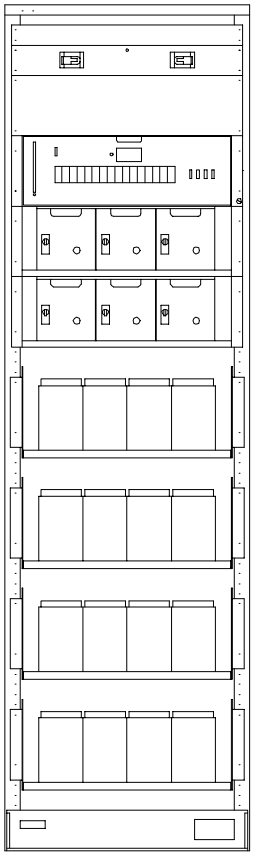
Emerson Energy Systems

UM6C28C (167-9021-102)

MFA150 Modular Front Access Power System—NT6C28C

User Manual



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MFA150 Modular Front Access Power System—NT6C28C
User Manual

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Standard Issue 9.0. Modifications throughout and reference to manual number UM6C28C added. (ECN 102-17192)

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Standard 8.0. Revised to remove the "Installation" Chapter now covered in a new Installation Manual (167-9021-133), to replace Nortel information by Astec information, and general revision to improve illustrations and procedures.

December 1995

Issue 7.0 Standard. Revisions to the "Specifications" and "Installation" Chapters.

August 1995

Issue 6.0 Standard. Revised to update the functional description of the equipment.

April 1995

Issue 5.0 Standard. Revised to include information about the LVD Manual Reconnect optional feature.

December 1994

Issue 4.0 Standard.

May 1992

Issue 3.0 Standard.

November 1991

Issue 2.0. Standard.

June 1991

Issue 1.0. Standard.

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About this manual

Purpose of this manual

This manual provides all the necessary information to operate and maintain an NT6C28C(x) MFA150 power system.

The installation procedures for the NT6C28C(x) MFA150 power system are covered in installation manual IM6C28C (167-9021-133).

Applicability of this manual

This manual applies to NT6C28C(x) MFA150 power systems having any configuration of controller, rectifier, distribution, monitoring and battery equipment.

How this manual is organized

This manual is divided into six parts:

1) Front matters: contain the manual information, the table of Contents and this chapter.
2) Introduction: provides a brief description of the NT6C28C(x) MFA150 power system, as well as its applications and configurations.
3) Specifications: describes the technical characteristics of the NT6C28C(x) MFA150 power system.
4) Operation: describes the operational features of the NT6C28C(x) MFA150 power system.
5) Maintenance: describes the maintenance procedures to maintain the power system in a good operational state, and to replace or add equipment to the power system.
6) Appendices: provide schematics, technical service assistance, and feedback information for the manual, as well as a list of abbreviations and acronyms used throughout this manual.

Other documents

In addition to the present manual, the following documentation may also be required for the operation and maintenance of the NT6C28C(x) MFA150 power system:

- User Manual for other Emerson Energy Systems products, such as the rectifiers, the RPM1000C, and the Helios TCM/48 as required (see the list in Appendix D)
- configuration sheets for the RPM1000C
- User Guides for the products of other manufacturers (for example : batteries).

Introduction

Description

The NT6C28C(x) MFA150 power system is a positive ground, –48 V dc nominal, 150 A capacity power system consisting of a control and distribution panel and power shelves which support plug-in rectifiers mounted on a relay rack type framework.

An intelligent controller/monitor (RPM1000C), a temperature compensation module (Helios TCM/48), a low voltage disconnect (LVD) feature, a battery disconnect panel, a supplementary battery return busbar, and battery shelves for rack mounted batteries are available as options.

The NT6C28C(x) MFA150 power system is a front access power system. All installation, operation and maintenance activities can be done from the front and top of the power system. A minimum space of 3 inches (7.6 cm) is required behind the NT6C28C(x) MFA150 power system for ventilation.

The NT6C28C(x) MFA150 power system is intended for non-seismic and seismic applications up to zone 4 (Bellcore) depending upon the relay rack selected.

- The standard 7-foot (2.13 m) rack is for non-seismic applications.
- The earthquake braced 7-foot (2.13 m) rack is for top braced applications.
- The 4-foot (1.22 m) and 7-foot (2.13 m) seismic racks are for seismic freestanding applications (no top support required).
- The 25.36-inch (64.41 cm) rack is for wall mount applications.

All of the various panels used in making the System 200/48 can be mounted on frameworks having mounting holes with either 1.0-inch or 1.75-inch spacing.

The NT6C28C(x) MFA150 power system provides a variety of monitoring, alarm and control features, such as low voltage alarm, fuse and circuit breaker alarms, rectifier failure alarms, equalize, and an optional low voltage disconnect (LVD).

Distribution is achieved through the circuit breakers and fuses on the control and distribution panel.

The NT6C28C(x) MFA150 utilizes 15, 25, or 50 A rectifiers connected in parallel as building blocks to reach the maximum capacity of 150 A. The rectifiers operate from a 208 V or 240 V single phase 50/60 Hz AC source, except for the 15 A rectifier which operates from a 115 V ac source.

Equipment applications

The NT6C28C(x) MFA150 power system is designed to operate with any telecommunication system requiring up to 150 A capacity.

The NT6C28C(x) MFA150 power system can be used to provide power to the following products: OC-12, OC-48, DMS-1U, Access Node, DMS-100 remotes installed in huts, controlled environment vaults (CEVs) and customer premise equipment (CPE).

In many applications, a consistent single point ground topology should be maintained for all associated equipment. The NT6C28C(x) MFA150 power system complies with the requirements for single point grounding.

Mounting configurations

The NT6C28C(x) MFA150 can be configured in many ways to meet specific customer requirements. Typical examples are shown in Figures 1 and 2.

Figure 1 shows a standard relay rack equipped with the following equipment :

- A control and distribution panel equipped with a RPM1000C intelligent controller/monitor
- MPS 75 power shelves
- 25 A rectifiers
- rack-mounted VRLA batteries

Figure 2 shows a free standing seismic relay rack equipped with the following equipment :

- a control and distribution panel equipped with an analog controller card
- MPS150 power shelves
- 50 A rectifiers
- a battery disconnect panel equipped with two circuit breakers
- larger VRLA batteries stacked beside the framework

Figure 1 – Front view of a typical NT6C28C(x) MFA150 power system with shelf mounted batteries

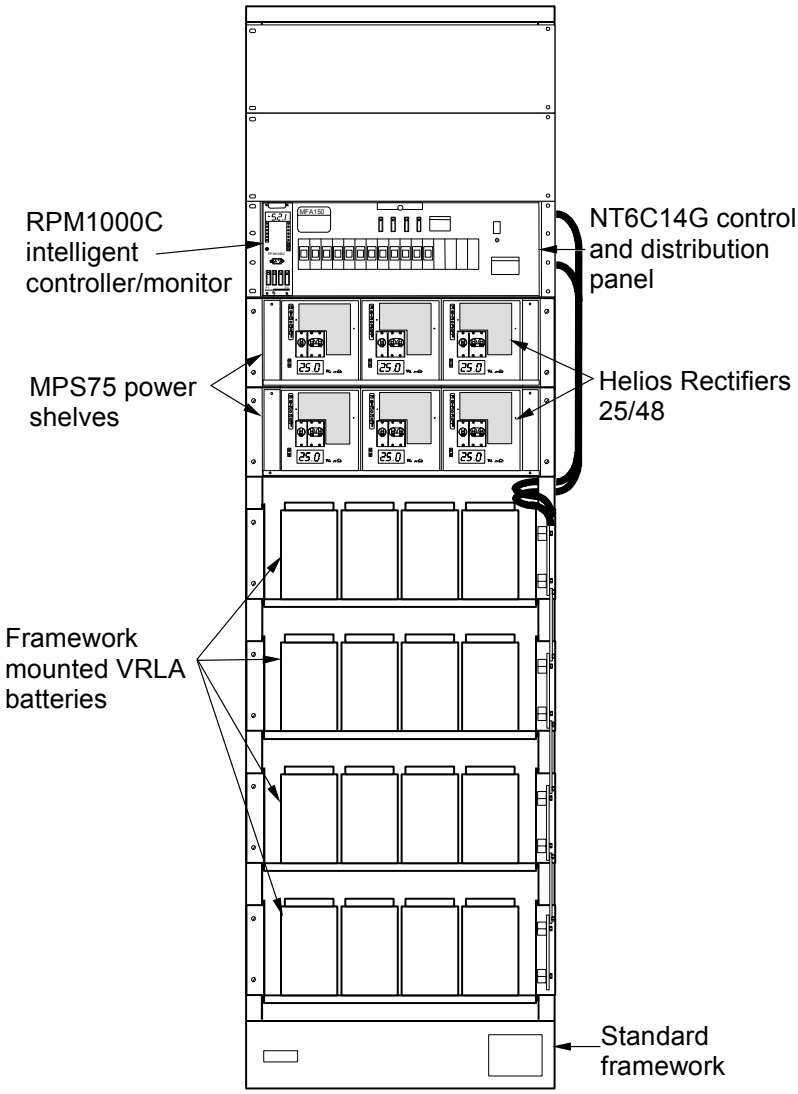
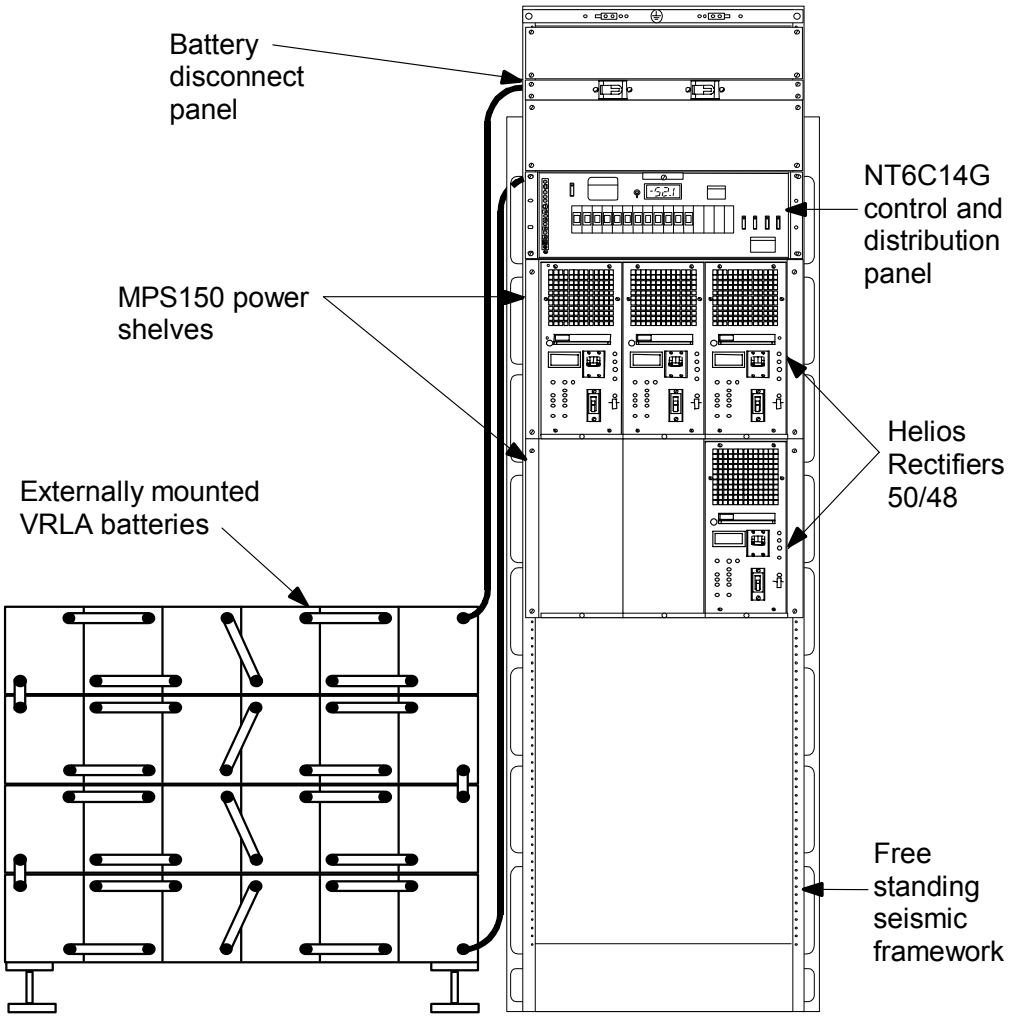


Figure 2 – Front view of a typical NT6C28C(x) MFA150 power system with larger VRLA batteries mounted beside the framework



Specifications

Frameworks

The NT6C28C(x) MFA150 mounts on a variety of relay rack type frameworks from 25.36 inches (64.41 cm) to 84 inches (213.36 cm) high. The mechanical specifications of these frameworks are listed in Table 1.

Table 1 – Mechanical specifications of the frameworks

Framework type	Height	Depth	Width	Weight
Standard	7 feet (2.13 m)	15.0 inches (38.1 cm)	24.13 inches (61.29 cm)	51 lbs (23.13 kg)
Seismic, top braced	7 feet (2.13 m)	15.0 inches (38.1 cm)	24.13 inches (61.29 cm)	55 lbs (24.95 kg)
Seismic, free standing	7 feet (2.13 m)	15.0 inches (38.1 cm)	26.1 inches (66.29 cm)	107 lbs (48.53 kg)
	4 feet (1.22 m)	15.0 inches (38.1 cm)	26.1 inches (66.29 cm)	80 lbs (36.29 kg)
Wall mount	25.36 inches (64.41 cm)	21.0 inches (53.34 cm)	24.13 inches (61.29 cm)	55 lbs (24.95 kg)
Note: Refer to Figures 1 and 2 for typical views of frameworks with equipment.				

