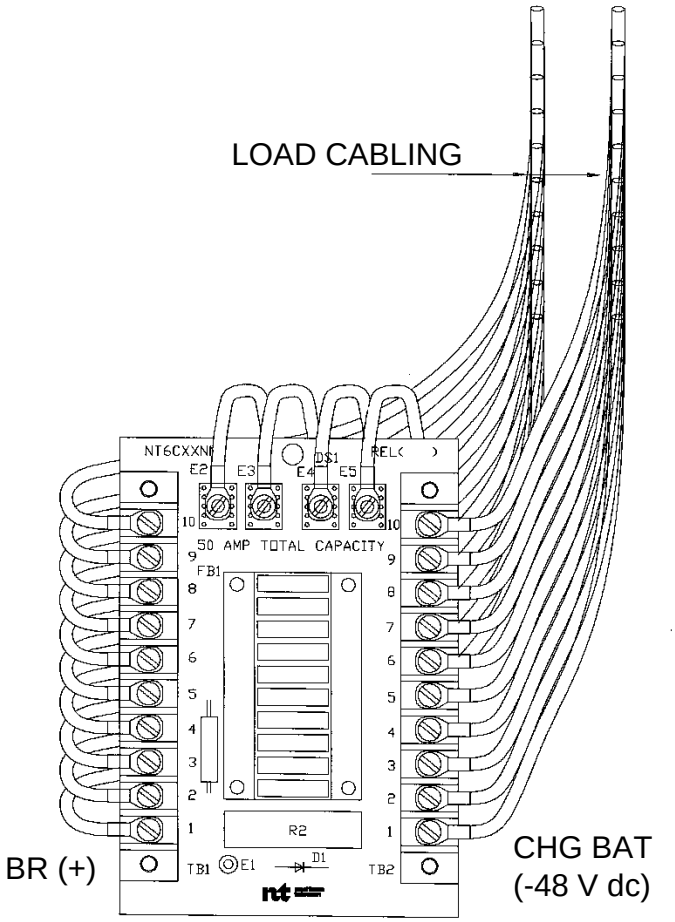
The GMT fuse block is located in the FACEP-600. Refer to Procedure 9 and Figure 26 below to connect loads to GMT fuses.

CAUTION
Protect the equipment against electrical damage.
Do not exceed the 50 A total rating for the NT6C18PE GMT circuit pack.

Procedure 9
Wiring GMT fuses

Step	Action
1	Ensure that all fuses are removed from the GMT fuse block.
2	Remove the front panel of the FACEP-600. Use a flat blade screwdriver to loosen the 1/4 turn captive screws.
3	Make battery and battery return connections at the terminal strips. TB2 is for battery and TB1 is for battery return. Each terminal strip position corresponds directly to each fuse. Refer to Figure 26
4	Reinstall the front panel.
5	Install the GMT fuses as required.
	—end—

Figure 26
Front view of the GMT fuse block



Connecting loads to the FACBR-50

The BAT (-48VDC) circuit breaker outputs inside the FACBR-50 are accessible by running the wire behind the DISCH BAT RTN busbar and down to the two hole lugs on the barrier type terminal strip above the breakers.

The BR and LRTN connections are made on the DISCH BAT RTN busbar. Position 1 (left most) accepts a two hole lug. Position 2 has a busbar angle attached to accept both a BR and an LRTN lug, back-to-back, as shown in Figure 28. Position 3, again, accepts a BR lug. The arrangement continues in this manner to the end of the DISCH BAT RTN busbar.

This arrangement is such that five wires, 2 BAT, 2 BR and 1 LRTN enter the top of the plant through one knockout in the conduit/bushings plate.

The circuit breaker and the battery return lugs are the two hole type. The holes are for 1/4 in. diameter studs or screws. The center to center spacing between the holes is 1.00 inch.

Since the load connections are close to each other, it is recommended to use shrink tubing on all battery and ground connections in the FACBR-50 panel.

Refer to Procedure 10 and Figures 25, 27 and 28 to connect loads inside the FACBR-50 distribution panel.

Procedure 10
Cabling the loads inside the FACBR-50 distribution panel

Step	Action
1	Remove the front panel of the FACBR-50. Use a flat blade screwdriver to loosen the 1/4 turn captive screws.
2	Ensure that the breakers to which loads are being connected are in the off position.
3	Connect the -48 V battery cables to the load side of the circuit breakers as required. Apply a torque of 8 ft/lb (11 Nm). Refer to Figure 25 for a side view of a breaker with the connecting details.
4	For the first column, install the first BR connection by securing the lug directly to the +BAT RTN busbar in position 1 as shown in Figures 27 and 28. Apply a torque of 8 ft/lb (11 Nm).
5	For the first column, the second BR connection and the first LR connection are secured, with lugs back-to-back, on the busbar angle installed at position 2. Use two nuts, two screws and four flat washers to secure the lugs on the busbar angle. Apply a torque of 8 ft/lb (11 Nm).
6	Repeat Steps 4 and 5 for each consecutive column.
7	Continue in this manner until all BR and LR connections have been secured.
8	Reinstall the front panel.
	—end—

Figure 27
Circuit breaker output (-48 V dc) battery return (BR) and logic return (LRTN) connections inside the FACBR-50 distribution panel

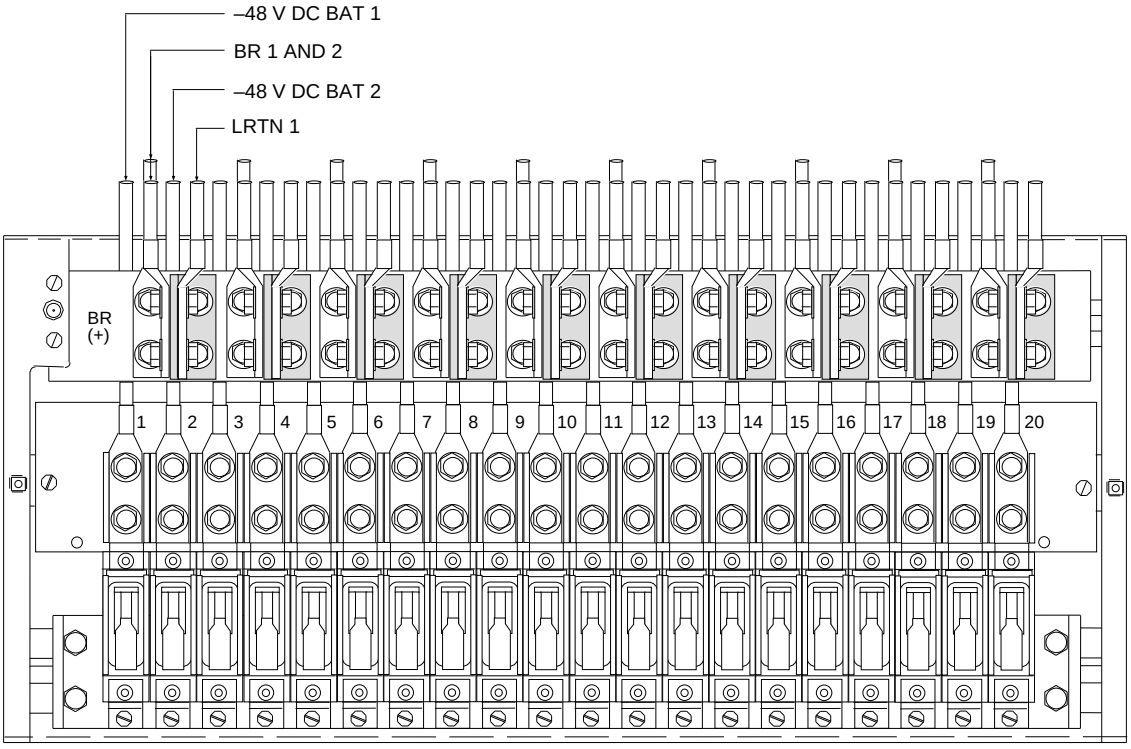
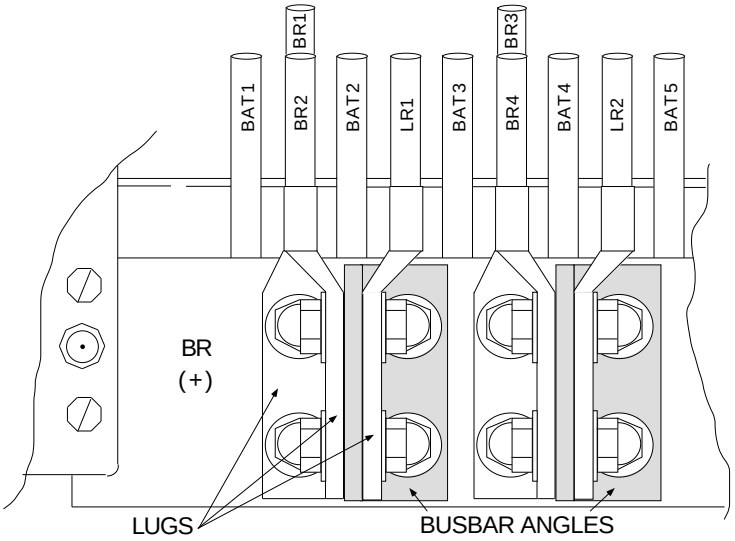


Figure 28
Details of the battery return (BR) and logic return (LRTN) connections on the DISCH BAT RTN busbar



Connections at the Meridian 1 equipment

This Procedure explains how to connect a System 600/48 power plant to the NT7D67CB DC Power distribution unit located in the Meridian 1 pedestal. This procedure assumes that the power plant has been installed and tested according to the installation instructions given previously in this document. This procedure specifies how to connect both power and signal leads.

> ***Note 1:*** Conduit is not required with the NT7D67CB PDU. However, 1-1/4 or 3/4 in. conduit can be installed if required by local codes or individual installation.
>
> ***Note 2:*** Make sure the AC input breakers are turned OFF at the AC service panel and the batteries are disconnected before proceeding.

Refer to Power engineering NTP (553-3001-152) for information about calculating the size and number of power conductors required.

If conduit is required, power wiring to the Meridian 1 pedestal can be installed in flexible or rigid metallic conduit. Up to seventeen 3/4 in. and up to seven 1-1/4 in. concentric knockouts are provided at the top of the System 600/48 distribution panel.

The pedestal can accommodate up to two 3/4 in. or 1-1/4 in. conduit (or a combination of both). If desired, the conduit may be clamped near the DC PDU (see Figure 30). Additionally, the NT7D0902 rear mount conduit/wiring kit may be used for conduit connections which must enter the pedestal from the rear at floor level.

A maximum of five # 8 AWG wires can be installed in the 3/4 in. conduit, which will be adequate for most installations. A maximum loop drop of two volts is allowed between the pedestal and the System 600/48 power plant. Table 11 provides acceptable wire sizes and distances from the distribution panel to the pedestal.

Use black wire for all BAT and BAT RTN connections. The copper ground busbar which is mounted in the control and distribution panels are used as the logic return equalizer (LRE) in this system

Some installations (ex.: with distances greater than 80 ft.) require an NT6D53AA junction box. The NT6D53AA junction box is equipped with a 10 ft. (3050 mm) flexible conduit which contains all the necessary wiring to connect DC power to the pedestal. The junction box must be installed close enough to the pedestal to allow the conduit to reach inside the top cap of the pedestal, the bottom of the pedestal where it will be secured by clamp (see Figure 30), or to the NT7D0902 rear mount conduit/wiring kit. Two 1-1/4 in. conduits can be installed from the System 600/48 power source to the junction box. The connections in the box can accept up to #4 AWG size wire.

The following Table and Figures provide wire gauge requirements and power plant connection information.

Table 11
Wire gauge requirements

Distance	Single conduit	Dual conduit	Junction box with single 4 AWG run *	Junction box with double 4 AWG run *
	8 AWG	6 AWG	4 AWG	4 AWG
0-10 FT	YES	YES	YES	YES
0-20 FT	YES	YES	YES	YES
0-30 FT	YES	YES	YES	YES
0-40 FT	YES	YES	YES	YES
0-50 FT	YES	YES	YES	YES
0-60 FT	NO	YES	YES	YES
0-70 FT	NO	YES	YES	YES
0-80 FT	NO	YES	YES	YES
0-90 FT	NO	NO	YES	YES
0-100 FT	NO	NO	YES	YES
0-200 FT	NO	NO	NO	NO
200 + FT	NO	NO	NO	NO

Note 1: Two 30 A feeds are typically adequate for a full Meridian 1 column of four modules (five wires total - two 30 A feed pairs plus one logic return with all wires of the same gauge).