NT6C14G control and distribution panel

Mechanical specifications of the control and distribution panel

The mechanical specifications of the NT6C14G control and distribution panel are listed in Table 2.

Table 2 – Mechanical specifications of the control and distribution panel

Model	Figure	Height	Depth	Width	Weight
With basic controller card	3	7 inches (17.78 cm)	12.96 inches (32.91 cm)	23.0 inches (58.42 cm)	54 lbs (24.49 kg)
With RPM100C intelligent controller	4	7 inches (17.78 cm)	12.96 inches (32.91 cm)	23.0 inches (58.42 cm)	58 lbs (26.31 kg)

Figure 3 shows a front view of the NT6C14G control and distribution panel equipped with the analog controller card and without an LVD feature, while Figure 4 shows a front view of the NT6C14G control and distribution panel equipped with the RPM1000C intelligent controller and with an LVD feature.

Figure 3 – Front view of the NT6C14G control and distribution panel equipped with the analog controller card

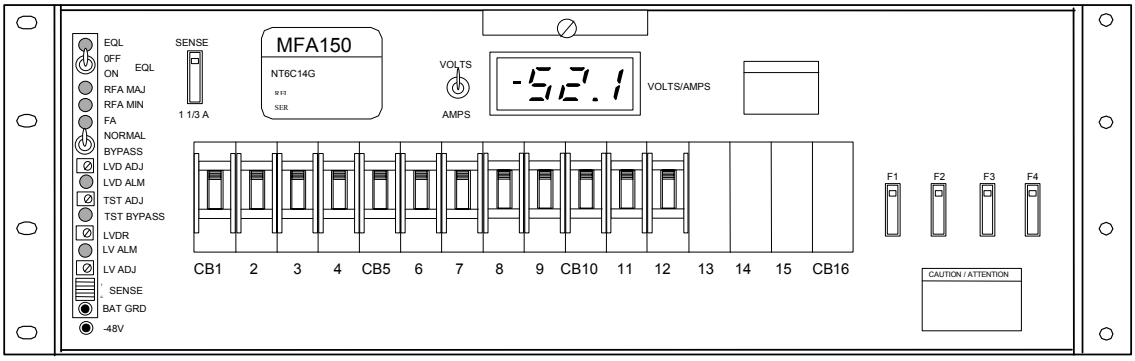
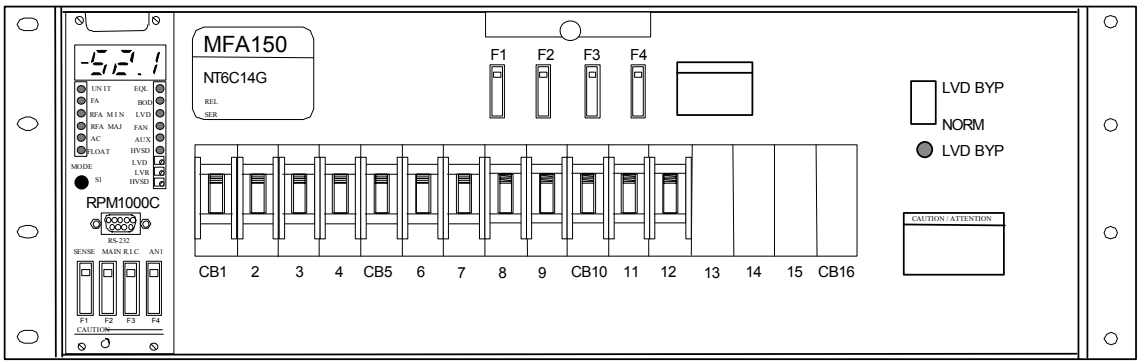


Figure 4 – Front view of the NT614G control and distribution panel equipped with the RPM1000C intelligent controller



Electrical specifications of the control and distribution panel

The electrical specifications of the NT6C14G control and distribution panel are as follows:

- Charge and discharge battery busbars capacity: 250 A
- Battery return busbars capacity: 250 A
- System discharge capacity: 150 A
- Shunt rating (50 mV drop): 250 A
- LVD (optional) capacity: 150 A

- Operating voltage nominal: –48 V dc
  range: –45 to –60 V dc
- Number of circuit breakers: up to 16
- Circuit breaker capacity (see Appendix B for list): 1-100 A
- Number of fuses: 5 or 8
- Fuse type: QFF
- QFF fuse rating (see Appendix B for list): .180 to 5 A

Power shelves, 75 A and 150 A

Mechanical specifications of the power shelves

The mechanical specifications of the MPS75 (75 A) and MPS150 (150 A) power shelves are listed in Table 3.

Table 3 – Mechanical specifications of the MPS75 and MPS150 power shelves

Model	Figure	Height	Depth	Width	Weight
MPS75	5	7.0 inches (17.78 cm)	12.0 inches (30.48 cm)	23.0 inches (58.42 cm)	23.0 lbs (10.43 kg)
MPS150	6	13.0 inches (33.02 cm)	15.0 inches (38.10 cm)	23.0 inches (58.42 cm)	33.0 lbs (14.97 kg)

Each MPS75 and MPS150 power shelf supports three plug-in rectifiers. Figure 5 shows a front view of the MPS75 power shelf without the rectifiers installed, while Figure 6 shows a front view of the MPS150 power shelf without the rectifiers installed.

Figure 5 – Front view of the MPS75 power shelf (shown without the rectifiers)

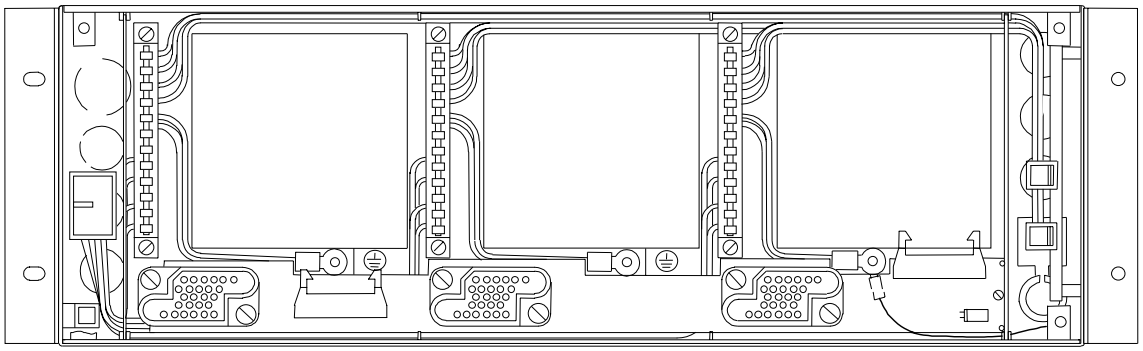
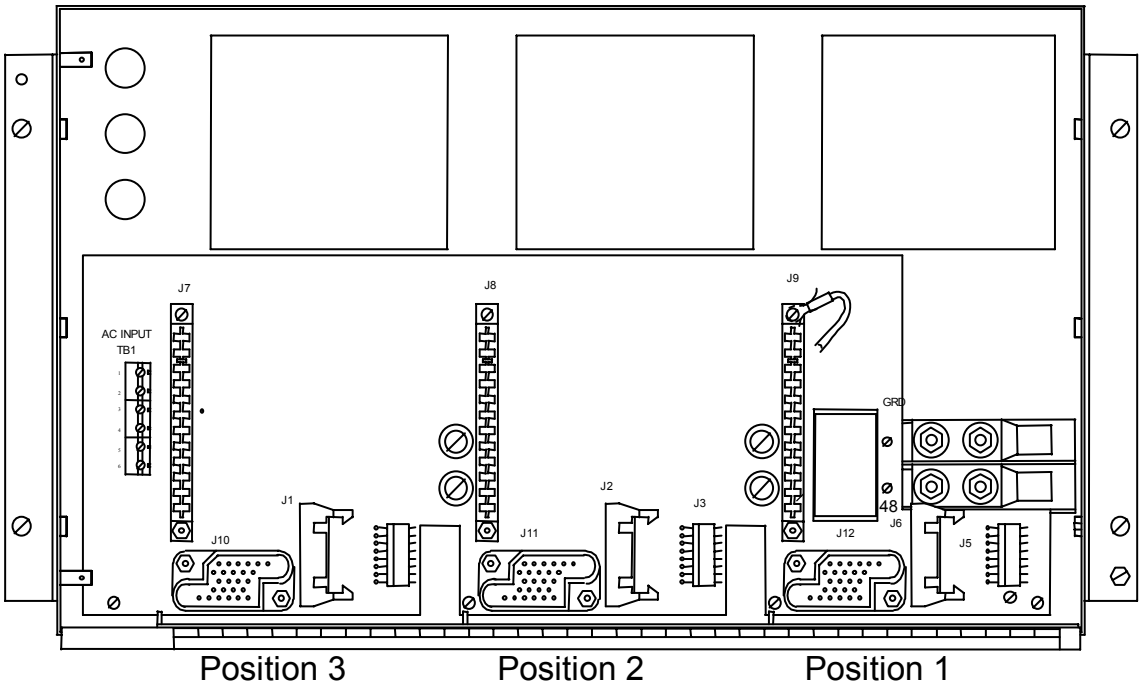


Figure 6 – Front view of the MPS150 power shelf (shown without the rectifiers)



Electrical specifications of the power shelves

Each rectifier position provides interconnection points for AC input, DC output and control and alarm signals.

The total output capacity for each shelf is 75 amperes for the MPS75 power shelf and150 amperes for the MPS150 power shelf.

The MPS75 is available in two versions:

- One that provides for common AC feed for the three rectifiers.
- One that provides for individual AC feed for each of the three rectifiers.

Rectifiers

Four models of rectifiers can be used with NT6C28C(x) MFA150 power system: the MPR15, the MPR25, the Helios Rectifier 25/48 and the Helios Rectifier 50/48.

MPR15

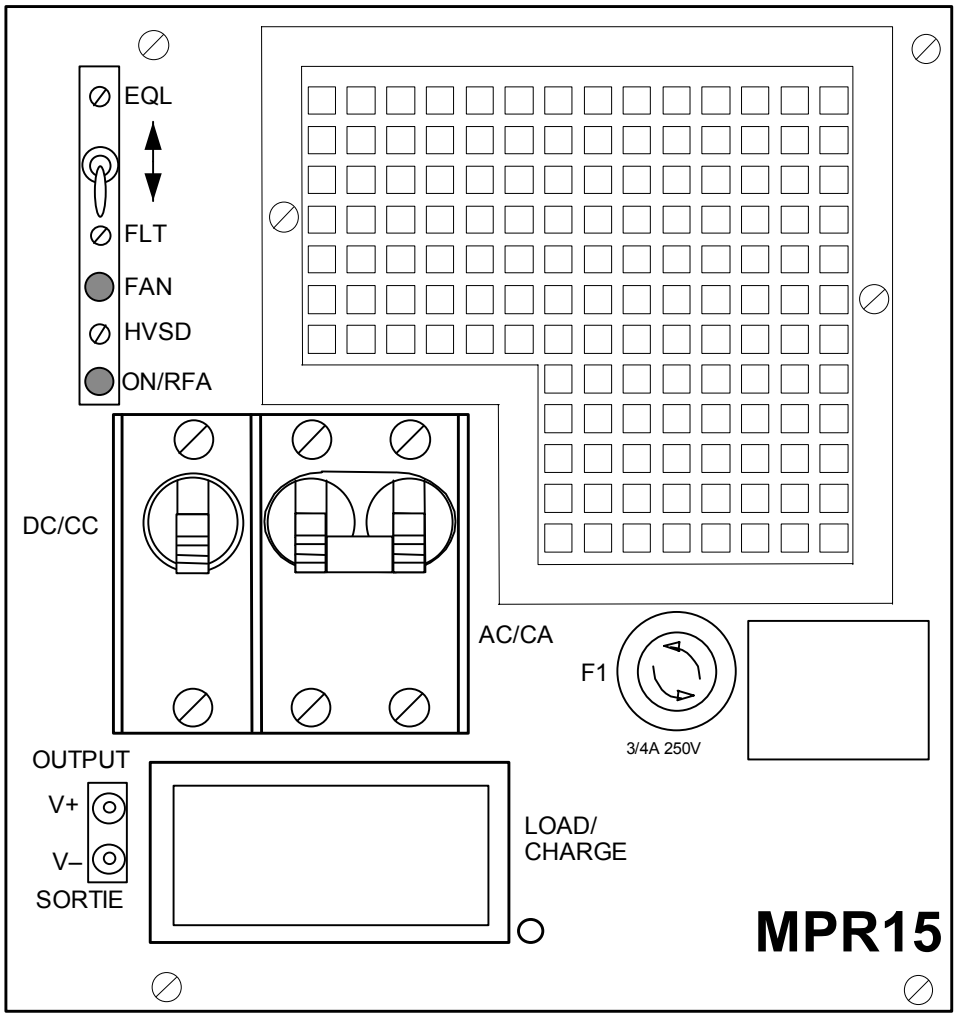
Mechanical specifications of the MPR15 rectifier

The mechanical specifications of the MPR15 rectifier are listed in Table 4.

Table 4 – Mechanical specifications of the MPR15 rectifier

Figure	Height	Depth	Width	Weight
7	6.60 inches (16.76 cm)	11.25 inches (28.58 cm)	6.0 inches (15.24 cm)	14.3 lbs (6.49 kg)

Figure 7 – Front view of the MPR15 rectifier



Electrical specifications MPR15 rectifier

The electrical specifications of the MPR15 rectifier are listed in Table 5.

Table 5 – Electrical specifications of the MPR15 rectifier

Parameter	Specifications
Input voltage:	110/120 V ac, one phase, 47-63 Hz Input voltage range: 96 to 132 V ac
Input current:	10.5 A nominal at 120 V ac input and –56 V dc, 15 A output
Recommended AC service input:	60 A, single pole AC circuit breaker for each shelf for common AC feed 20 A, single pole AC circuit breaker for each rectifier for individual AC feed
Output voltage:	Float: –46 to –57 V dc Equalize: 0 to 2.5 V dc above Float Maximum: –59.5 V dc
Output current:	15 A for each rectifier 45 A for a three position shelf
Input protection:	A 2-pole / 13 A circuit breaker opens both lines.
Output protection:	The rectifier is protected by a single pole 30 A circuit breaker at the output. The output current limiting circuit is factory set 16.5 A ±10% and is not field adjustable.
Efficiency:	Efficiency is 88% at a nominal input voltage of 120 V ac and loads greater than 9 A.
Power factor:	Power factor is 0.60 at a nominal input voltage of 120 V ac and an output load of 15 A.
Heat dissipation:	100 W (341 Btu/hr) at –58 V/15 A output

MPR25

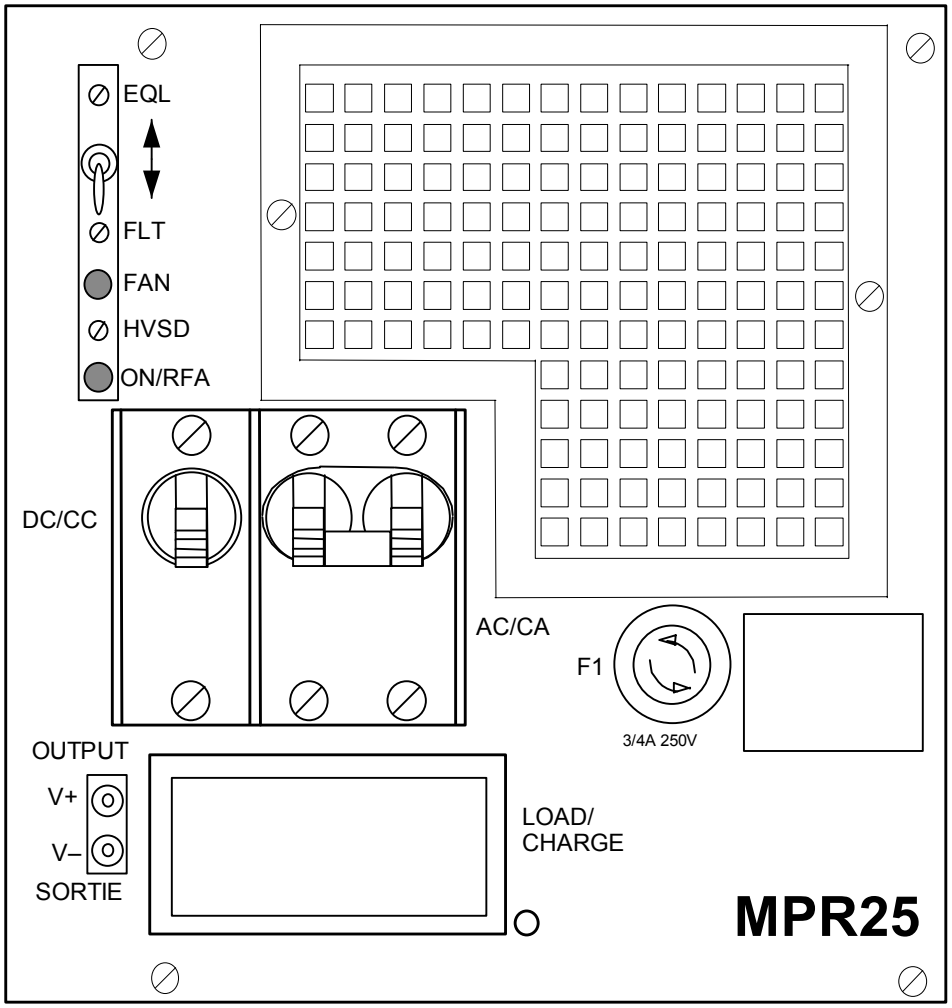
Mechanical specifications of the MPR25 rectifier

The mechanical specifications of the MPR25 rectifier are listed in Table 6.

Table 6 – Mechanical specifications of the MPR25 rectifier

Figure	Height	Depth	Width	Weight
8	6.60 inches (16.76 cm)	11.25 inches (28.58 cm)	6.0 inches (15.24 cm)	15.0 lbs (6.80 kg)

Figure 8 – Front view of the MPR25 rectifier



Electrical specifications of the MPR25 rectifier

The electrical specifications of the MPR25 rectifier are listed inTable 7.

Table 7 – Electrical specifications of the MPR25 rectifier

Parameter	Specifications
Input voltage:	208/240 V ac, one phase, 47-63 Hz Input voltage range: 176 to 264 V ac
Input current:	12 A nominal at 208 V ac input and –56 V dc, 25 A output
Recommended AC service input:	50 A, 2-pole AC circuit breaker for each shelf for common AC feed 20 A, 2-pole AC circuit breaker for each rectifier for individual AC feed
Output voltage:	Float: –46 to –57 V dc Equalize: 0 to 2.5 V dc above Float Maximum: –59.5 V dc
Output current:	25 A for each rectifier 75 A for a three position shelf
Input protection:	A 2 pole / 20 A circuit breaker opens both lines.
Output protection:	The rectifier is protected by a single pole 30 A circuit breaker at the output. The output current limiting circuit is factory set 27.5 A and is not field adjustable.
Efficiency:	Efficiency is 88% at a nominal input voltage of 208 V ac and loads greater than of 15 A.
Power factor:	Power factor is 0.60 at a nominal input voltage of 208 V ac and an output load of 25 A.
Heat dissipation:	190 W (649 Btu/hr)

Helios Rectifier 25/48

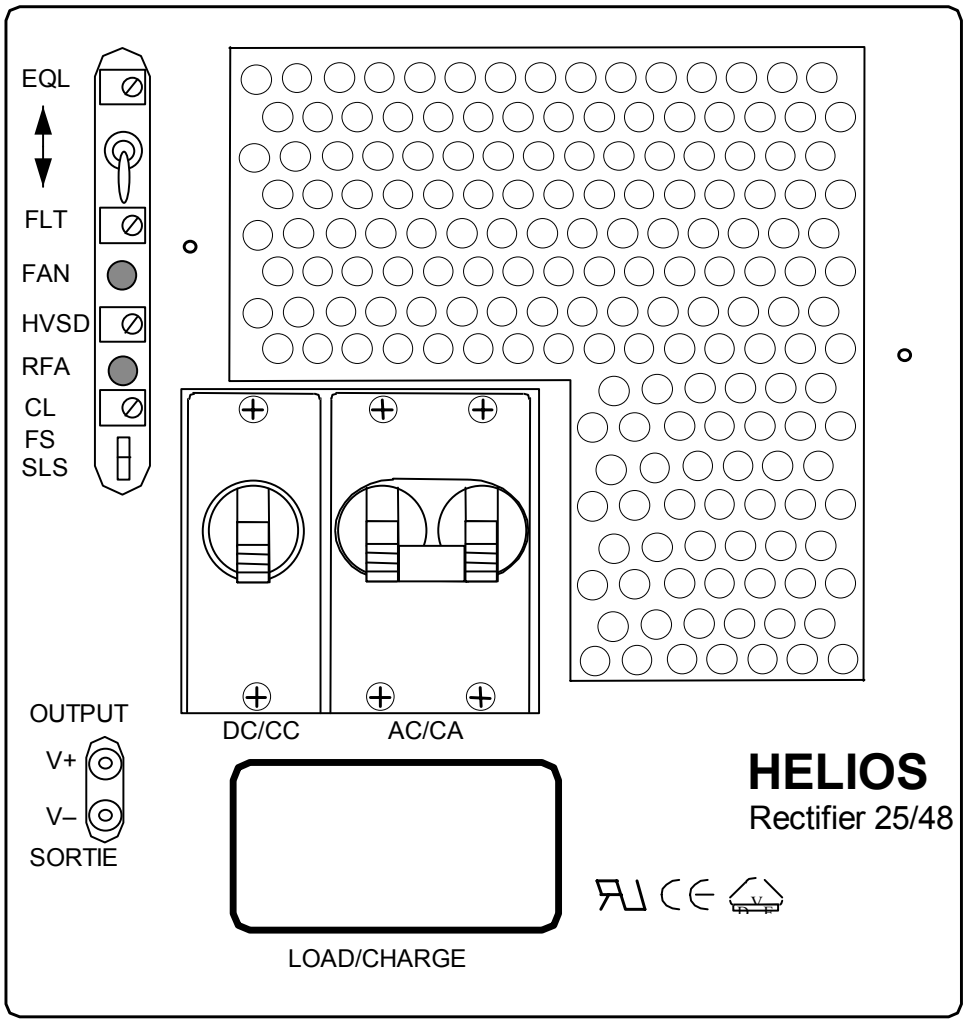
Mechanical specifications Helios Rectifier 25/48

The mechanical specifications of the Helios Rectifier 25/48 are listed in Table 8.

Table 8 – Mechanical specifications of the Helios Rectifier 25/48

Figure	Height	Depth	Width	Weight
8	6.60 inches (16.76 cm)	11.25 inches (28.58 cm)	6.0 inches (15.24 cm)	14.3 lbs (6.49 kg)

Figure 9 – Front view of the Helios Rectifier 25/48



Electrical specifications Helios Rectifier 25/48

The electrical specifications of the Helios Rectifier 25/48 are listed in Table 9.

Table 9 – Electrical specifications of the Helios Rectifier 25/48

Parameter	Specifications
Input voltage:	208/240 V ac, one phase, 47-63 Hz Input voltage range: 176 to 264 V ac
Input current:	7.5 A nominal at 208 V ac input and –56 V dc, 25 A output
Recommended AC service input:	45 or 60 A, 2-pole AC circuit breaker for each shelf for common AC feed 15 or 20 A, 2-pole AC circuit breaker for each rectifier for individual AC feed
Output voltage:	Float: –46 to –56 V dc Equalize: 0 to 4 V dc above Float Maximum: –59.5 V dc
Output current:	25 A for each rectifier 75 A for a three position shelf
Input protection:	A 2 pole / 20 A circuit breaker opens both lines.
Output protection:	The rectifier is protected by a single pole 35 A circuit breaker at the output. The output current limiting circuit is factory set 30 A and is field adjustable between 12.5 and 30 A.
Efficiency:	Efficiency is better than 90% at a nominal input voltage of 240 V ac and an output load greater than 15 A.
Power factor:	Power factor is better than 0.98 at loads greater than 10 A and 0.99 at loads greater than 20 A.
Heat dissipation:	156 W (532 Btu/hr)

Helios Rectifier 50/48

Mechanical specifications Helios Rectifier 50/48

The mechanical specifications of the Helios Rectifier 50/48 are listed in Table 10.

Figure 10 – Front view of the Helios Rectifier 50/48

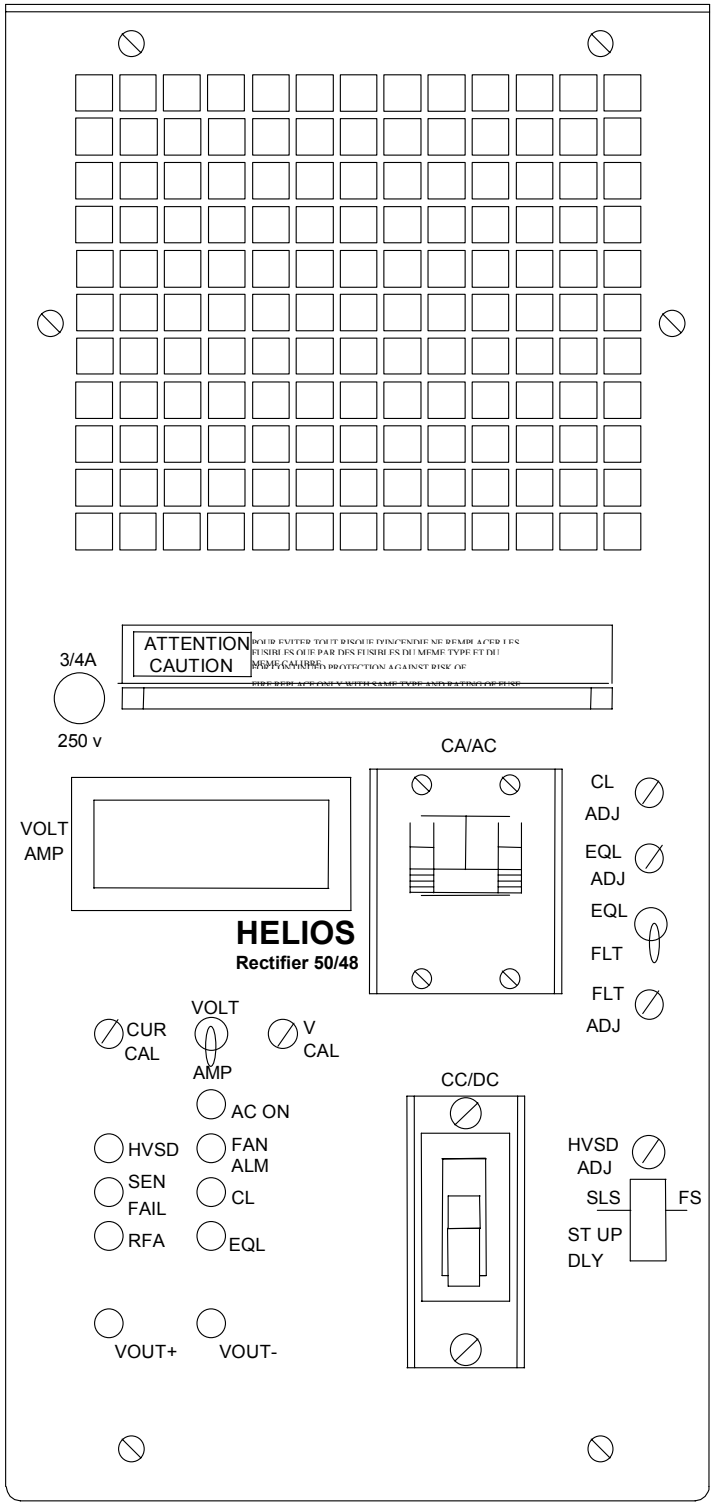


Table 10 – Mechanical specifications of the Helios Rectifier 50/48

Figure	Height	Depth	Width	Weight
10	12.9 inches (32.77 cm)	12.0 inches (30.48 cm)	6.0 inches (15.24 cm)	22.0 lbs (9.98 kg)

Electrical specifications Helios Rectifier 50/48

The electrical specifications of the Helios Rectifier 50/48 are listed in Table 11.