Note 2: When using dual conduit, the wires must be run in BAT/BAT RTN pairs with one pair in one conduit and the other pair plus LRTN in the other conduit.

* A single or double pair run of 4 AWG wire per conduit is used from the distribution point of the NT6C53AA junction box near the pedestal. 10 AWG wire in a single conduit (supplied with the junction box) is run from the junction box to the pedestal.

Legend:

- YES = Wire size is adequate for distance.
- NO = Wire size has too high a voltage drop and is inadequate for the distance.
  - Where the distance is the length of wire required between the distribution panel of the System 600/48 and the pedestal.

Figure 29
System 600/48 to Meridian 1 pedestal power connections

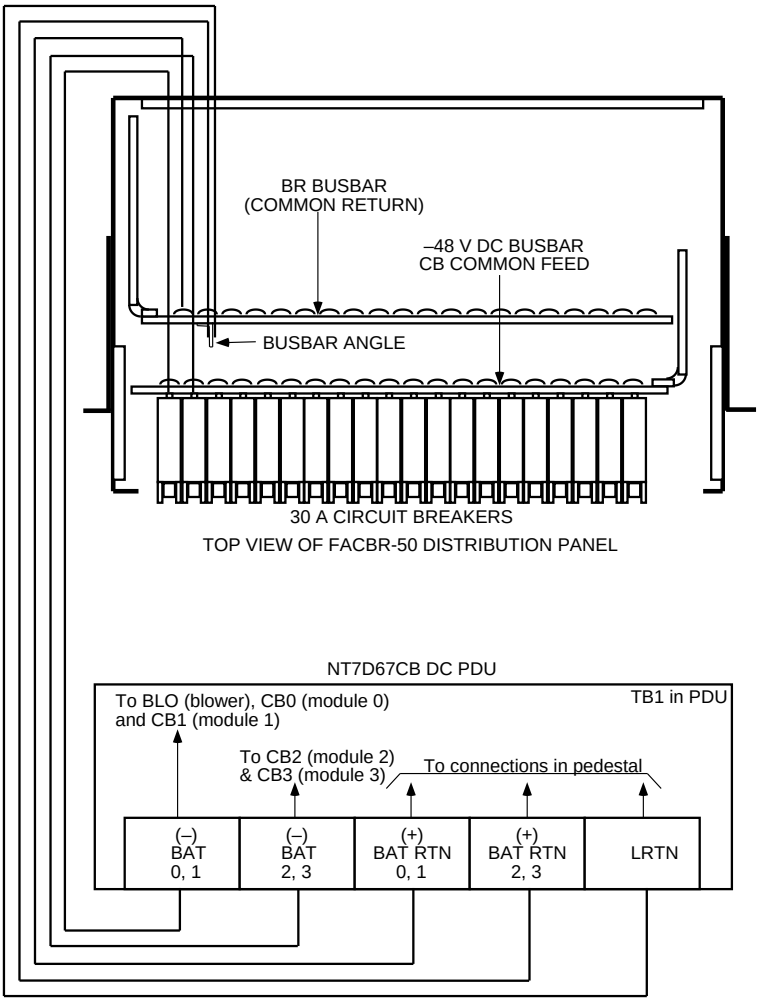


Table 12
System 600/48 to Meridian 1 or old SL-1 pedestal alarm connections

Alarm name in Meridian 1 or older SL-1	Wire color in NT8D46A cable	Terminal block in NT6C25FF	Type of relay contact	Alarm type in System600/48
Alarm	Orange	TB2-6	N.O.	LF (low float)
DCON 0	Black	TB4-8	N.O.	RFA
DCON 1, 2 & 3	Red, white & green	TB5-2	N.C.	MAJOR

Note: SENSE and TRIP off of the SL-1 cabinet (QCA type) will not be connected, this function is now managed by the System 600/48 from the batteries.

Figure 30
Pedestal rear view showing the NT7D67CB DC PDU

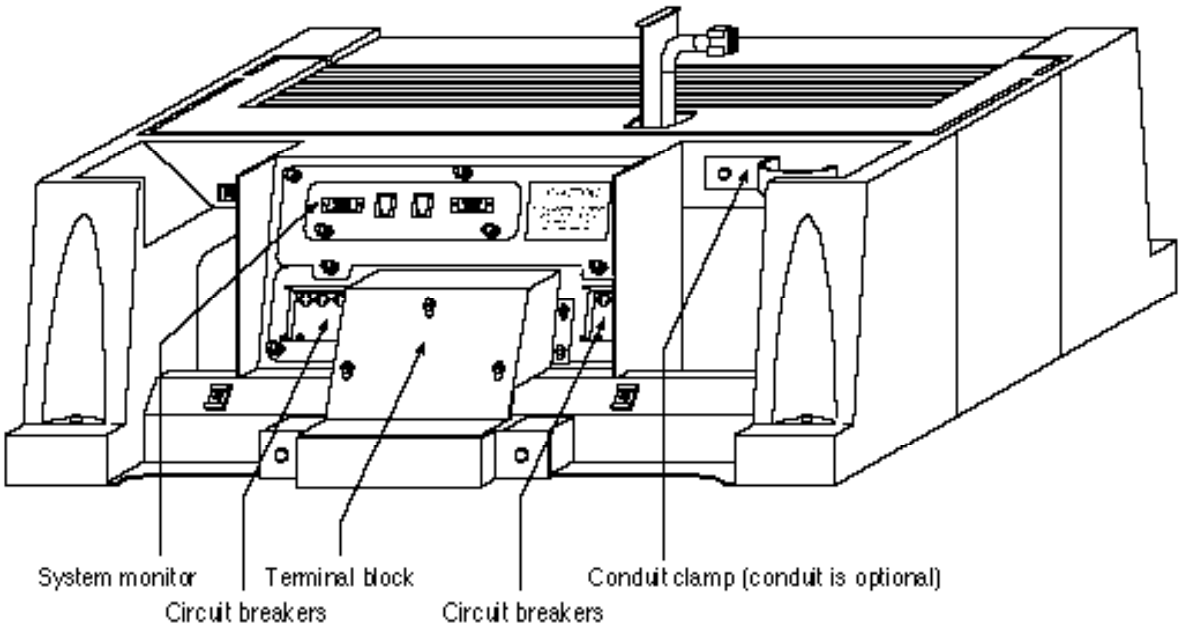
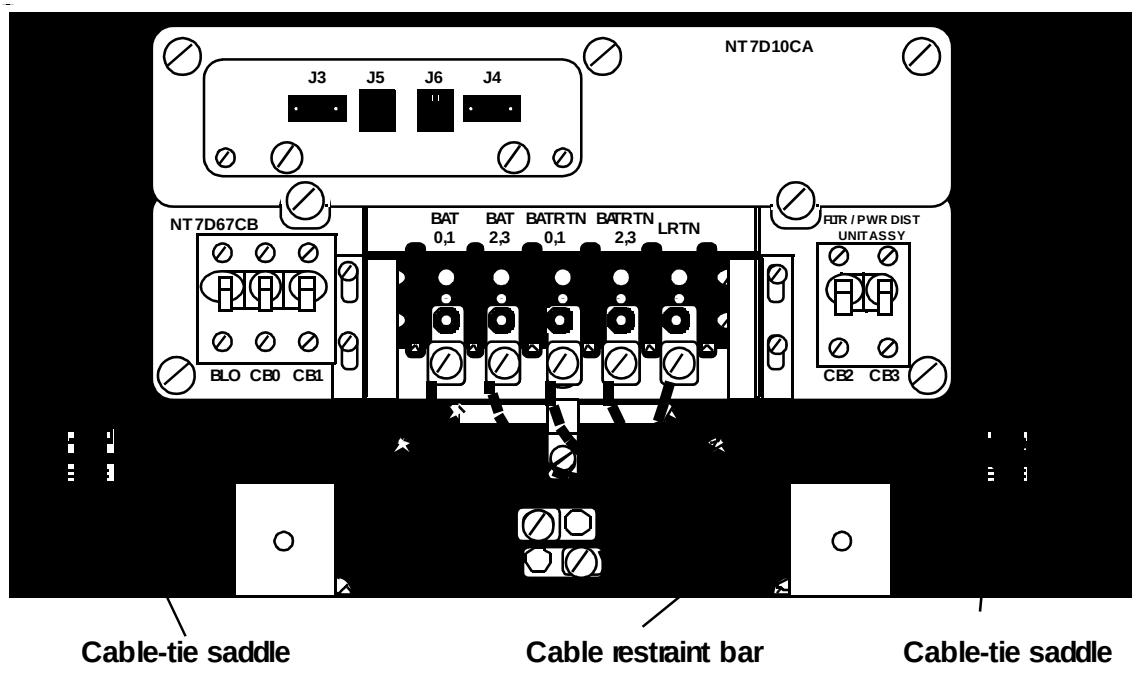


Figure 31
PDU position and wiring at rear of pedestal



Electrical connections to Meridian 1 with "OLD" (internal) NT7D10 PDU

Note: Conduit is required for the NT7D10 PDU

Proceed as shown in Procedure 11 and Figures 29 to 31 to do the electrical connections at a Meridian 1 pedestal. Repeat the Procedure for each column.

Procedure 11
Electrical connections to the Meridian 1 pedestal

Step	Action
1	***Note:*** Perform Steps 1 through 7 for each equipment column. Perform this step if the NT7D10 PDU is still installed in the pedestal. • Remove the rear grill from the pedestal. • Remove the rear cover from the module directly above the PDU. • Remove the rear plate from the I/O panel. • Disconnect the System Monitor and power cable from the module to the PDU. • If the module has an SDI paddle board, temporarily remove it to avoid damage. • Disconnect any cables that are connected to the System Monitor. • Loosen the retaining screws securing the PDU. • Remove the PDU to access TB1 at the bottom of the pedestal.
2	Install the junction box, if one is required, near the pedestal it will serve. Install the flexible conduit from the box into one of the conduit access holes in the pedestal. Connect the wires from the junction box to the corresponding connections on TB1. The wires are labelled as follows: • Four wires are labelled BAT0 through BAT3. • Four wires are labelled RTN0 through RTN3. • One wire is labelled FGRD. • The remaining wire is labelled LRTN.
	—continued—

Procedure 11
Electrical connections to the Meridian 1 pedestal

Step	Action
3	***Note:*** If a junction box is used, the connections in Steps 3 through 5 apply to the junction box, rather than the pedestal. Install the number of power wires required from the System 600/48 to the pedestal or junction box. All wires should be black. The –48V "BAT" and +48V "RTN" wiring pairs must be installed in the same conduit and must include the LRTN wire.
4	Connect the -BAT wiring from the first two circuit breakers in the FACBR-50 distribution panel located on the System 600/48 to TB1. Each wire from the circuit breakers is used to feed –BAT to two modules. It is connected to the modules as follows: • For module 0 and module 1 (from the first circuit breaker), connect to –BAT0 and add a strap (if not already installed) between -BAT0 and –BAT1. • For module 2 and module 3 (from the second circuit breaker), connect to –BAT2 and add a strap (if not already installed) between -BAT2 and –BAT3.
5	Connect the +RTN wiring from the +BAT RTN/LRE busbar located in the FACBR-50 distribution panel located on the System 600/48 to TB1. Each wire is used to feed +RTN to pairs of modules (for a total of two wires per pedestal for +RTN connections). It is connected to the modules as follows: • For module 0 and module 1 (from the first RTN position), connect to +RTN0 and add a strap (if not already installed) between +RTN0 and +RTN1 • For module 2 and module 3 (from the second RTN position), connect to +RTN2 and add a strap (if not already installed) between +RTN2 and +RTN3.
	—continued—

Procedure 11
Electrical connections to the Meridian 1 pedestal

Step	Action
6	Connect the LRTN wire (same size as other power conductors) from the +BAT RTN/LRE to LRTN on TB1.
7	Reinstall the PDU as follows: • Remove the front grill from the pedestal and slide the blower unit out approximately 3 in. (75 mm). • Insert the PDU and secure it with its retaining screws. • Insert the blower unit until it is properly plugged into the PDU. • Reinstall the front grill on the pedestal. • Reconnect the system monitor and power cables from the module to the top of the PDU. • Reinstall the SDI paddle board if it was removed. • Reinstall the rear plate on the I/O panel. • Reinstall the rear cover on the module. • Reconnect any cables that were disconnected from the front of the system monitor. • Reinstall the rear grill on the pedestal.
	—end—

System Monitor connections

This Procedure applies only to the CPU0 pedestal of the Meridian 1 system connecting to the System 600/48.

When connecting a System 600/48 to the Meridian 1, an NT8D46AV (32 ft), BV (64 ft), or CV (100 ft) cable is required to extend the LF alarm, DCON 0 (RFA alarm), and DCON 1, 2 and 3 (MAJOR alarm) signals from the System 600/48 to the System monitor. The trip lead is not required. Refer to Procedure 12 and Table 12.

These connections are made to terminal blocks TB2, TB4 and TB5, located in the NT6C25FF front access controller.

Procedure 12
System monitor connections (see Table 12)

Step	Action
1	Verify that a 22 AWG strap is connected between the positive (ground) charge busbar and TB2-4.
2	Verify that 22 AWG straps are connected between TB2-4 and TB4-6, as well as between TB4-6 and TB5-1.
3	Connect the orange wire (alarm) in the NT8D46AV, BV or CV cable to the LF (NO) terminal, position TB2-6, in the System 600/48 front access controller.
4	Connect the black wire (DCON 0) in the NT8D46AV, BV or CV cable to the RFA (NO) terminal, position TB4-8, in the System 600/48 front access controller.
5	Connect the red, white and green wires (DCON 0, 1 and 2) in the NT8D46AV, BV or CV cable to the MAJOR (NC) terminal, position TB5-2, in the System 600/48 front access controller (see note below).
6	Plug the other end of the NT8D46AV, BV or CV cable in the System Monitor connector J4 in column 0.
7	Install the rear grill on the pedestal.
8	Reconnect AC input and battery (if applicable) to the System 600/48.
	—end—

Note: The MAJOR alarm connection is used for the reporting of the following major alarm conditions from the System 600/48:

- High Voltage Shutdown (HVSD)
- High Voltage (HV)
- Battery On Discharge (BOD)
- Low Voltage (LV)
- Low Voltage Disconnect (LVD)
- Alarm Bus Supply (ABS)
- Internal Fuse Alarm (INT FA)
- Fuse Alarm (FA)
- Multiple Rectifier Failure Alarm (RFA MAJOR)

Installing the rectifiers in the power shelves

The System 600/48 is equipped with 50 A plug-in rectifiers. Refer to Procedure 13 to install the rectifiers in the power shelves.

Procedure 13
Installing the rectifiers

Step	Action
1	Use a flat blade screwdriver to release the captive screw on the rectifier shelf retaining bar and swing the bar down.
2	Remove the blank filler face plate by lifting it up, pulling the bottom out and lowering it. ***Note:*** Should a rectifier be removed at any time, reinstall the blank panel to meet UL/CSA regulation.
3	Place the blank filler plate at the bottom of the shelf under the rectifier, with the tape strips up and the screw hole towards the back.
4	Verify that the AC, DC and control cabling for the three rectifier positions has been completed.
5	Verify that the AC and DC breakers on the front panel of the rectifier are in the OFF position.
6	Slide the rectifier into the appropriate slot, ensuring that it is fully inserted.
7	Raise the rectifier retaining bar and tighten the captive screw to secure the rectifiers into position.
8	Repeat the procedure for each rectifier in the shelf.
	—end—

Start-up overview

Start-up involves powering of the rectifiers and adjustment of all the operating parameters for the complete power plant. The start-up procedures for the 50 A rectifier and the NT6C25FF front access controller are included herein.

Unless otherwise specified, the rectifiers are factory adjusted as follows:

- Float voltage -52.1 V dc
- Equalize voltage 0.70 V dc above float
- High voltage shut down -57.0 V dc
- Current limit 52.5 A
- Start-up delay 4 seconds
- Load sharing slope load sharing method

CAUTION
Float voltages. Equalizes voltages and Alarm adjustments of the rectifiers and the plant controller should be made according to the battery manufacturer's installation guide, or damage to the battery may result. Appendix E lists the suggested voltage and alarm level settings based on the type of batteries being used.

If batteries will not be connected to the power plant, the float voltage may be adjusted anywhere between -52.1 Vdc and -56.0 Vdc. The Equalize timer should be disabled at the controller panel and the following equalization adjustments may be disregarded in this case.

Start-up, verification and adjustments of the rectifiers

IMPORTANT NOTE
The current meter calibration (CUR CAL) and current limit adjust (CLADJ) potentiometers on the rectifiers must not be removed.

Start-up and adjust the rectifier's operating parameters as described in the following Procedure. Rectifiers are to be adjusted one at a time with the AC and DC circuit breakers of all rectifiers set to OFF.

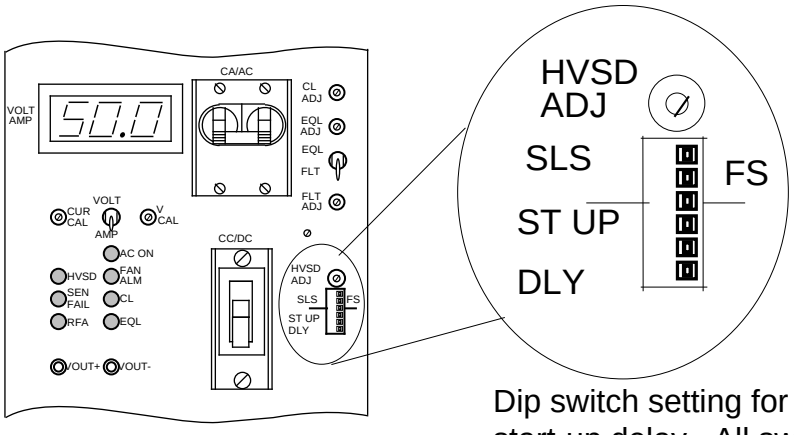
Procedure 14
Start-up and adjustments of the NT5C07AC rectifiers

Step	Action
1	***Plant meter calibration*** Before adjusting the float voltage of the first rectifier, the plant volt meter on the Front Access Controller Panel must be calibrated. Set the AC and DC circuit breakers on the first rectifier to ON. Operate the PLT switch on the front access controller to the VOLT position. Connect an external voltmeter to the Discharge Battery Return buses and verify that its reading matches the plant controller meter reading. If it does not match, adjust the PLT V ADJ potentiometer until the controller meter reading is within 10 mV of the external meter reading. Set the DC circuit breaker of the first rectifier to OFF.
2	***Rectifier switch settings*** Set the miniature dip switches on all rectifiers to Force Load Share and 4 Second Start-up Delay as shown in Figure 32.
3	***Rectifier meter calibration*** Set the AC circuit breaker on the rectifier being adjusted to ON and verify that the AC ON indicator lights. Do NOT set the DC circuit breaker of the rectifier to ON at this time, and ignore the SEN FAIL and RFA indicators.
4	Place the meter selector switch to the VOLT position and connect an external meter to the VOUT+ and VOUT- test points and verify that its reading matches the rectifier meter reading. If it does not match, adjust the V CAL potentiometer until the rectifier meter reading is within 50 mV of the external meter reading. Remove the external volt meter.
5	***High voltage shutdown adjustment*** Adjust the high voltage shutdown level by turning the FLT ADJ potentiometer slowly clockwise until the rectifier volt meter reads -56.1 V. Turn the HVSD ADJ potentiometer slowly counter clockwise until the output voltage begins to drop. Within a few seconds the rectifier will attempt to restart. When the output voltage again reaches 56.1 V the rectifier will shut down and the HVSD indicator will light. Turn the FLT ADJ potentiometer counter clockwise one half turn. Reset the rectifier by toggling the AC circuit breaker to OFF and back to ON.
6	Verify the new HVSD setting by turning the FLT ADJ potentiometer slowly clockwise, the high voltage shut down must occur between -56.0 V and -56.1 V. Turn the FLT ADJ potentiometer counter clockwise two turns. If necessary, reset the rectifier by toggling the AC circuit breaker to OFF and back to ON.
	—continued—

Procedure 14
Start-up and adjustments of the NT5C07AC rectifiers

Step	Action
7	***Float voltage adjustment*** Place the FLT/QL switch on the rectifier being adjusted in the FLT position. Set the DC circuit breaker of the rectifier being adjusted to ON and verify that only the AC ON indicator is lit. Using the plant volt meter on the Front Access Controller Panel, adjust the FLT ADJ potentiometer for the correct float voltage level by turning it slowly counter clockwise.
8	***Equalize voltage adjustment*** Place the FLT/EQL switch on the rectifier being adjusted in the EQL position. Using the plant volt meter, adjust the EQL ADJ potentiometer for the correct equalize voltage (clockwise to increase, counter clockwise to decrease). Return the FLT/EQL switch to the FLT position. Set the DC circuit breaker to OFF.
9	***Other rectifiers*** Repeat Steps 2 through 8 for all the rectifiers. ***Note:*** The Float voltage and Equalization offset of every rectifier in the system must be adjusted to within 10 mV of each other to ensure proper load sharing.
10	After all rectifiers have been adjusted set the DC circuite breakers of all rectifiers to ON. Verify that the SEN FAIL and the RFA indicators on all rectifiers are not lit.
	—end—

Figure 32
Setting the start-up delay of the rectifier



Front view of rectifier

Dip switch setting for force sharing and 4 sec start-up delay. All switches set to the right

Start-up, verification and adjustments of the front access controller

Start-up and verify/adjust the operating parameters of the NT6C25FF front access controller as described in the following Procedure.

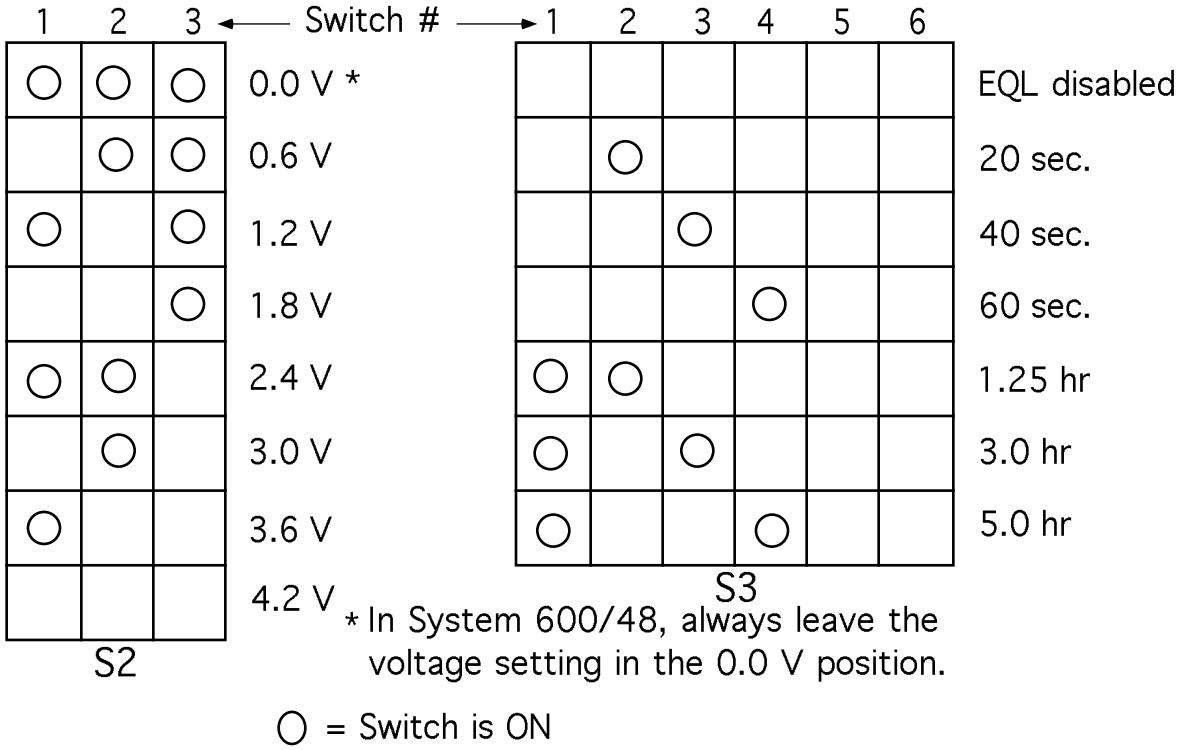
Procedure 15
Start-up, verification and adjustments of the NT6C25FF front access controller