Table 11 – Electrical specifications of the Helios Rectifier 50/48

Parameter	Specification
Input voltage:	208/240 V ac, 1-phase, 47-63 Hz Input voltage range: 176 to 264 V ac
Input current:	15 A nominal at 208 V ac input and –56 V dc, 50 A output
Recommended AC service input:	20 A, 2- pole AC circuit breaker
Output voltage:	Float: –46 to –56 V dc Equalize: 0 to 4 V dc above Float Maximum: –59.5 V dc
Output current:	50 A for each rectifier 150 A for a three position shelf
Input protection:	A two pole / 20 A circuit breaker opens both lines.
Output protection:	The rectifier is protected by a 60 A circuit breaker at the output. The output current is limited to a value adjustable from 50% to 105% of the rated capacity of the rectifier (factory set to 52.5 A).
Output regulation:	The rectifier output voltage is automatically regulated to remain within ±0.5% of the selected value under all load conditions and within the specified input voltage, frequency, and ambient temperature ranges. And within + 1% for any combinations of specified input, output and environmental conditions.
Efficiency:	Efficiency is better than 88% at a nominal input voltage of 208/240 V ac and an output load greater than 20 A.
Power factor:	Power factor is 0.99 at a nominal input voltage of 208 V ac and an output load of 50 A.
Electromagnetic interference (EMI):	The rectifier meets the FCC requirements for conducted and radiated EMI for Class “A” equipment.
Heat dissipation:	380 W (1298 Btu/hr)

RPM1000C (optional)

Mechanical specifications of the RPM1000C

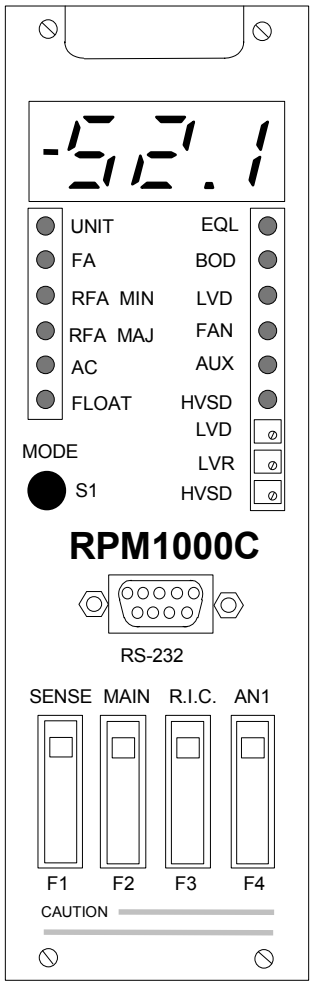
The mechanical specifications of the RPM1000C are listed in Table 12.

Table 12 – Mechanical specifications of the RPM1000C

Figure	Height	Depth	Width	Weight
11	6.6 inches (16.76 cm)	8. 5 inches (21.59 cm)	2.2 inches (5.59 cm)	4.15 lbs (2.04 kg)

In the MFA150, the RPM1000C is plugged and inserted at the front of the control and distribution panel in order to maintain the “front access” status of the power system. Figure 11 shows a front view of the RPM1000C.

Figure 11 – Front view of the RPM1000C



Electrical specifications of the RPM1000C

The input voltage of the RPM1000C is –48 V dc nominal with a range of -42 V dc to –60 V dc. The input current drain is 200 mA.

For more detailed electrical specifications of the RPM1000C, refer to the appropriate user manual listed in Appendix D.

Helios TCM/48 temperature compensation module (optional)

Mechanical specifications Helios TCM/48

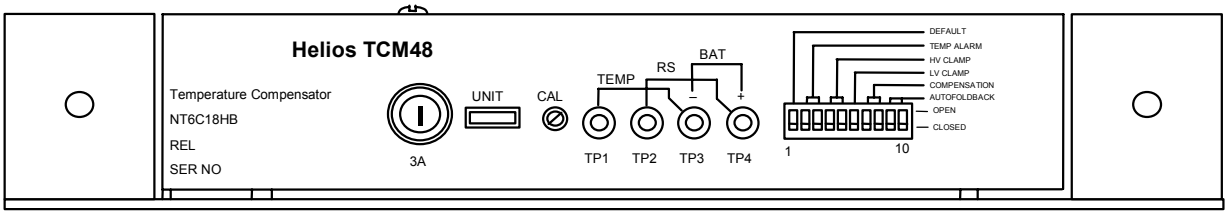
The mechanical specifications of the Helios TCM/48 temperature compensation module are listed in Table 13.

Table 13 – Mechanical specifications of the Helios TCM48 temperature compensation module

Figure	Height	Depth	Width	Weight
12	1.44 inches (3.66 cm)	4.48 inches (11.38 cm)	9.0 inches (22.86 cm)	1.1 lbs (5.5 kg)

Figure 12 shows a front view of the Helios TCM/48 temperature compensation module.

Figure 12 – Front view of the Helios TCM/48 temperature compensation module



Electrical specifications Helios TCM/48

The input voltage of the Helios TCM48 temperature compensation module is –48 V dc nominal with a range of –42 V dc to –57 V dc and a typical input current drain of 350 mA.

The output voltage range is 2.00 V dc to 7.80 V dc.

For more detailed electrical specifications of the Helios TCM/48 temperature compensation module, refer to appropriate user manual listed in Appendix D.

NT6C18EA/EB battery disconnect panel (optional)

Mechanical specifications of the battery disconnect panel

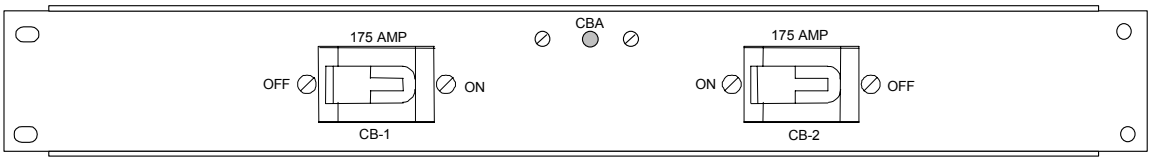
The mechanical specifications of the NT6C18EA/EB battery disconnect panel are listed in Table 14.

Table 14 – Mechanical specifications of the battery disconnect panel

Figure	Height	Depth	Width	Weight
13	1.71 inches (4.34 cm)	3.61 inches (9.17 cm)	23.0 inches (58.42 cm)	5.1 lbs (2.31 kg)

Figure 13 shows a front view of a NT6C18EA/EB battery disconnect panel equipped with two 175 A circuit breakers.

Figure 13 – Front view of the battery disconnect panel



Electrical specifications of the battery disconnect panel

The NT6C18EA/EB battery disconnect panel can be equipped with one or two 175 A circuit breakers.

NT6C18IFA/FD supplementary battery return busbar (optional)

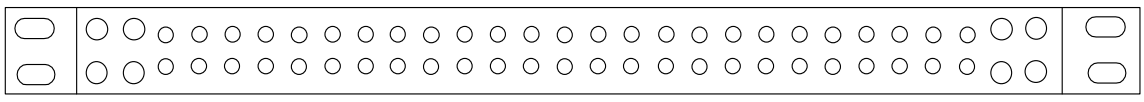
Mechanical specifications of the NT6C18IFA/FD battery return busbar

The mechanical specifications of the NT6C18IFA/FD battery return busbar are listed in Table 15.

Table 15 – Mechanical specifications of the NT6C18IFA/FD battery return busbar

Figure	Length	Width	Thickness	Weight
14	23.44 inches (59.54 cm)	2 inches (5.08 cm)	0.25 inch (0.64 cm)	3.5 lbs (1.59 kg)

Figure 14 – Front view of the NT6C18FA/FD battery return busbar (cover removed)



Electrical specifications of the NT6C18IFA/FD battery return busbar

The NT6C18IFA/FD battery return busbar has a total current carrying capacity of 400 A.

Overall power system specifications

Mechanical specifications of a complete NT6C28C(x) MFA150

The mechanical specifications of a complete NT6C28C(x) MFA150 power system are listed in Table 16.

Note: The weight of the system is based on the power system configuration shown in Figure 2, but without the batteries as too many different battery options are available.

Table 16 – Mechanical specifications of a complete NT6C28C(x) MFA150

Parameter	Specifications
Height	84.0 inches (213.36 cm)
Depth	15.0 inches (38.1 cm)
Width	24.0 inches (60.96 cm)
Total weight (without batteries)	300 lbs (136.08 kg)

Color

The NT6C28C(x) MFA150 is available in two colors, dolphin gray or maple brown.

Electrical

Refer to the individual component specifications.

Electromagnetic interference (EMI) compliance

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

Electrostatic discharge (ESD) immunity

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

Environmental

Operating

- Temperature: 0° to +50°C (32° to 122 °F)
- Humidity: 0 to 95% non-condensing
- Altitude: Sea level to 7000 fee (2134 m)

Transportation

Note: Do not ship with the rectifiers installed in the rectifier framework(s).

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

- Temperature: -50° to +75°C (-58° to +167°F)
- Humidity: 0 to 95% (non condensing) 4kPa max. WVP for 10 days
- Vibration: GR-63-CORE section 5.4.3 Transportation Vibration-Packaged Equipment
- Shock: GR-63-CORE, Section 5.3.1 Handling Drop Tests-Packaged Equipment and section 4.4.4 Transportation Vibration Criteria

Storage

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

Heat dissipation

An MFA150 power system equipped with 7 Helios Rectifiers 25/48 will dissipate a maximum of 1,092 watts or 3,729 Btu/hr.

An MFA150 power system framework equipped with 4 Helios Rectifiers 50/48 will dissipate a maximum of 1,520 watts or 5,190 Btu/hr.

Floor and point loading

The floor and point loading calculations in Table 17 are based on the total weight without batteries in Table 16.

The floor loading is based on a footprint of 24.38 inches by 15 inches (61.92 cm by 38.1 cm) plus a 30-inch (76.2 cm) aisle width (15 inches [38.10 cm] front and rear).

The point loading is based on distributing the framework weight over four shims, each with an assumed area of 4 inches^2 (25.8 cm^2).

Table 17 – Floor and point loading of a complete NT6C28C(x) MFA150

Rack type	Floor loading	Point loading
Standard	39.4 lb/sq ft (17.9 kN/sq m)	18.75 lb/sq inches (12.9 N/sq cm)

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Operation

General

This chapter describes the control, adjustment and operational features of the NT6C28C(x) MFA150 power system.

NT6C14G control and distribution panel

The NT6C14G control and distribution panel uses a very compact design, but without compromising on the accessibility and functionality. It is available in three versions:

- the NT6C14GA/GM equipped with the analog controller card and the LVD feature
- the NT6C14GP equipped with analog controller card but without the LVD feature
- the NT6C14GC/GN equipped with the intelligent microprocessor based controller/monitor and the LVD feature

The operational features of the control and distribution panel are described in the following sections.

Front of the NT6C14GA/GM and NT6C14GP control and distribution panels

The front of the NT6C14GA/GM and NT6C14GP control and distribution panels are provided with the control, alarm and operational features shown in Figures 15 and 16, and described in the following sub-sections.

Note: On the NT6C14GP control and distribution panel, which is not equipped with the LVD feature, the LVD ALM indicator and the LVD ADJ and LVDR potentiometers are still present on the controller card, but should be deactivated by turning the LVD potentiometer fully clockwise and the LVDR potentiometer fully counterclockwise.