Step	Action
1	To verify the fuse alarm indicators, depress the fuse indicator on all QFF type fuses in the controller. The FA and INT FA LED indicators should light.
2	Operate the PLT switch to the VOLT position. Connect an external voltmeter to the Charge Battery and Battery Return buses and verify that its reading matches the plant controller meter reading. If it does not match, adjust the PLT V ADJ potentiometer until the controller meter reading is within 10 mV of the external meter reading.
3	Verify that DIP switches S1 and S3-5 are set for the correct shunt range (800 A) for the power plant. The shunt settings for S1 and S3-5 are printed on the back of the front panel.
4	Operate the PLT switch to the AMP position.
5	Connect the digial voltmeter to the TP3 and TP4 test points inside the controller door. Set the voltmeter range to 200mV.
6	Operate and hold the CAL/NORM switch to the CAL position [the switch may be held operated with a piece of tape or a rubber band].
7	The voltmeter should read 50 mV. If not, adjust potentiometer R22 until the voltmeter reads 50 mV.
8	Release the CAL/NORM switch, disconnect the voltmeter and close the front door of the controller.
9	Operate and hold the CAL/NORM switch to the CAL position.
10	The controller meter should display the shunt's rated current. If it does not, adjust the SHT CAL potentiometer until it does.
11	Release the CAL/NORM switch.
12	Operate and hold the CAL/NORM switch to the CAL position. No alarms will be transmitted to the office while this switch is in the CAL position. The switch may be held operated with a piece of tape or a rubber band.
	—continued—

Procedure 15
Start-up, verification and adjustments of the NT6C25FF front access controller

Step	Action
13	Adjust the TEST V CAL potentiometer to the LOW FLOAT alarm setting according to the requirements and verify that the LOW FLOAT LED indicator lights.
14	If the LED indicator does not light, adjust the LOW FLOAT alarm potentiometer until the corresponding LOW FLOAT LED indicator lights.
15	Repeat the previous three steps to verify the battery on discharge (BOD), low voltage (LV), low voltage disconnect (LVD), high float (HF), high voltage (HV) and high voltage shutdown (HVSD) thresholds each in turn.
16	Once all the settings are completed, adjust the TEST V CAL potentiometer until float voltage is displayed. Release the CAL/NORM switch.
17	Refer to Figure 33 below to set the S3-1 to S3-4 DIP switches for the required equalize period. The three switches on the S2 DIP switch module **SHALL** be left in the closed position (left). ***Note 1:*** The adjustment of the equalize value for a system 600/48 should only be done at the rectifiers as described in Procedure 14. Setting of these switches to any other position will vary the sense voltage for the rectifiers, causing the rectifiers to supply a higher voltage output which may damage the Meridian 1 equipment. ***Note 2:*** Equalization may be triggered manually by the EQL switch or automatically by the Low Float alarm. The Low Float alarm will not trigger the equalization if a Major alarm is also present.
18	Operate the EQL switch to MAN. Verify that the voltage on the rectifiers increases to the equalize voltage level.
19	Operate the EQL switch to RESET. Verify that the voltage on the rectifiers returns to the float voltage level.
20	Test the RFA alarms by shutting down one rectifier. Verify that the RFA LED lights yellow.
21	Shut down a second rectifier. Verify that the color of the RFA LED changes to red.
—end—	

Figure 33
Setting the equalize voltage and period on the NT6C25FF controller



Remote activation of the LVD contactor

Some installation may require the remote activation of the LVD contactor. Some customers or local code may require that a kill switch be installed to instantly cut off the power to the switchroom and the telephone system in case of emergency. The following Procedure describes the required wiring and the method to verify the activation of the LVD contactor.

Procedure 16
Wiring and testing the remote activation of the LVD contactor

Step	Action
1	An electrician must first wire the switch that turns off the AC power to the AC service panel which supplies power to the System 600/48 Power plant.
2	Have the electrician provide a lead referenced to ground only when the switch that turns off the power to the AC service panel is operated. During normal operation, this lead is open.
3	Connect the above lead to pin 3 of TB1 on the LVD control and bypass card inside the FACEP-600 panel on the System 600/48.
4	When the ground signal is present on pin 3 of TB1 on the LVD control and bypass card, the LVD contactor opens, disconnecting the power to the Meridian 1. The LVD contactor remains open as long as the ground is present on pin 3. When the ground is removed from pin 3, the LVD contactor closes, again providing power to the Meridian 1.
	—end—

Meridian 1 system powering and verification

Power and verify each column of Meridian 1 equipment as described in the following Procedure.

Procedure 17
Meridian 1 equipment powering and verification

Step	Action
1	Set all PDU circuit breakers in each pedestal to OFF
2	Make sure the AC circuit breaker on each rectifier is OFF.
3	Make sure all circuit breakers in the System 600/48 distribution panels which are providing power to the Meridian 1 are OFF.
4	Make sure the AC input wiring to each rectifier is connected to the AC power source.
5	Set the main AC service circuit breaker for each power shelf to ON, as well as the AC circuit breaker on each rectifier.
6	Test the System 600/48 to verify that proper voltage is present by observing the meter panel.
	—continued—

Procedure 17
Meridian 1 equipment powering and verification

Step	Action
7	In sequence, turn ON all circuit breakers in the distribution panels which are providing power to the Meridian 1.
8	Set all module power supply faceplate switches and blower unit switches to ON.
9	Set the PDU circuit breakers to ON, working from left to right. • The circuit breaker for the blower (first breaker on the left). Verify that the blower is operating. • The second circuit breaker (for module 0). Verify the green LED indicator on module 0 power supply(s). • The third circuit breaker (if module 1 is equipped). Verify the green LED indicator on module 1 power supply(s). • The fourth circuit breaker (if module 2 is equipped). Verify the green LED indicator on module 2 power supply(s). • The fifth circuit breaker (if module 3 is equipped). Verify green LED indicator on module 3 power supply(s).
	—end—

A SYSLOAD can now be performed, according to NTP 553-3001-210 System Installation Procedures.

After the Meridian 1 is operational, the System 600/48 interface to the System Monitor may be verified by inducing fault conditions as follows:

- Turn one rectifier off to generate a minor alarm.

- Turn a second rectifier off to generate a major alarm.

Final verification and adjustments of the NT5C07AC rectifiers

After all loads connected to the System 600/48 are powered up and batteries are fully charged, the battery bus voltage and current load sharing should be verified and the rectifiers re-adjusted if necessary.

If batteries will not be connected to the power plant, the equalization voltage verification may be disregarded.

This procedure may also be used if necessary for periodic maintenance.

Procedure 18
Final verification and adjustments of the NT5C07AC rectifiers

Step	Action
1	***Load share verification*** Place the meter selector switch on all rectifiers to the AMP position. Verify that the curent readings on all rectifiers are within 10% of each other. If the rectifiers are balanced go to Step 4**.**
2	Verify that the top two miniature DIP switches on each rectifier are set to «FS» as shown in Figure 32 and that the Force Load Share wires are connected to terminal E6 in the bottom right corner of every MPS150 power shelf as shown in Figure 15.
3	If the rectifiers are still not balanced, slowly adjust the FLT voltage potentiometer on the rectifiers that are out of balance until they all share within 10% of each other. ***Note:*** If the Batt Bus voltage is correct, or too low, begin by raising the float voltage of the rectifier supplying the least current. If the plant voltage is too high, begin by lowering the float voltage of the rectifier supplying the most current.
4	***Float voltage verification*** Verify that the plant controller meter reading matches the required battery float voltage. If the float voltage is correct go to Step 8. ***Note:*** It is not necessary to measure the voltage at the battery leads if the cable sizing requirement of less that 0.5 V drop at full load is met.
5	If the float voltage reading does not meet the battery requirements, calculate and record the difference between the required voltage and the measured voltage. The float voltage of every rectifier in the system must be readjusted by this voltage difference.
6	Connect an external meter to the VOUT+ and VOUT- test points and set the DC circuit breaker of the rectifier being adjusted to OFF. Record the rectifier voltage reading. Adjust the FLT ADJ potentiometer to increase or decrease the voltage by the difference recorded in Step 5. Set the DC circuit breaker to ON. Repeat this step for every rectifier.
7	Repeat steps 3 thru 6 as necessary until the rectifiers are balanced within 10% and the proper float voltage is obtained.
	—continued—

Procedure 18
Final verification and adjustments of the NT5C07AC rectifiers

Step	Action
8	***Equalize voltage verification*** Operate the controller EQL switch to MAN and verify that the rectifiers switch to the equalize mode. Verify that the current readings on all rectifiers are within 10% of each other. If the rectifiers are balanced, go to Step 10.
9	If the rectifiers are not balanced, slowly adjust the EQL ADJ potentiometer, on the rectifiers that are out of balance until they all share within 10% of each other. ***Note:*** If the Batt Bus voltage is correct, or too low, begin by raising the float voltage of the rectifier supplying the least current. If the plant voltage is too high, begin by lowering the float voltage of the rectifier supplying the most current.
10	Verify that the plant controller meter reading matches the required battery equalize voltage. If the equalize voltage is correct go to Step 14. ***Note:*** It is not necessary to measure the voltage at the battery terminals if the cable sizing requirement of less than 0.5 V drop at full load is met.
11	If the equalize voltage reading does not meet the battery requirement, calculate the difference between the required voltage and the measured voltage. The equalize voltage of every rectifier in the system must be readjusted by this voltage difference.
12	Connect an external meter to the VOUT+ and VOUT– test points and open the DC circuit breaker of the rectifier being adjusted to OFF. Record the rectifier voltage reading.Adjust the EQL ADJ potentiometer to increase or decrease the voltage by the difference recorded in Step 11. Set the DC circuit breaker to ON. Repeat this step for every rectifier.
13	Repeat steps 9 thru 12 as necessary until the rectifiers are balanced and the proper equalize voltage is obtained.
14	Operate the controller EQL switch to RESET and verify that the rectifiers switch back to float mode.
	—end—

Connecting the batteries to the FACEP-600

CAUTION

Protect the equipment against electrical damage.

The conductors from the batteries to the positive and negative charge busbars should be connected only after all other conductor installation on the System 600/48 has been completed and verified. Before connecting the batteries to the FACEP-600 busbars, ensure that all output fuses are removed or circuit breakers at the rectifiers, control and distribution bays and distribution panels are OFF, and that the rectifiers are physically removed or pulled away from their connectors by at least 2 in. Always use insulated tools and place canvas over adjacent busbars.

When connecting the battery cables inside the FACEP-600, start placing the lugs at the rear positions and working forward, leaving access clear for future cabling.

Except for 535 MCM and 750 MCM lugs, connect the cables on the inside of the “U” shape busbars to minimize the risks of short circuits.

Since all the holes on the busbars inside the FACEP-600 are tapped 3/8 -16, only one wrench is required to tighten the connection, further minimizing the risks of short circuits.

Before making any connection, ensure that all contact surfaces on busbars are clean and coated with a thin coat of NO-OX-ID compound.

Cable sizing

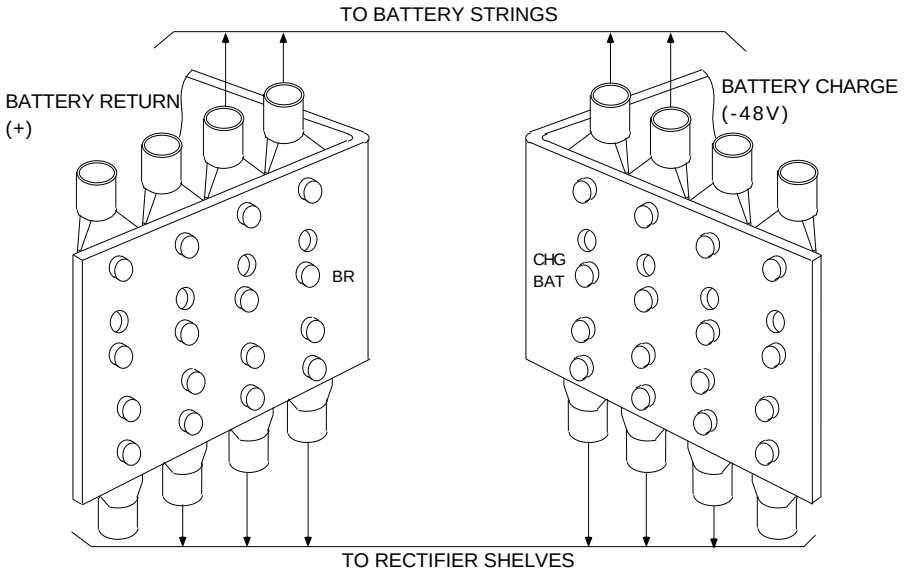
For economic reasons, use the smallest sized cables that are adequate to carry the current and meet the voltage drop requirements.

When large lugs such as 535MCM and 750MCM are required, they must be carefully arranged to fit on the –CHG BAT and +BAT RTN busbars (see Figure 34).

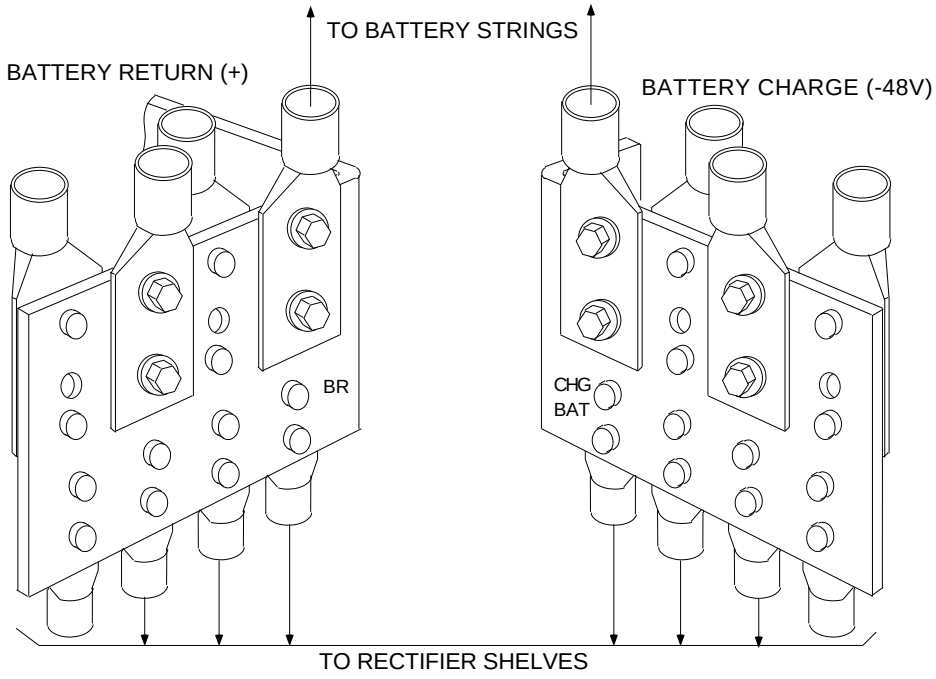
Procedure 19
Connecting the batteries to the FACEP-600

Step	Action
1	On new installations only, verify that all load circuit breakers are open and that all fuses are removed before connecting the battery cables.
2	Determine the length of battery cables required. Cable size will depend on the size and type of battery string(s).
3	Cut the battery cables to the required length. Use a power knife to strip the insulation from both ends of the cables.
4	Run and dress the cables between the batteries and the power plant. Tie the cables to the cable racking at regular intervals with tie wraps as required.
5	Crimp two hole lugs onto the cable ends. The lugs should be sized according to the cable size .
6	Connect the battery return and battery leads on the +BAT RTN and –CHG BAT busbars respectively inside the FACEP-600 panel on the System 600/48. Refer to Figure 34. Apply a torque of 15 ft-lb (20 Nm).
7	Connect the battery return (+) and the battery (–) leads at the batteries. Apply the torque value recommended by the battery manufacturer.
	—end—

Figure 34
Battery connections in the FACEP-600



WITH LUGS SMALLER THAN 535 MCM



WITH 535 AND 750 MCM LUGS

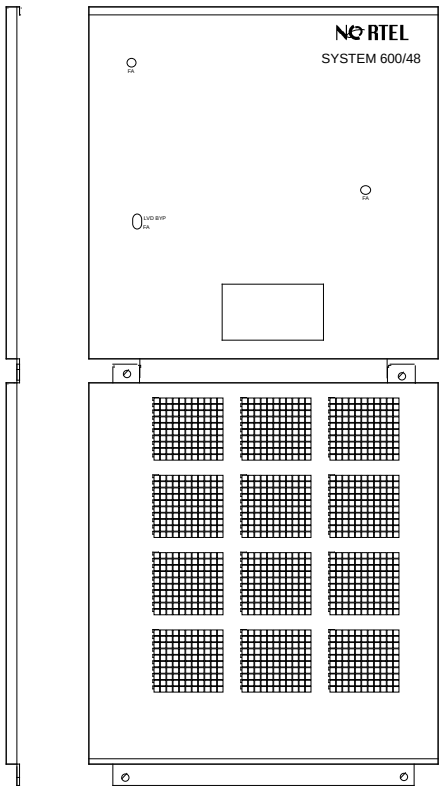
Installation of the front panels of the System 600/48

After completing the installation and verification of a new System 600/48, install the front cover panels on the main and supplementary bays as shown in Figure 35.

These covers consist of an upper cover with cutouts to view the alarms and the controller display on the main bay or the alarms on the supplementary bay, and a lower cover with grilles for rectifier ventilation.

Install the upper cover first, then the lower cover and secure the two panels by tightening the two captive 1/4 turn screws on the lower cover. The lower cover overlaps the upper cover thus securing both covers.

Figure 35
Installation of the front cover panels on the main bay



THIS PAGE IS INTENDED TO BE BLANK

Operation

NT6C18CB Front Access Common Equipment Panel (FACEP-600)

The functional characteristics of the FACEP-600 are as follows:

- It serves as the interconnecting point for all the DC power charge and discharge leads for the system.
- It contains the main shunt for the system.
- It provides the Low Voltage Disconnect (LVD) function for the system by means of the LVD contactor and the associated LVD control, BYPASS and alarm circuit card.
- It provides ten (10) small distribution circuits by means of GMT fuses, 0.180 to 15 amperes, as well as fuse alarm indicating for these.

The front panel of the FACEP-600 is provided with the following control and alarm features:

- An “LVD BYP/NORM” switch to select the BYPASS or NORMAL operating mode for the LVD circuit.
- An “LVD BYP” LED to indicate that the LVD circuit is in the BYPASS mode.
- An “FA” LED to indicate that the fuse for the LVD circuit is blown.
- An “FA” LED to indicate that one or more of the GMT distribution fuses have blown.

The BAT CHG and BR busbars provide for the connection, from the top, of up to four strings of batteries. The largest gauge is 750 MCM.

The BAT CHG and BR busbars also provide for the connection, at the bottom of the busbars, of up to four power shelves. The largest gauge is 4/0AWG.

The LVD, with automatic reconnect, is used to provide automatic shutdown of the load at low battery voltage (-43 VDC), typically after an extended AC power outage, to prevent complete discharge, and therefore damage to the batteries. The automatic reconnect feature monitors the battery voltage and

ensures that the load will be reconnected as soon as the commercial AC power is restored and the DC voltage is at least -50 V, without operator intervention.

The LVD may be wired with a remotely located "kill switch" to provide a means to cut the battery off from the loads in emergencies (refer to IS6C32AD/AE).

NT6C12FB Front Access Circuit Breaker panel (FACBR-50)

The FACBR-50 provides distribution to the loads by means of standard 30 A circuit breakers. However, breakers with up to 50 A capacity are optionally available.

The breakers are mid-trip. When manually tripped, the breaker will not send an alarm and the toggle will move to its full OFF position. When electrically tripped (ex.: overload), the breaker will send an alarm and the toggle will move to the mid position.

The panel also provides local alarm indication by means of the “FA” LED, as well as remote alarm extension to the controller.

NT6C25FF Front Access Controller

The NT6C25FF front access controller monitors the operation of the entire power plant. It monitors all the alarms, it controls and monitors the rectifiers, and it controls the operation of the LVD contactor.

Provision is made in the controller to extend any occurring alarm to the alarm center through the facilities provided in the powered equipment.

The front cover opens through a 90 degree rotation providing full access to internal connections and switches. There is a schematic printed on the rear cover of the front door.

The front cover is magnetically latched. A screw in the top of the chassis engages the front cover to prevent accidental opening in seismic areas. This screw is not required in non-seismic areas and may be discarded.

Front panel

The front panel of the controller has the following alarm and control features (refer to Figure 4 in the Specification Chapter):

Visual indications

A 3.5 digit red LED readout to display the plant current and voltage.

Fourteen (14) LEDs to display the alarm conditions as shown in the following Table.

Table 13
Visual indicators

Rectifier Fan Failure	RECT FAN	yellow
Equalize On	EQL	yellow
Fuse Failure Alarm	FA	red
Rectifier Failure Alarm	RFA	yellow/red
Alarm cutoff	ACO	red
Alarm Battery Supply Fuse Failure	ABSF	red
Internal Fail Alarm	INT FA	red
High Voltage Shutdown Alarm	HVSD	red
High Voltage Alarm	HV	red
Low Voltage Alarm	LV	red
High Float Alarm	HF	yellow
Low Float Alarm	LF	yellow
Low Voltage Disconnect	LVD	red
Battery On Discharge	BOD	red

Switches

Six (6) switches for the control of functions as shown in the following Table.

Table 14
Switches

PLT/VOLT/AMP	Used to select the plant current or voltage on the display.
NORM/CAL	Used for adjustment and calibration of various functions.
EQL/MAN/RESET	Used to activate or deactivate the equalize function.
HVSR	Used to reset the high voltage shutdown circuit.
ACO	Used to cancel the audible alarm signal.
LT	Used to test all the visual indicators on the controller.

Potentiometers

Eleven (11) potentiometers for the adjustment of alarm and control functions thresholds as shown in the following Table.

Table 15
Potentiometers

High Voltage Shutdown	HVSD
High Voltage Alarm	HV
Low Voltage Alarm	LV
High Float Alarm	HF
Low Float Alarm	LF
Low Voltage Disconnect	LVD
Battery On Discharge	BOD
Plant Voltage Adjust	PLT V ADJ
Shunt Calibration	SHT CAL
Test Voltage Calibration	TEST V CAL
Low Voltage Reconnect	LVR

Test points

A set of test points for the measurement of the battery and ground as shown in the following Table.

Table 16
Test points

Battery voltage test point	TEST V
Ground voltage test point	COM

Inner side of the front panel

There is a circuit pack mounted on the inner side of the hinged front panel. This circuit pack provides the following operational characteristics:

Switches

S3 DIP switch — Used to select the decimal point for the shunt readings, the duration time for the equalize function and the capability of inhibiting the local audible alarm.

Potentiometers

Shunt reference voltage calibration — Potentiometer R22

Test points

TP3 and TP4 — Test points used to calibrate the shunt reference voltage.

Back plane circuit pack

The back plane circuit pack inside the front access controller provides the following alarm and control features:

Switches

Two (2) DIP switches for the control of functions as shown in the following Table.

Table 17
Switches

S1 DIP switch	Used to select the power plant shunt size.
S2 DIP switch	Used to select the equalize voltage level.

Fuses

Sixteen (16) fuses to supply internal plant loads as shown in the following Table.

Table 18
Fuses

RC1 to RC12 (F1 to F12)	Sense signal fuses for the rectifiers
CONT (F13)	Controller power supply fuse.
METER (F15)	LED display supply and protection fuse.
ABS (F16)	Alarm bus supply fuse.
F14	Spare fuse.

Terminal strips

Eleven (11) terminal strips for external wiring as follows:

TB1 to TB11 — Interface with all external wiring.

Visual indicators

The DS1 and DS2 light emitting diodes are used for presence of voltage and polarity indication at the time of cabling and testing the panel at the factory.

Connectors

Sixteen (16) connectors for connectorized internal wiring as shown in the following Table.

Table 19
Connectors

J1 to J12	Rectifier control and signal interface.
J13 to J15	Interface with front panel control board.
J16	Interface with HVSDR circuit pack.

Alarm transmitting relays

Relays with form C contacts are used to transmit alarms as shown in the following Table. The connection information is shown in the Appendix Schematics IS6C32AD/AE, section IS2.

Table 20
Transmitted Alarms

RFA	(1 - Form C contacts)
HF	(1 - Form C contacts)
LF	(1 - Form C contacts)
HV	(1 - Form C contacts)
LV	(1 - Form C contacts)
FA	(1 - Form C contacts)
LVD	(1 - Form C contacts)
AC OFF	(1 - Form C contacts)
DC OFF	(1 - Form C contacts)
BOD	(1 - Form C contacts)
MN	(4 - Form C contacts)
MJ	(4 - Form C contacts)
ABS	
	Note: Form C contacts are rated at .5 A, 60 V ac.

NT5C12AC power shelf (MPS150)

The MPS150 power shelf provides the interconnecting points for all the AC input, DC output, alarm and control cabling and wiring for up to three (3) NT5C07AB 50 A switch mode rectifiers.

NT5C07AC 50 A switch mode rectifiers

The rectifiers provide isolated, filtered and regulated DC power, from a single-phase AC source, for powering the load while charging a positive grounded battery. Nominal output is adjustable over the range of –46 to –59.5 V for floating a 23 or 24 cell battery string. The factory set output value is –52.1 V.

Each rectifier plugs into an MPS150 power shelf, requiring no other connections. Each rectifiers is equipped with a 20 A, 2 pole AC input circuit breaker, a 60 A, 1 pole DC output circuit breaker, a digital ammeter and a set of potentiometers and LEDs for thresholds adjustment and alarm indication. The rectifiers use high frequency switching technology and forced air cooling.