Figure 15 – Control, alarm and operational features on the front panel of the NT6C14GA/GM and NT6C14GP control and distribution panels

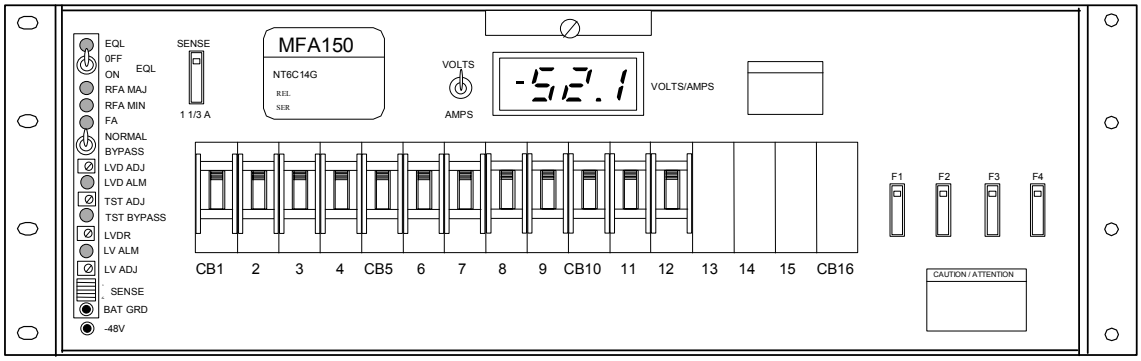
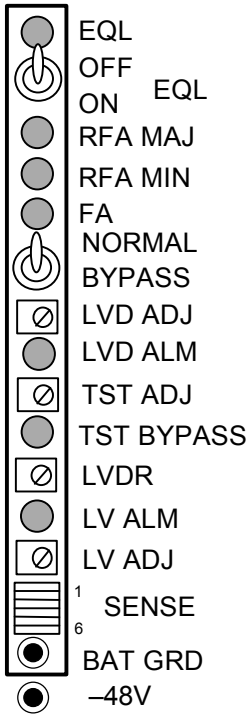


Figure 16 – Enlarged view of the controller card section



Visual indicators

A red LED readout displays the system current and voltage, and seven LED indicators display the conditions described in Table 18.

Table 18 – Visual indicators

Designation	Description	Color
EQL	To indicate that the equalize function is activated.	yellow
RFA MIN	To indicate a minor rectifier failure alarm.	yellow
RFA MAJ	To indicate a major rectifier failure alarm.	red
FA	To indicate a fuse and circuit breaker alarm.	red
LVD ALM*	To indicate a low voltage disconnect alarm.	red
TST BYPASS	To indicate that the LV alarm and LVD alarm and control adjustment circuits of the controller card are in the test mode and, if provided, that the LVD contactor is placed in the bypass mode for maintenance purposes.	red
LV ALM	To indicate a low voltage alarm.	red

Note: * See the Note in the "Front of the NT6C14GA/GM and NT6C14GP control and distribution panels" section.

Switches

There are three switches to control the functions described in Table 19.

Table 19 – Switches

Designation	Description
EQL OFF/ON	Used to activate and deactivate the equalize function of the rectifiers.
NORMAL/BYPASS	Used to place the LV alarm and LVD alarm and control adjustment circuits of the controller card in the test mode for adjustment purposes, and, if provided, the LVD contactor in the bypass mode in order to prevent accidental release of the LVD contactor during test and maintenance routines.
VOLTS/AMPS	Used to select the system current or voltage on the display.

Dip switches

There is one six-position DIP switch module on the controller card to activate and deactivate rectifier sense leads 1 to 6.

Potentiometers

There are four potentiometers for the adjusting the functions described in Table 20.

Table 20 – Potentiometers

Designation	Description
LVD ADJ*	To adjust the low voltage disconnect threshold
TST ADJ	To adjust the internal test voltage used for the setting of other thresholds
LVDR*	To adjust the low voltage disconnect reconnect threshold
LV ADJ	To adjust the low voltage alarm threshold

Note: * See the Note in the "Front of the NT6C14GA/GM and NT6C14GP control and distribution panels" section.

Test points

There is one set of test points for calibrating the thresholds shown in Table 21.

Table 21 – Test points

Designation	Description
BAT GRD	The positive side of the display
–48V	The negative side of the display

Fuses

There are five QFF type fuses for protecting the circuits listed in Table 22.

Table 22 – Fuses

Designation	Description
SENSE	Protection fuse for the sense leads of the rectifiers.
F1 to F4	Protection fuse for loads as required.

Circuit breakers

Up to 16 standard trip or mid trip circuit breakers, in capacities from 1 A to 100 A, protect the loads as required. Refer to "Appendix B : Recommended replacement parts" for a list of circuit breakers.

The standard trip circuit breaker will trigger an alarm when it is electrically tripped (for example : overload) or by manually putting it in the OFF position.

The mid trip circuit breaker will trigger an alarm only when it is electrically tripped (for example : overload), not when it is manually put in the OFF position.

Note : Circuit breakers with a capacity of more than 80 A must be located adjacent to circuit breakers having a capacity of less than 65 A.

Internal connecting features of the NT6C14GA/GM and NT6C14GP control and distribution panels

The inside of the NT6C14GA/GB/GM and NT6C14GE/GF/GP control and distribution panels contain the following terminal blocks and connectors.

Terminal blocks

There is one 4-position screw-type terminal block (TB1) on the back of the front door of the control and distribution panel to connect small loads to QFF type fuses F1 to F4.

There are three 8-position screw type terminal blocks (TB1, TB2 and TB3) on the controller card itself to interface with alarm signals, sensing signals from busbars, FA IN signals from distribution fuses and circuit breakers, and the battery disconnect panel, if provided.

Table 23 – TB1 and TB2 pin assignment on the controller card

TB1 pin No.	Description	TB2 pin No.	Description
1	LVD ALARM (NC)	1	RFA (C)
2	LVD ALARM (C)	2	RFA MINOR (NC)
3	LVD ALARM (NO)	3	RFA MINOR (NO)
4	LVA (NC)	4	RFA MAJOR (NC)
5	LVA (C)	5	RFA MAJOR (NO)
6	LVA (NO)	6	FUSE ALARM (NC)
7	EQL STAT (C)	7	FUSE ALARM (C)
8	EQL STAT (NO)	8	FUSE ALARM (NO)

Table 24 – TB3 pin assignment on the controller card

Pin number	Description	Pin number	Description
1	+ to LVD contactor coil	5	FA IN (–48 V)
2	– to LVD contactor coil	6	FA IN (–48 V)
3	Charge busbar (–48 V)	7	VR+ (BRG)
4	BRG busbar	8	VR– (–48 V)

Connectors

There are ten connectors on the controller card for internal wiring terminated with connectors, as shown in Tables 25 and 26.

Note: Connector J8 is for internal use only. Connectors J9 and J10 interface with the LVD control relay, if provided, in which case they are factory wired.

Connectors J1 to J6 are used to interface with up to six rectifiers.

Table 25 – J1 to J6 connector pin assignment

Pin number	Description	Pin number	Description
1	EQL	5	HVSDR
2	RG+	6	HVSD
3	RC–	7	RFA (NC)
4	FAN ALM (NC)	8	TR

Connector J7 interfaces with the optional remote signals and controls.

Table 26 – J7 connector pin assignment

Pin number	Description	Pin number	Description
1	FAN ALM (NC) - output	5	HVSD - remote input
2	HVSDR - input	6	unused
3	REM LVD - input	7	unused
4	REM EQL - input	8	unused

Front of the NT6C14GC/GN control and distribution panels

The front of the NT6C14GC/GN control and distribution panels are provided with the control, alarm and operational features shown in Figures 17 and 18, and described in the following sub-sections.

Figure 17 – Control, alarm and operational features on the front panel of the NT6C14GC/GN control and distribution panels

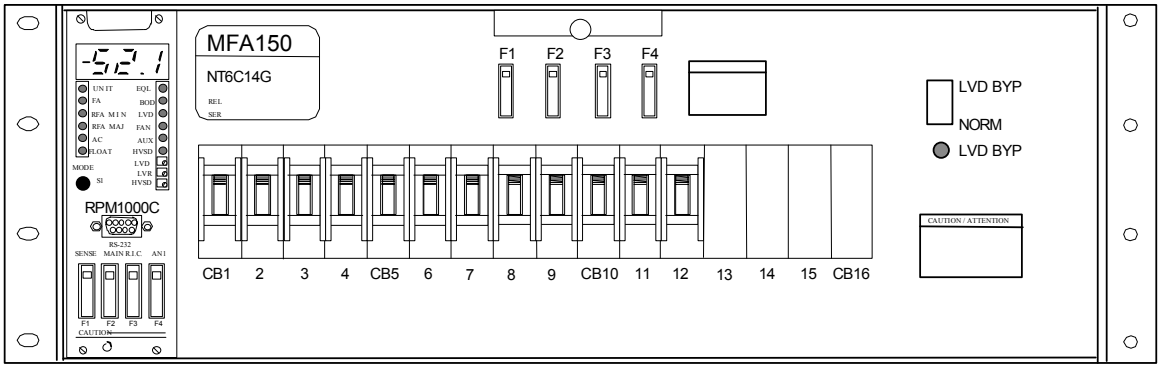
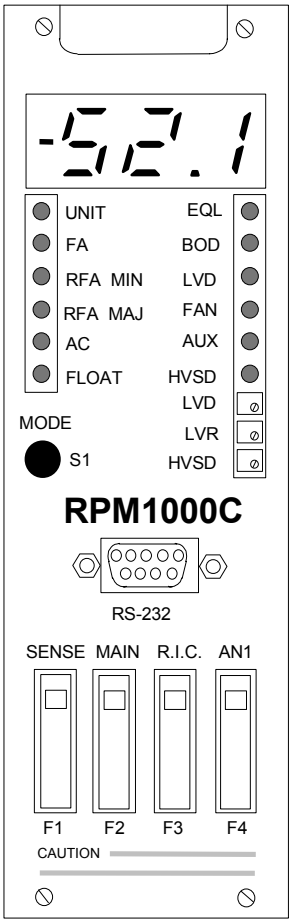


Figure 18 – Enlarged view of the RPM1000C section



Visual indicators

A red LED readout displays the values of the analog channels selected with the MODE push-button (S1), and 12 or 13 LED indicators to display the conditions described in Table 27.

Table 27 – Visual indicators

Designation	Description	Color
UNIT	Normal operation	green
	RPM1000C failure	red
	RPM1000C low memory back-up battery voltage	flashing
FA	Fuse and circuit breaker Alarm	red
RFA MIN	Minor rectifier failure alarm	yellow
RFA MAJ	Major rectifier failure alarm	red
AC	Rectifier AC supply failure alarm	red
FLOAT	Normal operating voltage	green
	High or low float voltage	yellow
	High or low voltage	red
EQL	Equalize function activated	yellow
BOD	Battery on discharge alarm	red
LVD	Low voltage disconnect alarm	red
FAN	Rectifier fan failure alarm	yellow
AUX	Auxiliary alarm (user programmable)	red
HVSD	High Voltage Shutdown	red
LVD BYP (NT6C14 GC/GN only) *	To indicate that the LVD contactor is placed in the bypass mode	red

Note : * Although it is designated on the front panel, the LVD BYP LED indicator location is filled with a blank plate on the NT6C14GG/GQ control and distribution panel not equipped with the LVD feature.

Switch

The LVD BYP/NORM switch, which is used to place the LVD contactor in the bypass mode, is present on the NT6C14GC/GN control and distribution panel only. On the NT6C14 GC/GN, although it is designated, the switch location is filled with a blank panel.

LVD MANUAL RECONNECT (option)

This option consists of adding a strap identified as "Manual reconnect jumper" between pins 3 and 9 of TB1 on the NT6C14PA LVD circuit board (located on the back of the front door of the control and distribution panel).

When this option is provided, the load will not reconnect automatically after disconnecting due to a low voltage condition. To reconnect the load to the system, the LVD BYP/NORM switch must be put in the BYPASS position and back to the NORMAL position. If this option was furnished, the additional stamping "MANUAL RECONNECT" should have been added beside the switch.

Note : If the LVD BYP/NORM switch is left in the BYPASS position, the LVD will not disconnect if the voltage decreases below the LVD threshold.

Potentiometers

There are three potentiometers for adjusting the functions described in Table 28.

Table 28 – Potentiometers

Designation	Description
LVD*	To adjust the low voltage disconnect threshold
LVR*	To adjust the low voltage disconnect reconnect threshold
HVSD	To adjust the global rectifier high voltage shutdown threshold

Note: * On the NT6C14GC/GN control and distribution panel, which is not equipped with the LVD feature, the LVD and LVR potentiometers are still present on the RPM1000C, but are inactive.

Push-button

The MODE push-button (S1) is used to display the measured value for each of the eight analog channels on the RPM1000C. Refer to the RPM1000C user manual listed in Appendix D for additional details on the MODE push-button.

Fuses

There are eight QFF type fuses for protecting the circuits described in Table 29.

Table 29 – Fuses

Designation	Description
SENSE	Protection fuse for the sense leads of the rectifiers.
MAIN	Protection fuse for the main board inside the RPM1000C.
R.I.C.	Protection fuse for the rectifier interface board inside the RPM1000C.
AN1	Protection fuse for the analog channel 1 of the RPM1000C.
F1 to F4	Protection fuses for loads as required.

Circuit breakers

There are up to 16 standard trip or mid trip circuit breakers for the protection of loads as required.

The standard trip circuit breaker will provide alarm when electrically tripped (for example : overload) or when manually put in the OFF position.