Circuit description

The main AC line voltage is rectified and filtered to an unregulated high DC voltage. The input circuit provides EMI filtering, inrush current limiting, low and high AC inhibit, power factor compensation, lightning and surge voltage protection and input fault protection in the form of a 20 A AC breaker.

The high frequency isolating power section consists of a full bridge converter using power MOSFETs and a high frequency power transformer.

The high frequency AC voltage generated at the secondary of the power transformer is rectified and filtered. The output section provides EMI filtering, a shunt for output DC current sense and output protection in the form of a DC breaker. A current mode pulse width regulator varies the pulse width of the signal driving the power MOSFETs. This allows regulation of the output DC voltage.

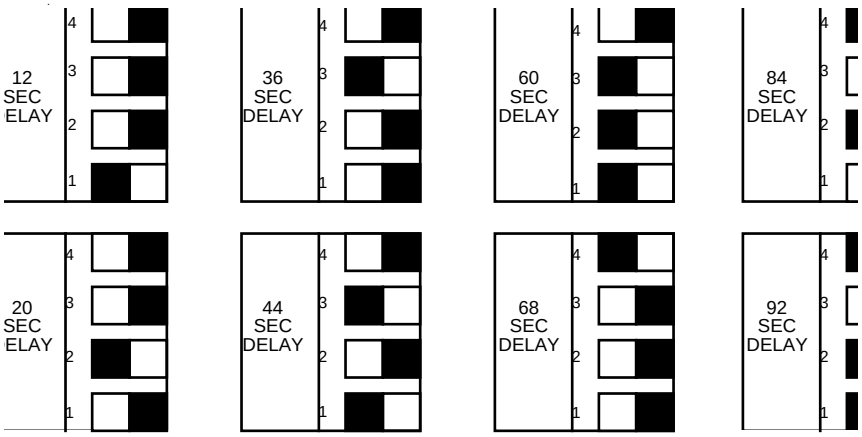
The monitoring circuitry includes soft start, rectifier fail alarm (RFA), monitoring and control for local and remote equalize, temporary release, thermal shutdown, AC valid, local and remote high voltage shut down (HVSD), local and remote HVSD reset and fan failure detect and LED.

A 3-1/2 digit output current meter displays either the current or the voltage at the sense point. Finally, an internal logic power supply provides the various voltages required by the logic circuitry and the cooling fan unit.

Description of the front panel control and display features

The front panel is provided with switches, potentiometers and test jacks used to select and adjust the operating parameters of the rectifier, an LED display and LED indicators used for the indication of the operating and alarm conditions, and circuit breakers used for the protection and control of the input and output supplies. There is also a 3/4 A fuse for protection against inrush current. Refer to Figure 36

Figure 36



Visual indicators

Seven (7)LEDs to display operating and alarm conditions as shown in the following Table.

Table 21
Visual indicators

Rectifier ON	AC ON	green
Rectifier Failure Alarm	RFA	red
High Voltage Shutdown	HVSD	red
Remote Sense Fail	SEN FAIL	red
Fan Fail Alarm	FAN ALM	red
Current Limit	CL	yellow
Equalize ON	EQL	yellow

Potentiometers

Six (6) potentiometers for the adjustment of alarm and control functions as shown in the following Table.

Table 22
Potentiometers

Equalize Voltage Adjust (0 V to 4 V above float)	EQL ADJ
Float Voltage Adjust (46 V to 59.5 V)	FLT ADJ
High Voltage Shutdown Adjust (52 V to 59.5 V)	HVSD ADJ
Current Limit Adjust (25 to 52.5 A)	CL ADJ
Calibration of the display meter in the current mode	CUR CAL
Calibration of the display meter in the voltage mode	V CAL

Switches

Two (2) switches and two sets of DIP switches for the control of functions as shown in the following Table.

Table 23
Switches

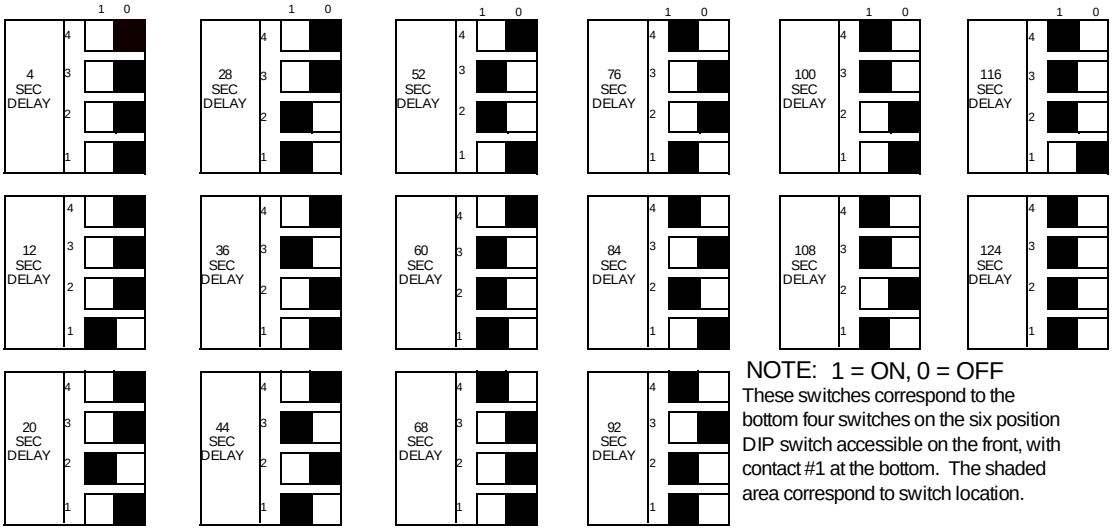
EQL/FLT	Equalize/Float selection switch
VOLT/AMP	To select current or voltage display and calibration modes
SLS/FS DIP	To select the load sharing mode
ST UP DLY DIP	To select the start up delay period.

Start-up delay

The rectifier start-up delay time can be set anywhere between 4 seconds [all 4 dip switches to the right] and 124 seconds [all 4 dip switches to the left].

If a different start-up delay time is required, see Figure 37 to choose the new setting.

Figure 37
Start-up delay switches



Once the start-up delay time required is determined, the start-up delay switch setting should be the same on every rectifier of the power plant.

In cases where the rectifiers are fed from a generator, the start-up delay switch settings can be set in such a way as to have the rectifiers start-up in sequence to avoid stalling the generator. Refer to Figure 37 to set the required start-up delay time between the rectifiers.

Circuit breakers

Two (2) circuit breakers for input/output protection as shown in the following Table.

Table 24
Circuit breakers

CA/AC	AC input breaker
CC/DC	DC output breaker

Test points

A set of test points for the measurement of the battery and ground as shown in the following Table.

Table 25
Test points

Positive test point for the measurement of the output voltage	VOUT+
Negative test point for the measurement of the output voltage	VOUT-

Note: This voltage represents the output voltage at the sensing point.

Description of the operating, monitoring, measurement, protection and control features

AC ON monitor

When the AC supply is available at the input of the rectifier, the AC ON LED is green.

Current/Voltage meter

A 3-1/2 digit output meter reads the current signal on the output shunt or the voltage signal at the sensing point and displays the value using an integrated logic circuit.

Rectifier failure alarm (RFA)

Upon detection of an internal failure, the rectifier extends a global alarm and the RFA LED lights.

Fan failure alarm

Failure of one or both fans will activate the fan alarm on the rectifier and extend a fan alarm signal to the controller. If only one fan has failed, the rectifier will keep on operating and there will be no RFA alarm. If both fans have failed, it will inhibit the operation of the rectifier and the RFA alarm will also be issued.

Local ON/OFF control (DC and AC breakers)

Circuit breakers are used to turn the rectifier ON/OFF locally and disengage it from the AC or DC circuit. The local ON/OFF control overrides the remote control signals.

Inrush current limiting fuse F1

A 3/4 A 250 V time delay fuse is connected in line with the soft start circuitry to protect the input circuitry against high inrush currents in case of an internal failure. Refer to Appendix B for ordering of replacement fuses.

Test points (VOUT+ and VOUT-)

Test points allow the user to measure the voltage at the point of regulation, whether the DC breaker is ON or OFF. A 5 kOhm resistor is placed in series with the -48 V lead to prevent damage due to short circuit at the jack terminals.

Local float/equalize control

The rectifier is equipped with a momentary Float/Equalize switch. When the switch is operated to the EQL position, the rectifier changes to the equalize mode and boosts the output voltage to the value set by the EQL ADJ potentiometer located above the switch. In the normal mode, the rectifier delivers a float voltage set by the FLT ADJ potentiometer located below the switch.

Remote equalize control

The rectifier is equipped with remote equalize control. This function is operated by applying a remote ground signal (BAT RTN). The rectifier returns to normal (Float) operation upon removal of the ground signal.

Local high voltage shut down (HVSD)

The rectifier includes a high voltage monitor. Whenever the output voltage exceeds a value adjustable from -52 to -59.5 V, the rectifier shuts down immediately. The rectifier will attempt to restart itself automatically after an HVSD. However, if another HVSD occurs within approximately two minutes, the rectifier shuts down, locks out and transmits an RFA. The AC breaker must then be toggled to restart the rectifier. This function does not depend on the output load condition.

Local high voltage shutdown reset (HVSDR)

The rectifier may be reset from an HVSD condition by toggling its AC circuit breaker or the associated AC breaker on the distribution panel.

Thermal shutdown (THSD)

The rectifier protects itself against thermal overstress by inhibiting its operation for the duration of the high temperature condition. The RFA alarm is triggered. The rectifier will restart after the temperature has dropped to a safe level.

Remote voltage sensing

Provision is made to extend the sensing leads to the battery or to the charge/ discharge bus (batteryless operation) of the plant. Opening of either sensing leads does not adversely affect the rectifier output voltage and the rectifier defaults to internal sensing mode.

Sense fail alarm

If the remote sense leads are not connected, or if the sense fuse is blown or not installed, the SEN FAIL indicator will light on the front panel.

Soft start and walk-In

The rectifier incorporates a walk-in circuit which limits the output current rate of rise to a maximum of 7 A per second (typical).

In power plants equipped with low voltage battery disconnect, the start up delay dip switch settings can be set to in such a way as to allow all the rectifiers to be powered up at the same time. Otherwise, the rectifiers may never be able to recharge fully discharged batteries. This can be achieved by simply having the dip switches set to the same position on all the rectifiers.

Current limiting

The rectifier will automatically limit the output current to 52.5 and (factory setting). Extended periods of operation in the current limiting mode and repeated transitions between constant-voltage operation and constant-current operation have no detrimental effect on the rectifier's performance or service life.

The rectifier is capable of starting when connected across a completely discharged battery without requiring human intervention or operating protecting devices. Transitions from constant-voltage operation to constant-current operation and vice versa will occur automatically as determined by the output current. The current limit circuit will remain working in both the float and equalize modes.

Discharge of output capacitors

The output capacitors will automatically discharge to less than 2 volts within two (2) minutes when the AC power is removed and the rectifier is disconnected from the batteries or parallel units.

Input AC voltage monitor

The rectifier monitors the input voltage and inhibits its operation when the voltage is outside a specified range (176 to 264 V ac). An RFA is initiated.

The rectifier resumes its normal operation automatically when the input voltage is again within the specified range

Parallel operation

The rectifier is capable of operating in parallel with other rectifiers having similar output characteristics and to share the load proportionally to its output rating.

Load sharing

Two load sharing methods are available:

- Slope load sharing
- Force load sharing (positive bus)

The load sharing mode is normally set at the time of installation and setup by the SLS/FS switches located on the front panel (lower right side) of the rectifier. The rectifier is factory set to slope sharing mode.