The mid trip circuit breaker will provide alarm only when electrically tripped (for example : overload), not when manually put in the OFF position.

Connector

There is one DB9 connector for local access to the database and stored data in the RPM1000C through the RS-232 serial port.

Internal connecting features of the NT6C14GC/GD/GN and NT6C14GG/GH/GQ control and distribution panels

The inside of the NT6C14GC/GN control and distribution panels are provided with the following terminal blocks and connectors.

Terminal block

There is one 4-position screw type terminal block (TB1) on the back of the front door of the control and distribution panel to connect small loads to QFF type fuses F1 to F4.

Connectors

There are 12 connectors on the RPM1000C for internally wiring the interface with the components inside the control and distribution panel, as well as for external interface with probes, detectors and transducers for the input channels and the external alarm circuits, as required. For detailed connector pin assignment for the RPM1000C, refer to the appropriate user manual listed in Appendix D.

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.

The output is adjustable over a range of –46 to –59.5 V for floating a 23- or 24-cell battery string.

The rectifiers are equipped with AC input and DC output circuit breakers, a digital ammeter, potentiometers for adjusting the thresholds, and LED indicators for alarm indications.

The rectifiers use high frequency switching technology and are forced air-cooled.

Refer to the appropriate rectifier user manual listed in Appendix D for detailed operation information on the MR15 rectifier, the MPR25 rectifier, the Helios Rectifier 25/48, and the Helios Rectifier 50/48.

RPM1000C (optional)

The RPM1000C is a microprocessor-based controller/monitor which, in addition to providing the basic controller functions found on analog controllers, provides advanced control and monitoring functions. It can monitor and record the operational data of the power systems that can be locally or remotely accessed or retrieved for further analysis. The recorded data can be accessed by means of the push-button or the RS-232 port on the front panel, or remotely through the modem link.

If an RPM1000C was supplied with your system, refer to the appropriate user manual listed in Appendix D for the detailed operational characteristics.

Helios TCM/48 temperature compensation module (optional)

The temperature compensation module (Helios TCM/48) is used to control the output voltage of the rectifiers according to the variations in the temperature input. When the temperature rises, the Helios TCM/48 modifies the rectifier reference voltage to reduce it according to a pre-programmed algorithm.

The Helios TCM/48 controls the battery voltage according to the temperature to extend the life of the batteries and to eliminate the possibility of a thermal runaway condition.

If a Helios TCM/48 was supplied with your system, refer to the appropriate user manual listed in Appendix D for the detailed operational characteristics.

NT6C18EA/EB battery disconnect panel (optional)

The NT6C18EA/EB battery disconnect panel is used to manually disconnect the battery strings (up to two) from the power system for maintenance purpose. When a circuit breaker is in the OFF position, the FA indicator on the panel itself is lit, and an alarm signal (FA) is sent to the control and distribution panel for further extension to the external alarm circuits.

NT6C18FA/FD supplementary battery return busbar (optional)

The NT6C18FA/FD supplementary battery return busbar is mounted at the top of the MFA150 framework and is used to provide external battery return connecting points from the control and distribution panel. It provides easier access for the battery return connections, it permits the use of larger cables and lugs, and it provides more space inside the control and distribution panel.

Maintenance

Routine maintenance

The following is a list of general preventive maintenance procedures which should be performed periodically as required by the environmental conditions and the local maintenance policy to ensure trouble-free operation of NT6C28C(x) MFA150 power system:

- clean all ventilation openings
- clean, or replace the filters (if provided)
- tighten all the electrical connections
- check for hot fuses or breakers (loose, undersized, or overloaded)
- verify the alarm thresholds
- verify the meter calibration
- verify the rectifier settings

The detailed recommended maintenance and adjustment procedures for the rectifiers and other components of the NT6C28C(x) MFA150 are covered in their respective user manual (refer to list in Appendix D).

The following tools and test equipment are required to adjust equipment in the power system. Also, have available User Manual Voltage_level entitled *Voltage Level Limits for Power Plants, Rectifiers and Controllers* :

- potentiometer screwdriver, Bourns No. 60 or equivalent
- digital voltmeter, Fluke 8050A or equivalent
- dummy load, 100 A (or use the office load if available)

Troubleshooting

Table 30 provides a list of the problems which can occur on NT6C28C(x) MFA150 power system, along with their possible causes. Blown fuses and tripped circuit breakers must always be investigated before referring to this table.

WARNING

Precautions to take to avoid service interruptions

When working on a live power system, the low voltage disconnect contactor (if provided) should be kept from tripping. To do this, insert a 1/4-inch (3 mm) wide electrically isolated tool (preferably plastic) in the small opening on the side of the contactor assembly to lock it closed. See Figure 19.

Table 30 – Fault diagnosis

Fault symptom	Possible causes
No DC output current	• Open AC supply or AC circuit breaker • Open DC circuit breaker • Faulty connection between the power shelf and the controller • Low voltage disconnect is open • Sense leads are open
Incorrect indication of the DC output current	• Incorrect meter calibration • Loose shunt leads connection
Meter display is OFF	Meter display failure
Low voltage	• Faulty rectifier(s) • Shorted battery cell(s) • Prolonged power failure • Incorrect float voltage adjustment • Sense leads are open • Discharge load is greater than the rectifier's capacity • Helios TCM/48 failure (if provided)
High voltage	• Faulty rectifier(s) • Incorrect Float/Equalize adjustment
Failure to generate alarms during an alarm conditions	Incorrect connections between the control and distribution panel or the rectifier shelves or the RPM1000C or the TCM/48
Failure to generate an FA alarm	• Faulty wiring • Faulty fuse or circuit breaker • Faulty FA LED • Loose connection • Mid trip circuit breaker

—continued—

Table 30 – Fault diagnosis (continued)

Fault symptom	Possible causes
Failure to generate an RFA alarm under appropriate conditions	• Faulty rectifier • Faulty wiring • Faulty RFA MIN or RFA MAJ LED
Rectifiers are not sharing the load	• Incorrect float or equalize adjustment on one or more of the rectifiers • Sense leads are open on one or more rectifiers • Share mode incorrectly set on one or more rectifiers
LVD contactor does not reconnect the load	• Incorrect LVR or LVDR threshold setting • Faulty controller card or RPM1000C • Blown F1 fuse on the controller (NT6C14GA/GB/GM and NT6C14GE/GF/GP) or LVD (NT6C14GC/GD/GN and NT6C14GG/GH/GQ) card • Faulty contactor
On NT6C14GA/GM and NT6C14GP control and distribution panels only:	
LV ALM lamp is lit	• Low discharge voltage condition • Incorrect LV level adjustment
TST BYPASS lamp is lit	The NORMAL/BYPASS switch is in the BYPASS position on the controller card.
On NT6C14GC/GN control and distribution panels only:	
UNIT lamp is lit red	Failure of the RPM1000C
UNIT lamp is flashing	Low voltage on the memory back-up battery of the RPM1000C
AC lamp is lit	AC supply for the rectifiers has failed.
FLOAT lamp is lit yellow	• Slightly high or low discharge voltage condition • Incorrect HF or LF level adjustment • Incorrect float or equalize level adjustment on one or more rectifiers
FLOAT lamp is lit red	• High or low discharge voltage condition • Incorrect HV or LV level adjustment • Incorrect float or equalize level adjustment on one or more rectifiers
BOD lamp is lit	• Low discharge voltage condition • Incorrect BOD level adjustment • Incorrect float or equalize level adjustment on one or more rectifiers
HVSD lamp is lit	• A high voltage shutdown signal was sent to the rectifiers by the RPM1000C • Incorrect HVSD level adjustment
FAN lamp lit	Fan failure on one or more rectifiers
AUX lamp lit	Auxiliary equipment failure (when programmed)
—continued—	

Table 30 – Fault diagnosis (continued)

Fault symptom	Possible causes
On all models of control and distribution panels:	
EQL lamp is lit	The equalize mode is activated
RFA MIN lamp is lit	One rectifier has failed
RFA MAJ lamp is lit	Two or more rectifiers have failed
FA lamp is lit	Blown fuse or tripped circuit breaker on the control and distribution panel
LVD ALM lamp is lit	Low voltage disconnect condition initiated by the controller
LVD BYP lamp is lit	The low voltage disconnect contactor has been manually bypassed by means of the LVD BYP/NORM switch.

Addition / replacement procedures

Replacing the RPM1000C

Refer to the maintenance chapter of the appropriate RPM1000C user manual, listed in Appendix D for the procedure to replace the RPM1000C.

Replacing the NT6C14PF controller card (NT6C14GA/GM and NT6C14GP control and distribution panels only)

The NT6C14PF controller card can be easily replaced without taking the NT6C28C(x) MFA150 power system out of service.

Proceed as described in Procedure 1.

CAUTION

Protect the equipment against an electro static discharge (ESD)

The control card contains some discrete and microelectronic solid state devices that can be permanently damaged by electrostatic potentials that may occur during handling and installation unless the necessary precautions are taken.

CAUTION

Precautions to take to avoid service interruptions

When working on a live power system, the low voltage disconnect contactor (if provided) should be kept from tripping. To do this, insert a 1/4-inch (3 mm) wide electrically isolated tool (preferably plastic) in the small opening on the side of the contactor assembly to lock it closed. See Figure 19.

Procedure 1 – Replacing the NT6C14PF controller card

Step	Action
1	Notify the alarm centre of the possibility of incoming alarms during the execution of this procedure.
2	If possible, use the TEST mode to record the existing alarm settings of the control card.
3	Remove the top cover and open the front door of the control and distribution panel.
4	If the system is provided with an LVD feature, insert a 1/4-inch (3 mm) wide electrically isolated tool in the small side opening of the contactor assembly to lock it closed as shown in Figure 19.
5	Remove the sense fuse on the front door of the control and distribution panel and open the connector going to the controller card.
6	Disconnect and insulate the red lead coming from TB3-4 on the battery (–) charge busbar.
7	Remove and tag the power leads on TB3-3 and TB3-4 of the controller card, as well as all the other alarm and control leads on terminal block TB1, TB2 and TB3.
8	Unplug the rectifier and power plant alarm cable assemblies from connectors J1 to J7.
9	Remove the mounting screw securing the controller card in place, then pull the card slightly forward, slightly to the right, and pull it forward completely to remove it.
10	Install the new card by reversing the operation in step 10 and securing it in place with the mounting screw.
11	Reconnect all wires and cables by reversing steps 6, 7 and 8.
12	**Adjustments** Put the BYPASS/NORMAL switch in the BYPASS position. The TST BYPASS indicator should light up.
13	Connect an external digital multimeter set for a 60 V dc reading across the test points located on the front of the control and distribution panel.

—continued—

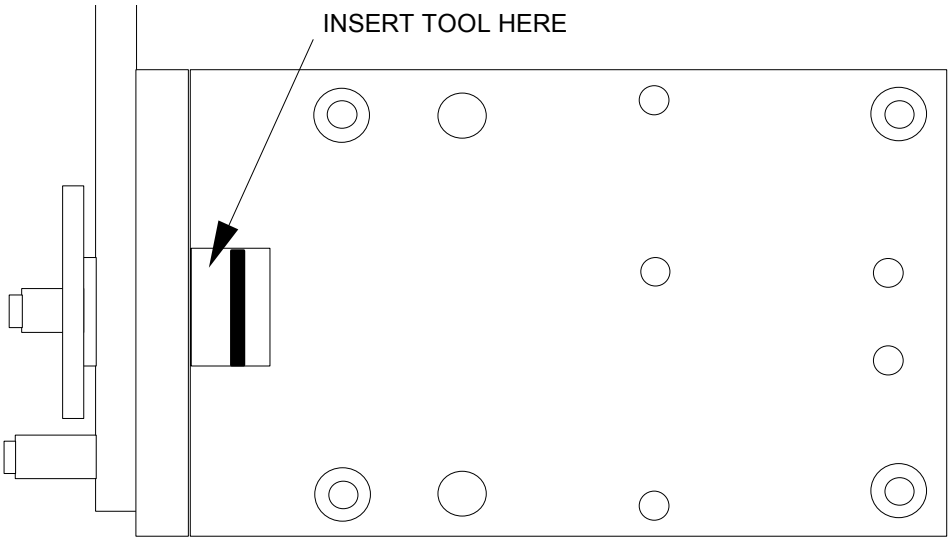
Procedure 1 – Replacing the NT6C14PF controller card (continued)

Step	Action
14	Turn the TST ADJ potentiometer slowly counterclockwise and verify that the LV ALM indicator lights up at the appropriate voltage level. If the LV ALM indicator lights up before the appropriate voltage level is reached or does not light up, adjust the LV ADJ potentiometer until the LV ALM indicator lights up at the appropriate voltage level.
15	If the system is provided with an LVD feature, slowly turn the TST ADJ potentiometer counterclockwise and verify that the LVD ALM indicator lights up at the appropriate voltage level. If the LVD ALM indicator lights up before the appropriate voltage level is reached or does not light up, adjust the LVD ADJ potentiometer until the LVD ALM indicator lights up at the appropriate voltage level.
16	Turn the TST ADJ potentiometer slowly clockwise and verify that the LV ALM indicator extinguishes at the appropriate voltage level.
17	If the system is provided with an LVD feature, slowly turn the TST ADJ potentiometer clockwise and verify that the LVD ALM indicator extinguishes at the appropriate voltage level. If the LVD ALM indicator extinguishes before the appropriate voltage level is reached, or does not extinguish, adjust the LVDR ADJ potentiometer until the LVD ALM indicator extinguishes at the appropriate voltage level.
18	Put the BYPASS/NORMAL switch in the NORMAL position. The TST BYPASS indicator should extinguish.
19	Reinstall the sense fuse on the front door of the control and distribution panel, and close the connector going to the controller card (opened in step 5).
20	**Operational tests** Put the EQL switch in the ON position. Verify that the voltage on the rectifiers increases to the equalize voltage level and stays at that level until the EQL switch is returned to the OFF position.
21	Verify that the circuit breaker and fuse alarm is functional by depressing the alarm pin on one of the F1 to F4 QFF fuses, or by inserting a blown fuse in one of the fuse positions. Verify that the red FA LED lights up and that a major alarm is triggered. Release the alarm pin or remove the blown fuse. Verify that the alarm conditions have been canceled.
22	Test the RFA alarms by shutting down one rectifier. Verify that the yellow RFA MIN LED lights up and that a minor alarm is triggered.
23	Shut down a second rectifier. Verify that the red RFA MAJ LED lights and that a major alarm is triggered.
24	Restart the rectifiers and verify that the alarm conditions have been canceled.
25	If the system is provided with an LVD feature, remove the electrically isolated tool installed in step 4.
—continued—	

Procedure 1 – Replacing the NT6C14PF controller card (continued)

Step	Action
26	Reinstall the top cover and close the front door securing it with the captive screw.
27	Notify the alarm centre at the end of the procedure.
–end–	

Figure 19 – Locking the LVD contactor in the closed position



Replacing the NT6C14PG meter display card (NT6C14GA/GM and NT6C14GP control and distribution panels only)

The NT6C14PG meter display card can be easily replaced without taking the NT6C28C(x) MFA150 power system out of service.