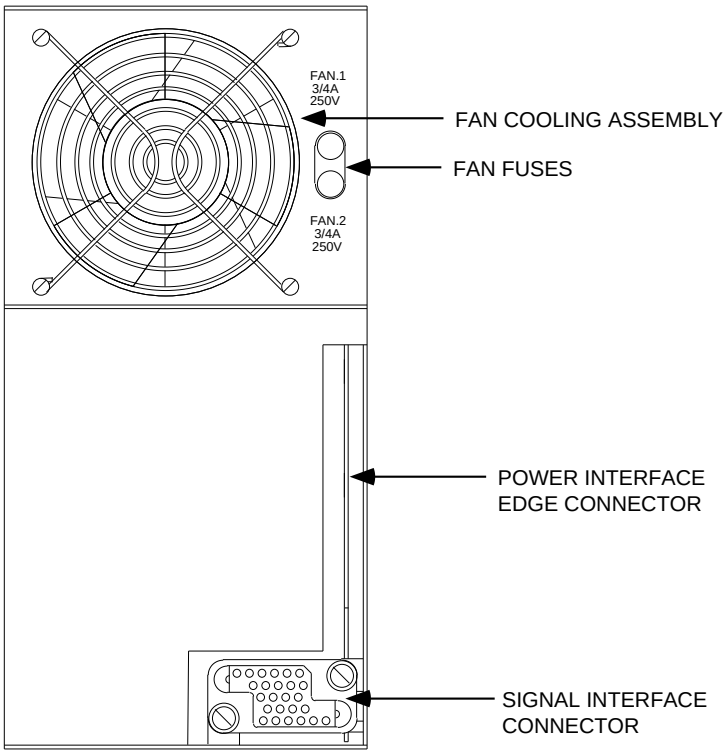
Slope load sharing (SLS): When the SLS/FS switch is set to the SLS position, load sharing is achieved due to a –300 mV slope on the output voltage from no load to full load on the rectifier. This mode should be used when rectifiers from different vendors are used which are not all equipped with the forced load sharing feature.

Forced load sharing (FS): When the SLS/FS switch is set to the FS position, forced load sharing is done by an internal control circuit which achieves equal output current between rectifiers by slightly modifying the loop reference. In order for this to occur, the rectifiers must communicate their operating current to other units on the same power plant. For this feature to be available, the CS terminal (E6) of all the rectifiers in the same power plant must be connected together, including those of the supplementary bay, when provided.

Rear Interface

The rear of the rectifier is provided with the cooling fan assembly and the power and signal interface connectors (see Figure 38).

Figure 38
Rear view of the rectifier



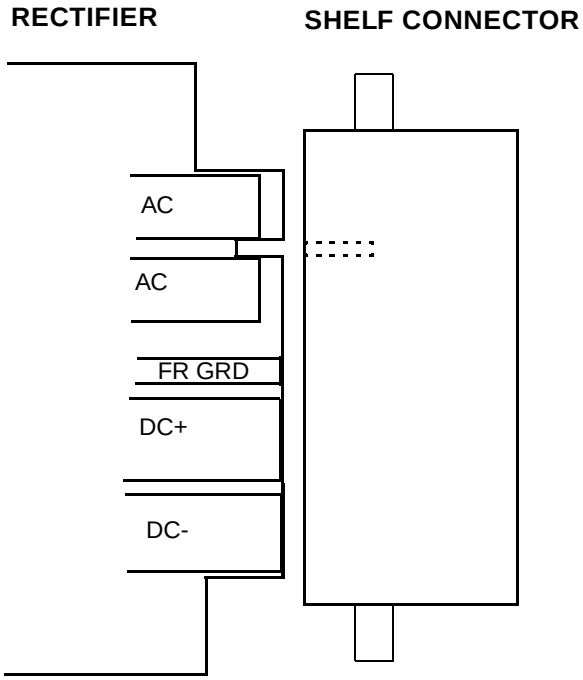
Fan cooling assembly

The fan cooling assembly ensures adequate cooling of the internal components.

Power interface edge connector

The rectifier AC, DC and chassis ground interface is done through the power interface edge connector. This connector is designed so that the DC and frame ground connections are established before the AC connections. Figure 39 shows the rectifier to shelf power interface connections.

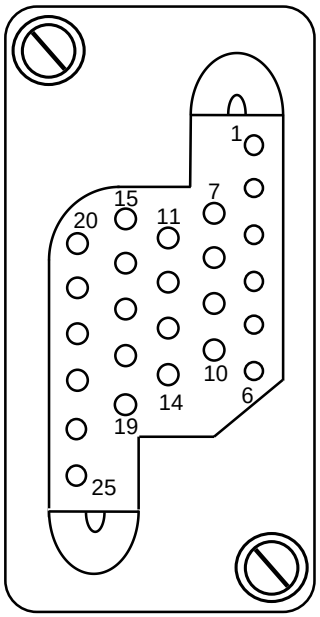
Figure 39
Power interface connections



Signal interface connector

This connector is used to interface all the control, alarm and monitoring signals with the power shelf which, in turn, interfaces these with the controller. The control inputs are activated by a ground (BAT RTN) signal. The alarms are extended by relay contacts and are isolated from each other and from the rectifier chassis. All contacts are rated 0.5 A at 60 V dc. The "SENSE" alarm contact closes to indicate that the remote sense leads are open. Figure 40 shows the pin assignment of the signal interface connector.

Figure 40
Control signal connections



PIN - DESCRIPTION (DESIGNATION)

1 - REMOTE EQL (EQL)
2 - SENSING POSITIVE (RG+)
3 - SENSING NEGATIVE (RC-)
4 - TEMPORARY RELEASE (TR)
5 - REMOTE HVSD RESET (HVSDR)
6 - REMOTE HVSD (HVSD)
7 - RECTIFIER FAILURE ALARM NORMALLY CLOSED (RFA NC)
8 - CURRENT SHARE (CS)
9 - FAN ALARM NORMALLY CLOSED (FAN ALM NC)
10 - RECTIFIER FAILURE ALARM COMMON (RFA COM)
11 - FAN ALARM COMMON (FAN ALM COM)
12 - SHUNT POSITIVE (SH+)
13 - SHUNT NEGATIVE (SH-)
14 - FAN ALARM NORMALLY OPEN (FAN ALM NO)
15 - RECTIFIER FAILURE ALARM NORMALLY OPEN (RFA NO)
16 - BATTERY RETURN (BAT RTN)
17 - SENSE FAIL COMMON (SEN FAIL COM)
18 - SENSE FAIL NORMALLY CLOSED (SEN FAIL NC)
19 - SENSE FAIL NORMALLY OPEN (SEN FAIL NO)
20 - DC CIRCUIT BREAKER COMMON (DC BRKR COM)
21 - DC CIRCUIT BREAKER NORMALLY CLOSED (DC BRKR NC)
22 - RECTIFIER PLUGGED IN (PRESENT 1)
23 - RECTIFIER PLUGGED IN (PRESENT 2)
24 - Not connected
25 - Not connected

Maintenance

Routine maintenance

The following is a list of general preventive maintenance procedures which should be performed periodically as required according to the environmental conditions and customer maintenance policy to ensure trouble free operation of the NT6C32AD/AE System 600/48:

- clean all ventilation openings
- tighten all electrical connections
- check for hot fuses or breakers (loose or undersized)
- verify alarms and alarm thresholds
- verify calibration settings
- verify rectifier settings

The detailed recommended maintenance and adjustment procedures for the controller and the rectifiers are covered in their respective NTPs. Refer to Appendix D.

The following tools and test equipment, and NTP-167-7011-010, are required to adjust equipment in the power plant:

- potentiometer screwdriver, Bourns No. 60 or equivalent.
- digital voltmeter, Fluke 8000A or equivalent.
- dummy load, 100 A (or use office load if available)

Troubleshooting

Table 26 provides a list of the problems which may occur on the NT6C32AD/AE System 600/48, along with their possible causes. Blown fuses and tripped circuit breakers should always be investigated before utilizing this table.

CAUTION
Precautions shall be taken to avoid service interruptions.
When working on a live power plant, the Low Voltage Disconnect contactor should be prevented from tripping. To do so, set the NORM/BYP switch to "BYP" on the FACEP-600 panel.

Table 26
Fault diagnosis

Fault symptom	Possible causes
No output current	• AC supply open or AC fuse open • Open DC circuit breaker • Faulty connection between the power shelf and the power plant • Low voltage disconnect open • Sense leads opened
Incorrect indication of output current	• Incorrect meter calibration • Loose shunt leads connection
Low discharge voltage	• Incorrect float voltage adjustment • Discharge load greater than the rectifier capacity • Sense leads opened
Low float voltage	• Faulty rectifier(s) • Shorted battery cell • Prolonged power failure • Incorrect float voltage adjustment • Sense leads opened
High discharge voltage	• Faulty rectifier(s) • Incorrect float/equalize voltage adjustment
High float voltage	• Faulty rectifier • Incorrect float/equalize voltage adjustment

—continued—

Table 26
Fault diagnosis

Fault symptom	Possible causes
Failure to generate alarms during alarm conditions	• Incorrect connections between the controller, the rectifiers and the interconnection and distribution unit
Failure to generate RFA alarm under appropriate conditions	• Faulty rectifier • Faulty wiring • Faulty RFA LED
Failure to generate FA alarm	• Faulty wiring (alarm wire not connected to "NC" pin of breaker) • Faulty fuse or circuit breaker • Faulty FA LED • Loose connection • Mid trip circuit breaker
HV lamp lit	• High discharge voltage condition • Incorrect HV level adjustment
LV lamp lit	• Low discharge voltage condition • Incorrect LV level adjustment
HF lamp lit	• High discharge voltage condition • Incorrect HF level adjustment
LF lamp lit	• Low discharge voltage condition • Incorrect LF level adjustment
BOD lamp lit	• Low discharge voltage condition • Incorrect BOD level adjustment
FA lamp lit	• Blown fuse or tripped circuit breaker or extended FA alarm • Alarm wire connected on wrong pin on circuit breaker
RFA lamp lit (yellow)	• One rectifier has failed
RFA lamp lit (red)	• Two or more rectifiers have failed

—continued—

Table 26
Fault diagnosis

Fault symptom	Possible causes
ACO lamp lit	• ACO switch has been operated during an alarm condition which is still ongoing
EQL lamp lit	• The equalize has been activated
Rectifiers not load sharing	• Share mode incorrectly set • Incorrect float adjustment on one of the rectifiers • Sense leads opened on one rectifier
LVD contactor does not reconnect the load	• Incorrect LVR threshold setting • Verify the "F1" fuse on the control card • Faulty control and alarm card • Faulty contactor
Meter display is OFF	• Open F15 fuse (located on the back plane circuit pack inside the controller) • Meter display failure
—end—	

Addition / Replacement Procedures

Addition or replacement of a rectifier

When adding rectifiers, follow the "Installing the rectifiers" Procedure in the "Installation and start-up" Chapter.

CAUTION
Precautions shall be taken to avoid service interruptions.
When installing a rectifier, the FLOAT and EQUALIZE voltages must be set according to the type of batteries used with the system. Failure to set these voltages properly may result in battery under charging or over charging and/or battery damage.

Replacing a rectifier

Procedure 20
Replacing a rectifier NT5C07

Step	Action
1	Notify the Alarm Center of incoming alarms during this procedure.
2	Turn OFF the AC and DC circuit breakers on the rectifier being replaced.
3	Release the rectifier retaining bar by loosening the captive screw and swing the bar down.
4	Slide the rectifier out of the shelf carefully. Reuse the shipping carton of the new rectifier to store or ship the removed unit.
5	Ensure that the AC and DC circuit breakers on the new rectifier about to be plugged-in are in the "OFF" position (down). Slide the unit firmly into the shelf, resting it on top of the stored blank panel.
6	Raise the retaining bar and tighten the captive screw to secure the rectifier into position.
7	Operate the AC circuit breaker of the rectifier to the "ON" position.
8	With the DC breaker in the "OFF" position, adjust the float and equalize voltage levels to the same level (approx.) as that of the other rectifiers.
9	Operate the DC circuit breaker to the "ON" position).
10	Set the SLS/FS switch to the same position as that of the other rectifiers.
11	Verify that the replacement rectifier is sharing the load by observing its ammeter. It should display approximately the same value as the ammeter on the other rectifiers. If not, adjust its Float and Equalize voltage levels .
12	Notify the Alarm Center of the end of the procedure.
	—end—

Addition or replacement of a battery string

For new installations, go to Step 5. For replacements, proceed from Step 1 as follows:

CAUTION

This procedure implies that all or part of the batteries will be momentarily taken out of service.

This work should then be completed during reduced traffic hours and/or with a diesel generator backup available to ensure no loss of service during a possible AC outage. If more than one string is to be replaced, replace only one string at a time and do not disconnect the next string before the previous one is reconnected.

Procedure 21
Adding or replacing a battery string

Step	Action
1	**Removal of the old string:** Notify the Alarm Center of the possibility of incoming alarms during this procedure.
2	Inside the NT6C18CB front access common equipment panel, locate, disconnect and insulate the two charge leads (+ & –) coming from the battery string to be replaced.
3	Disconnect the intercell connectors and/or wiring harness from the individual battery cells, and insulate each exposed terminal.
4	The removed batteries shall be disposed of in accordance with local, state and national environmental legislation.
5	**Installation of the new string:** If required, install the new batteries in the space vacated by the ones previously removed.
6	Install the new batteries and use the new connecting material (or reuse the old one) to interconnect them.
7	Complete the initial charge of this new battery string according to the battery manufacturer's specifications using an external power supply.
8	If required, install two new battery charge leads to the charge busbars in the System 600/48 main bay. Recommended size is 535 MCM or 750 MCM if voltage drop requirements dictate. (A maximum of 2 volt drop may be tolerated between the batteries and the main bay.)
9	Notify the Alarm Center of the end of the procedure.
	—end—

Addition or replacement of a distribution circuit breaker

CAUTION
Precautions shall be taken to avoid service interruptions.
Make sure to use properly insulated tools when working inside a power distribution panel.

For new installations, go to Step 7. For replacements, proceed from Step 1 as follows:

Procedure 22
Adding or replacing a distribution circuit breaker

Step	Action
1	Notify the Alarm Center of the possibility of incoming alarms during this procedure.
2	Operate the circuit breaker to be replaced to the "OFF" position (down).
3	Remove the front cover of the NT6C12FB front access circuit breaker panel.
4	Carefully remove and insulate any load lead and alarm lead connected to the circuit breaker.
5	Remove the screw that secures the circuit breaker to the lower busbar.
6	Pull the circuit breaker out about two inches and disconnect the quick connect alarm wire.
7	***Note:*** Ensure that the new breaker is in the "OFF" position before installing it. Connect the quick connect alarm wire to the new circuit breaker.
8	Install the new circuit breaker kit using the new or the previously removed hardware.
9	Connect the load cable to the new circuit breaker.
10	Reinstall the front cover.
11	Operate the circuit breaker to ON and verify for power at the load.
	—end—

THIS PAGE IS INTENDED TO BE BLANK

Appendix A: Schematics

Appendix B: Recommended spares

For the NT6C25F controller, the following spares are recommended:

- QFF1G 1/2 A fuses (meter and ABS) A0205208
- QFF1A 1-1/3 A fuses (RC1-12) A0205202
- NT6C25PC Control circuit pack A0366307
- NT6C25PD Fuse circuit pack A0366308
- NT6C25PG HVSDR circuit pack A0398128

For the distribution, the following spares are recommended:

- GMT fuses as required for the FACEP-600 panel
- 30 A mid-trip circuit breaker kit as required for the FACBR-50 panel A0601247
- NT6C12PB alarm circuit pack A0408933

Appendix C: Customer service addresses

Meridian 1 Customers are required to contact their nearest Meridian 1 representative for service on the equipment covered in the present manual. However, in emergency situations, if unablbe to reach your Meridian 1 representative, contact one of the following service centers for service on power equipment.

In Canada:

NORTHERN TELECOM CANADA LIMITED
Customer Service - Advanced Power Systems
150 Montreal - Toronto Blvd.
Lachine, Quebec
H8S 1B6
Attn.: Dept. 5560
Tel. (514) 956-4793 or 1-800-363-2288

In the U.S.A. :

NORTHERN TELECOM INC.
4001 E. Chapel Hill
Nelson Hwy. P.O. Box 13010
Research Triangle Park
North Carolina 27709
Attn. Advanced Power Systems
- Marketing Division
Tel. (919) 992-4435 or 1-800-992-8417 (for ordering information)
1-800-347-4850 (for 8:00 a.m. to 6:00 p.m. repair service)
1-800-627-8318 (for 24 hours emergency repair service)

This page is left blank intentionally.

NORTEL

Advanced Power Systems

Fold and Tape

BUSINESS REPLY MA
FIRST CLASS

Northern Telecom
Advanced Power Systems
Dept. 5541, Technical Services
150 MontrÈal-Toronto Blvd
Lachine (QuÈbec)
Canada
H8S 1B6

Zip: Country: State: City:
Street Address:
Name:

Your Opinion Is Important To Us

Please help us better meet your needs by completing and returning the following questionnaire. Your replies give us valuable insight into the effectiveness of our documentation.

Document title: Meridian 1 applications - System 600/48, NTP 167-9021-111.

Job function: _____

Are you a Northern Telecom employee? _____ Yes _____ No

How did you use this document?

- ☐ Introduction to subject
- ☐ Reference
- ☐ Training
- ☐ Planning
- ☐ Installation
- ☐ Sales
- ☐ Maintenance
- ☐ Advanced knowledge
- ☐ Other _____

To rate this document, please circle one of the following numbers:

	Excellent	Satisfactory	Inadequate
Accuracy	1	2	3
Clarity	1	2	3
Completeness	1	2	3
Organization	1	2	3
Interest Level	1	2	3
Usefulness	1	2	3
Timeliness	1	2	3
Overall	1	2	3

Additional comments: _____

_____

_____

Thank you for your assistance.

Appendix D: Applicable documents

NTP number	Description
167-4311-100	NT6C25F series front access controller
167-7011-010	Voltage level limits for rectifiers and controllers
167-9021-105	MPP600 Modular Power System
167-2191-200	J2412A power equipment cabinet (QCA13)
169-2071-501	NT5C07AC 50 A rectifier
553-3001-120	Meridian 1 installation planning
553-3001-152	Meridian 1 power engineering
553-3001-210	Meridian 1 system installation

Appendix E: Voltage levels for rectifiers and controllers

Scope

This Appendix provides a list of suggested voltage levels for rectifiers and controllers.

The rectifiers provide a constant voltage source which supplies power to the telecommunication systems and maintains the batteries fully charged. The battery charge voltage and the ambient temperature will influence the life of the batteries. Thus, it is very important to select the correct float voltage for each battery type and environment. The voltage of a battery string depends on the number of cells connected in series, which is typically determined by the allowable operating levels of the equipment fed by the power plant.

The operating voltage level of a power plant is determined by the battery type and the safe operating limits of the load. Even though this document suggests power plant operating limits, the final decision remains however with the user to decide on the best choice for a specific application.

CAUTION

Suggested voltage limits

The suggested settings in this Appendix are to be used as a guide. The battery manufacturer's latest specifications and the telecommunication equipment requirements must be taken into consideration to determine the proper float and equalize voltages.

Battery types

This Appendix addresses the two most often used battery types; the conventional calcium and antimony lead acid battery, and the valve regulated lead acid (VRLA) battery.

In the conventional lead acid battery cell, when battery charging approaches its final stage, the charging current is consumed solely for electrolytic decomposition of water in the electrolyte, resulting in generation of oxygen and hydrogen gas which escape in the atmosphere. This results in a loss of water which must be regularly replaced by topping up, typically every 6 months. Proper ventilation is therefore required to eliminate any gas concentration around the batteries.

The same process occurs in the valve regulated battery cell, except that due to the unique gas recombination system which transforms most of the generated gas into water there is little gas escape and therefore very little water loss during normal operation.

Charging characteristics

The float voltage must be kept at a value high enough to compensate for the battery's shelf-discharge and to keep the battery in a fully charged condition at all times, but low enough to minimize life deterioration due to possible overcharge.

The manufacturers' charge voltages for different batteries are given in Table 27.

Table 27
Battery voltage limits at 25°C

Battery type	Minimum	Maximum	Recommended
Conventional lead calcium	2.17	2.20	2.17
Conventional lead antimony	2.17	2.17	2.17
GNB Absolyte II	2.25	2.28	2.27
Chloride Powersafe	2.27	2.30	2.28
Eagle Picher Carefree	2.28	2.32	2.28 (see Note)
C&D Liberty	2.22	2.32	2.27
Yuasa UXL	2.18	2.27	2.23

Note: It is recommended to charge the Eagle Pitcher batteries using the minimum per cell voltage. In most telecommunication systems, voltages above 55 V are permitted only as emergency limits.

Typically in a -48 V power system, each battery string consists of 23 or 24 cells. The battery string voltage is then the multiple of the individual battery cell voltage times the number of battery cells connected in series.

When the total battery string voltage in a -48 V power system is too high for the safe operation of the telecommunication equipment, the battery string must be reduced to 23 cells. A larger capacity battery string will then be required to compensate for the higher end voltage.

Application

Rectifier voltage limits

The suggested rectifier voltage and control limits are shown in Table 28.

Table 28
Rectifier voltage limits

Battery type	Number of cells	Float	Controls	
			EQL	HVSD
Conventional	24	52.08	+0.7	56
Absolyte II Liberty Chloride Eagle Picher	23 23 23 23	52.21 52.21 52.44 52.44	+0.7 +0.7 +0.7 +0.7	56
Conventional	25	54.25	+0.7	56
Absolyte II Liberty Chloride Eagle Picher	24 24 24 24	54.48 54.48 54.72 54.72	+0.7 +0.7 +0.7 +0.7	56
Yuasa (UXL)	24	53.52	0	56

Power plant voltage and alarm settings

The suggested power plant operational limits are shown in Table 29. These limits may be readjusted to suit different operational limits due to load or environmental requirements.

Table 29
Power plant voltage and alarm settings

Battery type	Qty. of cells	Alarms							Controls		
		FLOAT	LV	LF	BOD	HF	HV	HVSD	EQL	LVD	LVR
Conventional	24	52.08	47	51	50	52.5	54	56	+0.7	43.5	50.5
Absolyte II Liberty Chloride Eagle Picher	23 23 23 23	52.21 52.21 52.44 52.44	47	51	50	52.6	54	56	+0.7	43.5	50.5
Conventional	25	54.25	47	53	52	54.9	55.3	56	+0.7	43.5	50.5
Absolyte II Liberty Chloride Eagle Picher	24 24 24 24	54.48 54.48 54.72 54.72	47	53	52	54.9	55.4 55.6	56	+0.7	43.5	50.5
Yuasa (UXL)	24	53.52	47	52.5	51.5	53.9	55	56	0	43.5	50.5

Note 1: Not all alarms are provided in every power plant.

Note 2: The equalize voltage level can be set either by the power plant or by rectifier adjustment. It is preferable that the equalize level be set by the rectifier wherever this feature is provided. Do not use both equalize features at the same time.

Note 3: The float voltage is monitored and displayed by the power plant but is set by the rectifier's output voltage adjustment.

List of terms

A
ampere

ABSF
alarm battery supply fuse

AC
alternating current

ACEG
AC equipment ground

ACO
alarm cut-off

AD
assembly drawing

ADJ
adjust

AWG
American wire gaging

BOD
battery on discharge

BR
battery return

BYP
bypass

CAL
calibrate

CEP
common equipment panel

CL
current limit

COM
common

CONT
control

CSA
Canadian Standard Association

DC
direct current

EMI
electromagnetic interference

EQL
equalize

ESD
electrostatic discharge

EXTBR
external battery return

FA
fuse alarm

FABR
front access battery return

FACB
front access circuit breaker (panel)

FAFP
front access fuse panel

FS
forced sharing

GRD
ground

HF
high float

HV
high voltage

HVSD
high voltage shutdown

HVSDR
high voltage shutdown reset

INT FA
internal fuse alarm

IS
interconnect schematic

LED
light emitting diode

LF
low float

LR or LRTN
logic return

LT
lamp test

LV
low voltage

LVA
low voltage alarm

LVD
low voltage disconnect

LVDR
low voltage disconnect reconnect

MJ
major

MN
minor

MPS
modular power shelf

NC
normally closed

NORM
normal

PLT
plant

RC
rectifier control

RECT
rectifier

REQ
remote equalize

RFA
rectifier failure alarm

SEN
sense

SHT
shunt

SLS
slope load sharing

SPG
single point ground

TR
temporary release

TST
test

UL
Underwriter Laboratories

V
volt

WD

wiring diagram

WVP

water vapor pressure

Meridian 1 applications - HELIOS System 600/48

Description, Installation, Operation & Maintenance Manual

Advanced Power Systems
Northern Telecom Canada
150 Montreal-Toronto Blvd
Lachine, Quebec H8S 1B6
(514) 956-4793

Information is subject to change without notice. Northern Telecom reserves the right to make changes in design or components as progress in engineering and manufacturing may warrant. This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules and CIPSR No. 22 Class B, and the radio interference regulations of the Canadian Department of Communications. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. This equipment meets CSA C22.2 No. 0 - M1982, CSA C.22.2 No. 107.1 - M91 and UL1950. High voltages are present inside the unit, therefore insulated tools, eye wear, correct lighting and up to date drawings must be used. This equipment contains a number of discrete and micro electronic solid state devices subject to permanent damage due to electrostatic potentials which may occur during handling and installation unless appropriate precautions are observed.
Meridian and the Advanced Power Systems and Nortel logos are trademarks of Northern Telecom
Publication number: 167-9021-111
Product release: Standard
Document release: 2.0
Date: March 1997
Printed in Canada

NORTEL