Proceed as described in Procedure 2.

CAUTION

Protecting the equipment against an electro static discharge (ESD)

The meter display card contains some discrete and microelectronic solid state devices that can be permanently damaged by electrostatic potentials that may occur during handling and installation unless the necessary precautions are taken.

WARNING

Precautions to take to avoid service interruptions

When working on a live power system, the low voltage disconnect contactor (if provided) should be kept from tripping. To do this, insert a 1/4-inch (3 mm) wide electrically isolated tool (preferably plastic) in the small opening on the side of the contactor assembly to lock it closed. See Figure 19.

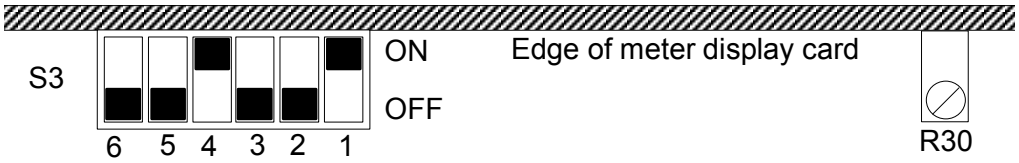
Procedure 2 – Replacing the NT6C14PG meter display card

Step	Action
1	Open the front door of the control and distribution panel.
2	If the system is provided with an LVD feature, insert a 1/4-inch (3 mm) wide electrically isolated tool in Figure 19.
3	Disconnect and insulate the ends of the brown, yellow, black and red wires connected to terminals E1, E2, E3 and E4 on the meter display card.
4	Remove the nut that secures the VOLT/AMPS switch to the font door.
5	Remove the four mounting screws securing the meter display card in place, then remove the card.
6	Install the new meter display card and secure it in place by installing the four mounting screws.
7	Secure the VOLT/AMPS switch to the font door with the appropriate nut.
8	If the new card is not provided with wires on terminals E1, E2, E3 and E4, connect the wires disconnected in step 4 directly to the E1, E2, E3 and E4 terminals. If the new card is provided with wires on terminals E1, E2, E3 and E4, cut these wires approximately 2” long, then splice them to the wires disconnected instep 4, matching the colors.
9	Set the switches of the S3 DIP switch module as follows: 1 and 4 in the ON position, 2, 3, 5 and 6 in the OFF position (see Figure 20).
10	If the system is provided with an LVD feature, remove the electrically isolated tool installed in step 2.
11	**Calibration** Putthe VOLT/AMPS switch on the front door in the AMPS position.
12	Connect an external digital multimeter set for a 2 V dc reading across system shunt E1 and E2 terminals on the meter display card.
13	Verify that the reading in amperes on the meter display of the control and distribution panel is equal to five times the reading in millivolts on the external digital multimeter.
—continued—	

Procedure 2 – Replacing the NT6C14PG meter display card (continued)

Step	Action
14	If the reading on the meter display of the control and distribution panel is off by more than 1% of what it should be, slowly rotate potentiometer R30 (located on the right side of the meter display card) clockwise or counterclockwise until the reading is within 1% of what it should be.
15	Disconnect the external digital multimeter connected in step 12 and close the front door of the control and distribution panel.
–end–	

Figure 20 – Setting the S3 dip switches on the meter display card



Adding or replacing a rectifier

WARNING

Precautions to take 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 battery damage.

Adding a rectifier

Add a rectifier as described in Procedure 3 for an MPR15, MPR25 or Helios Rectifier 25/48, or Procedure 4 for a Helios Rectifier 50/48.

Procedure 3 – Installing an MPR15, MPR25 or Helios Rectifier 25/48

Step	Action
1	Using a flat blade screwdriver lossen the captive screws on the rectifier retaining bar of the rectifier and swing it down.
2	Remove the rectifier blank filler plate by putting a finger in the hole, lifting it up, and pulling it out towards you.
3	With the angle up and oriented towards the rear of the shelf, put the blank filler on the bottom of the shelf. ***Note:*** If a rectifier is removed, reinstall the blank plate to meet regulatory requirements.
—continued—	

Procedure 3 – Installing an MPR15, MPR25 or Helios Rectifier 25/48 (continued)

Step	Action
4	Ensure that the AC and DC circuit breakers on the front panel of the rectifier are in the OFF position.
5	Slide the rectifier into position, making sure that it is fully inserted.
6	Rotate the rectifier retaining bar up and tighten the captive screws to secure the rectifiers into position.
7	Test the new rectifier as described in the appropriate user manual (see the list in Appendix D).
–end–	

Procedure 4 – Installing a Helios Rectifier 50/48

Step	Action
1	Using a flat blade screwdriver loosen the captive screw on the rectifier retaining bar where the rectifier is to be installed and swing the bar down.
2	Remove the rectifier blank filler plate by putting a finger in the hole, lifting it up, and pulling it out towards you.
3	With the hole for the screw at the back and the sliding tape up, place the blank filler plate on the bottom of the shelf. ***Note:*** If a rectifier is removed, reinstall the blank plate to meet regulatory requirements.
4	Ensure that the AC and DC circuit breakers on the front panel of the rectifier are in the OFF position.
5	Carefully slide the rectifier into position, making sure that it is fully inserted. If the batteries are connected, the RFA lamp should light up.
6	Rotate the rectifier retaining bar up and tighten the captive screw to secure the rectifier into position.
7	Test the new rectifier as described in the appropriate user manual (see list in Appendix D).
–end–	

Replacing a rectifier

Replace a rectifier as described in Procedure 5.

Procedure 5 – Replacing a rectifier

Step	Action
1	Notify the alarm centre of the possibility of incoming alarms during the execution of this procedure.
2	Ensure that the AC and DC circuit breakers on the rectifier being replaced are in the OFF position.
3	For a system equipped with an analog controller card, open the sense switch on the SENSE DIP switch module on the control and distribution panel associated with the rectifier being replaced. For a system equipped with an RPM1000C, disconnect the corresponding rectifier connector on the RPM1000C.
4	Using a flat blade screwdriver loosen the captive screw(s) on the rectifier retaining bar and swing the bar down.
5	Slide the rectifier out of the shelf carefully. Pack the rectifier in the shipping carton of the new rectifier.
6	Ensure that the AC and DC circuit breakers on the front panel of the new rectifier are in the OFF position.
7	Carefully slide the new rectifier into position, making sure that it is fully inserted. For a Helios Rectifier 50/48, the RFA lamp should light up.
8	Rotate the rectifier retaining bar up and tighten the captive screw(s) to secure the rectifier into position.
9	With the DC breaker in the “OFF” position, adjust the float and equalize voltage levels to the same level (approximately) as that of the other rectifiers.
10	For rectifiers equipped with the SLS/FS feature, ensure that the SLS/FS switch is set to the same position as that of the other rectifiers.
11	For a system equipped with an analog controller card, close the sense switch associated with the new rectifier on the SENSE DIP switch module on the control and distribution panel. For a system equipped with an RPM1000C, reconnect the corresponding rectifier connector on the RPM1000C.
12	Put the DC circuit breaker in the “ON” position.
13	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 as described in the appropriate user manual (see Appendix D).
14	Notify the alarm center at the end of the procedure.
–end–	

Adding a power shelf

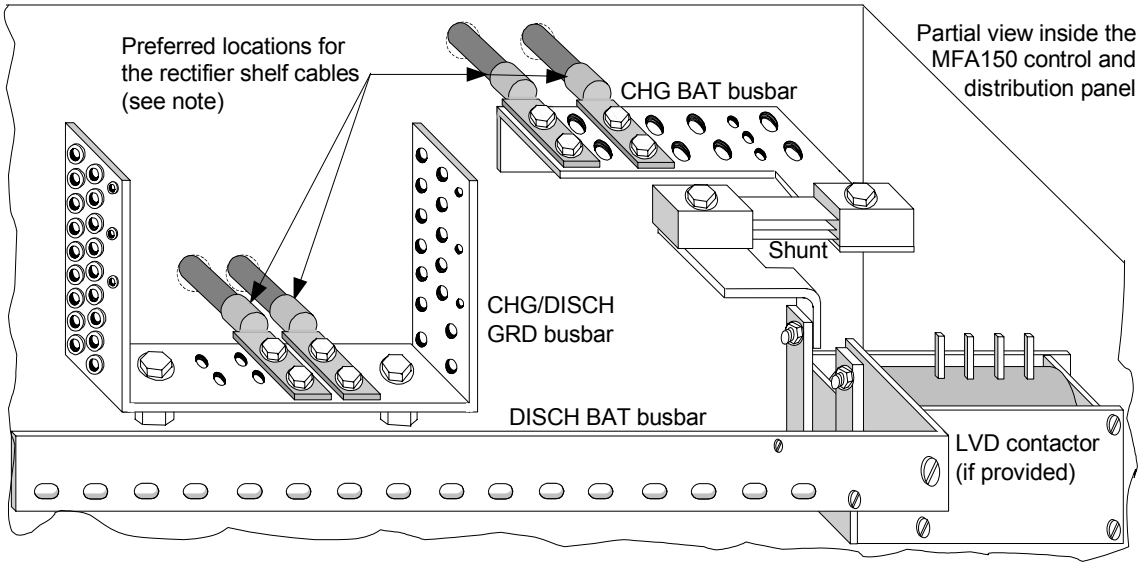
Refer to the applicable rectifier user manual listed in Appendix D for the installation and the AC cabling procedures for your specific model of rectifier shelf.

Connect the new shelf to the NT6C28C control and distribution panel as described in the following procedure.

Procedure 6 – Connecting a rectifier shelf

Step	Action
1	Connect the alarm cable of the rectifier shelf to connector J1, J2 and J3, or J4, J5 and J6, as applicable, on the controller card, or JE1, JE2 and JE3, or JE4, JE5 and JE6, as applicable, on the RPM1000C, inside the control and distribution panel.
2	Connect an appropriately sized cable to each of the –48 V and BR+ output terminals of the shelf.
3	Connect these cables to the charge + and charge – busbars inside the control and distribution panel as shown in Figure 21.
–end–	

Figure 21 – Rectifier shelf connections inside the control and distribution panel



Note: Use minimum No. 4 AWG cables for 75 A rectifier shelf intrabay cabling, and minimum No. 1/0 AWG cables for 150 A rectifier shelf intrabay cabling.

Adding or replacing a battery string

For additions, go to step 4 of Procedure 7. For replacements, proceed from step 1 of Procedure 7.

WARNING

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

This work should be completed during reduced traffic hours or with a diesel generator backup IS 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 has been reconnected.

WARNING

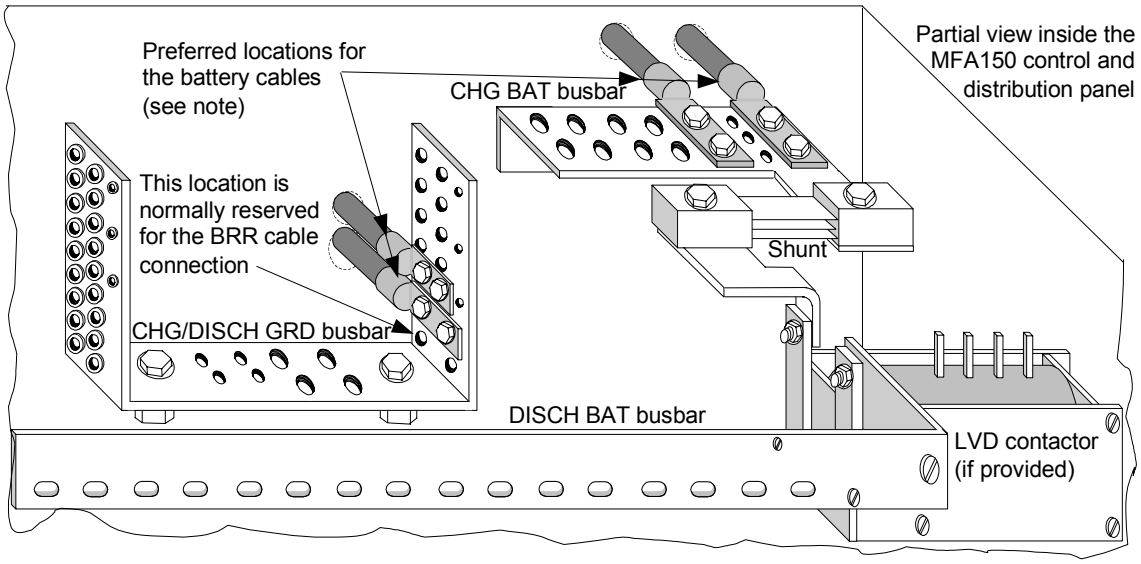
Generator requirements for Astec APS Power Systems

For information on selecting AC generators that will effectively maintain peak performance and operating characteristics, for all Astec APS power systems to to the partners' section of the Emerson Energy Systems web site at www.EmersonEnergy-NA.com. To obtain access to the partners' section follow the instructions found on the partners' page, or dial your local 1–800 technical support line.

Procedure 7 – Adding or replacing a battery string

Step	Action
1	Notify the Alarm Center of the possibility of incoming alarms during the execution of this procedure.
2	Disconnect the inter-cell connectors or wiring harness from the individual battery cells, and insulate each exposed terminal with electrical tape.
3	The removed batteries must be disposed of in accordance with local, provincial, state, national or federal environmental legislation.
4	Install the new batteries and use the new connecting material (typically furnished with the new batteries) to interconnect them. ***Note:*** If specified, install the new batteries in the space vacated by the removed batteries.
5	Complete the initial charge of the new battery string according to the battery manufacturer's specifications using an external power supply.
6	If required, install two new battery leads. Connect the new batteries to the charge + and charge – busbars inside the NT6C28C control and distribution panel. Refer to Figure 22. If a battery disconnect panel is provided, refer to the appropriate battery disconnect panel drawing for the connection details.
7	Notify the Alarm Center at the completion of the procedure.
–end–	

Figure 22 – Battery connections inside the control and distribution panel



Note: Connection positions are optimal if maximum 1/0 AWG cable is used. If the batteries are not in the proximity of the MFA150 power system, up to 4/0 AWG cables can be used. If 4/0 flex cable is used, narrow tongue lugs must be used.

Adding or replacing a distribution circuit breaker

WARNING
Precautions to take to avoid service interruptions
Use properly insulated tools when working inside the control and distribution panel.

Add a new circuit breaker as described in Procedure 8. Refer to Figure 23.

Procedure 8 – Adding a distribution circuit breaker

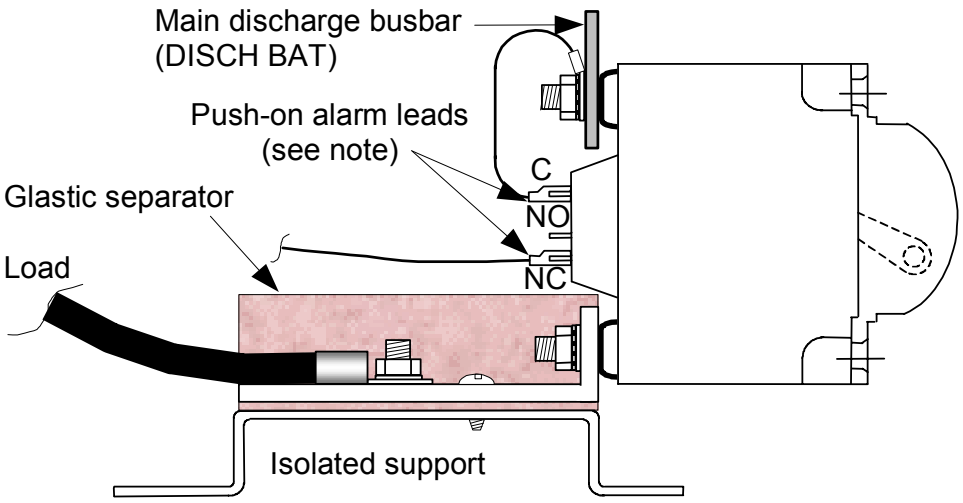
Step	Action
1	Notify the alarm center of the possibility of incoming alarms during the execution of this procedure.
2	Open the front door and remove the top panel of the control and distribution panel.
3	Ensure that the new circuit breaker is in the “OFF” position.
	—continued—

Procedure 8 – Adding a distribution circuit breaker (continued)

Step	Action
4	Position the “L” shaped Glastic separator for the new circuit breaker as shown in Figure 23.
5	Align the new circuit breaker with the appropriate position and insert the upper stud of the circuit breaker into the hole in the DISCH BAT busbar.
6	Install the “C” alarm wire as shown in Figure 23.
7	Secure the small busbar at the bottom of the circuit breaker and the “L” shaped Glastic insulator to the main isolated support with the screw provided for that purpose as shown in Figure 23.
8	Use a properly insulated wrench to secure the hex nut holding the circuit breaker and the “C” alarm wire to the DISCH BAT busbar.
9	Connect the “NC” or “NO” alarm wire to the circuit breaker as shown in Figure 23, depending on whether standard trip or mid trip circuit breakers are used (see note below Figure 23).
10	If a load is to be connected to the new circuit breaker, feed the load cable through the rear of the control and distribution panel, install the appropriate one-hole lug at the end of the cable and connect it to the vertical stud behind the circuit breaker as shown in Figure 23. ***Note:*** If no load is to be connected and the circuit breaker is a standard trip type, leave the circuit breaker in the ON position to prevent annoyance alarms.
11	Remove the appropriate filler position from the black filler plate mounted on the back of the front door.
12	Reinstall the top panel and close the front door of the control and distribution panel.
13	Notify the alarm center at the end of the procedure.
–end–	

Replace an existing circuit breaker as described in Procedure 9. Refer to Figure 23.

Figure 23 – Cross-section of an installed circuit breaker



Note: The position of the "C" (common) "NO" (normally open) and "NC" (normally closed) alarm pins at the rear of circuit breakers will vary upon the manufacturer of the circuit breakers. However, the "C" pin should always be connected to the main discharge bar of the power plant. The alarm lead should be connected to the "NO" or "NC" pin of the circuit breakers as follows:

- for standard trip circuit breakers, connect the alarm lead to the "NC" contact,
- for mid trip circuit breakers, connect the alarm lead to the "NO" contact.

Procedure 9 – Replacing a distribution circuit breaker

Step	Action
1	Notify the alarm center of possible incoming alarms during this procedure.
2	Open the front door and remove the top panel of the control and distribution panel.
3	Operate the circuit breaker to be replaced to the “OFF” position (down).
4	Disconnect the “NC” or “NO” alarm wire from the circuit breaker to be replaced.
5	Use a properly insulated wrench to remove the hex nut holding the circuit breaker and the “C” alarm wire to the top busbar, then the hex nut holding the circuit breaker to the bottom busbar.
6	Carefully remove the circuit breaker from the distribution panel by pulling on it forward.
7	Ensure that the new circuit breaker is in the “OFF” position. Remove also the small “L” shaped busbar from the new circuit breaker.
8	Align the new circuit breaker with the appropriate position and insert the studs into the holes in the top and bottom busbars.
9	Use a properly insulated wrench to secure the hex nut holding the circuit breaker to the bottom busbar.
10	Install the “C” alarm wire on the circuit breaker itself.
11	Use a properly insulated wrench to secure the hex nut holding the circuit breaker and the “C” alarm wire to the top busbar.
12	Connect the “NC” or “NO” alarm wire to the circuit breaker as shown in Figure 23, depending if standard trip or mid trip circuit breakers are used (see note below Figure 23).
13	Reinstall the top panel and close the front door of the control and distribution panel.
14	Notify the alarm center at the end of the procedure.
–end–	

Replacement of the LVD contactor

WARNING

Precautions to take to avoid service interruptions

Make sure to use properly insulated tools when working inside the control and distribution panel.

Replace the LVD contactor as described in the following procedure. Refer to Figures 24 and 25.

Procedure 10 – Replacing the LVD contactor

Step	Action
1	Notify the Alarm Center of the possibility of incoming alarms during the execution of this procedure.
2	Open the front door and remove the top panel of the control and distribution panel.
3	Install a size 1/0 AWG jumper cable between the negative charge busbar and the negative discharge busbar in such a way as to bridge out the LVD contactor (see Figure 24).
4	Disconnect the two control wires from the coil of the contactor.
5	Remove the two nuts connecting the contactor to the busbars.
6	Remove the three mounting nuts securing the contactor to the cabinet.
7	Carefully remove the contactor from the control and distribution panel.
8	Carefully install the new contactor in the space vacated by the old contactor.
9	Secure the contactor to the cabinet with the three mounting nuts removed in step 6.
10	Connect the contactor to the busbars with the two nuts removed in step 5.
11	Reconnect the two control wires on the coil of the contactor.
12	If the new contactor was not provided with a diode across the two center terminals of the coil, remove the diode on the old contactor and reinstall it on the new contactor observing the polarity (direction of arrow).
13	Reinstall the top cover and close the front door of the control and distribution panel.
14	Notify the alarm center at the completion of the procedure.
–end–	

Figure 24 – Jumper cable installation

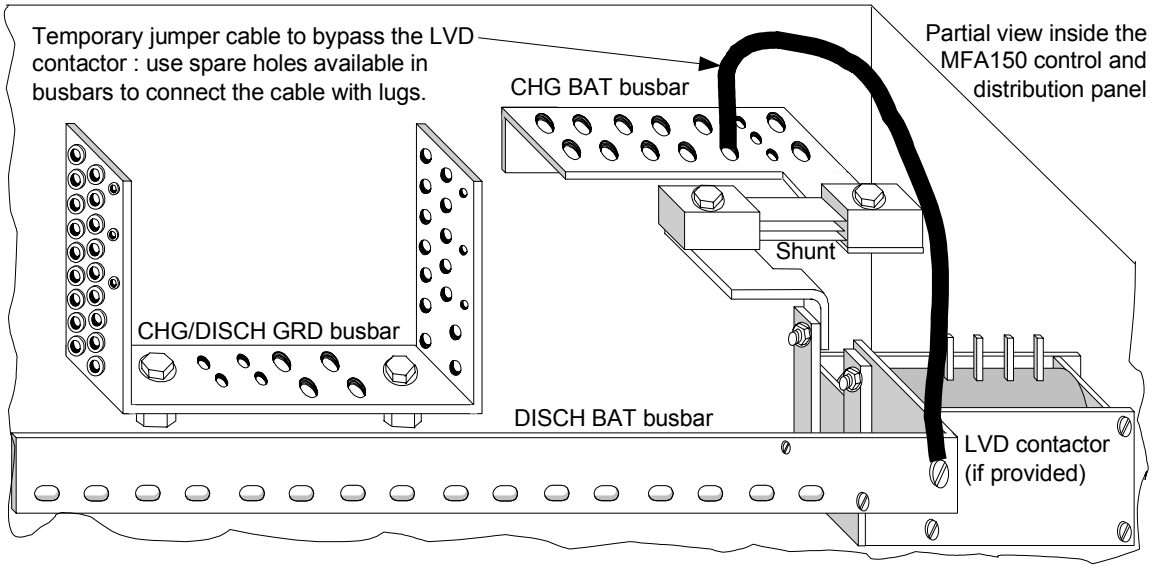
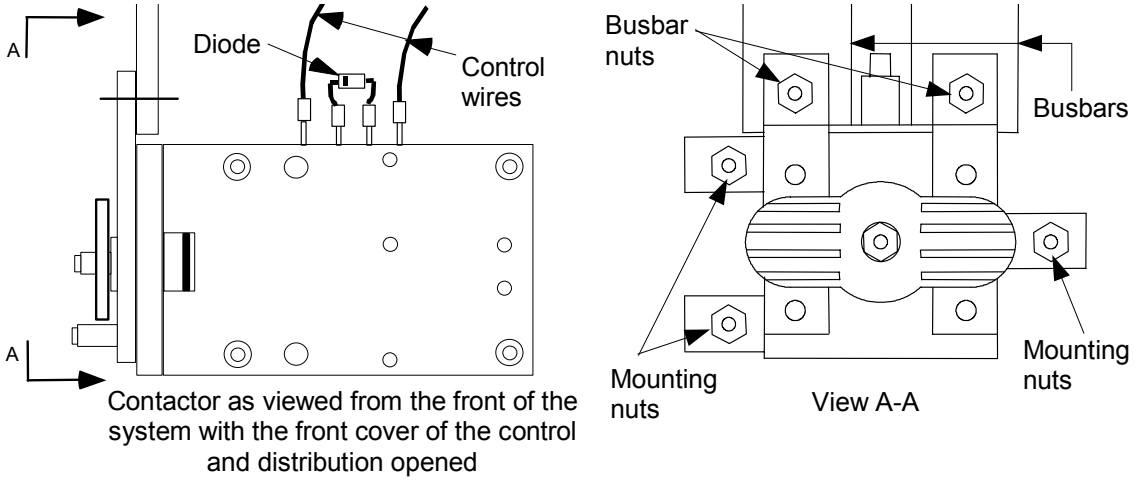


Figure 25 – LVD contactor installation



Contactor as viewed from the front of the system with the front cover of the control and distribution opened

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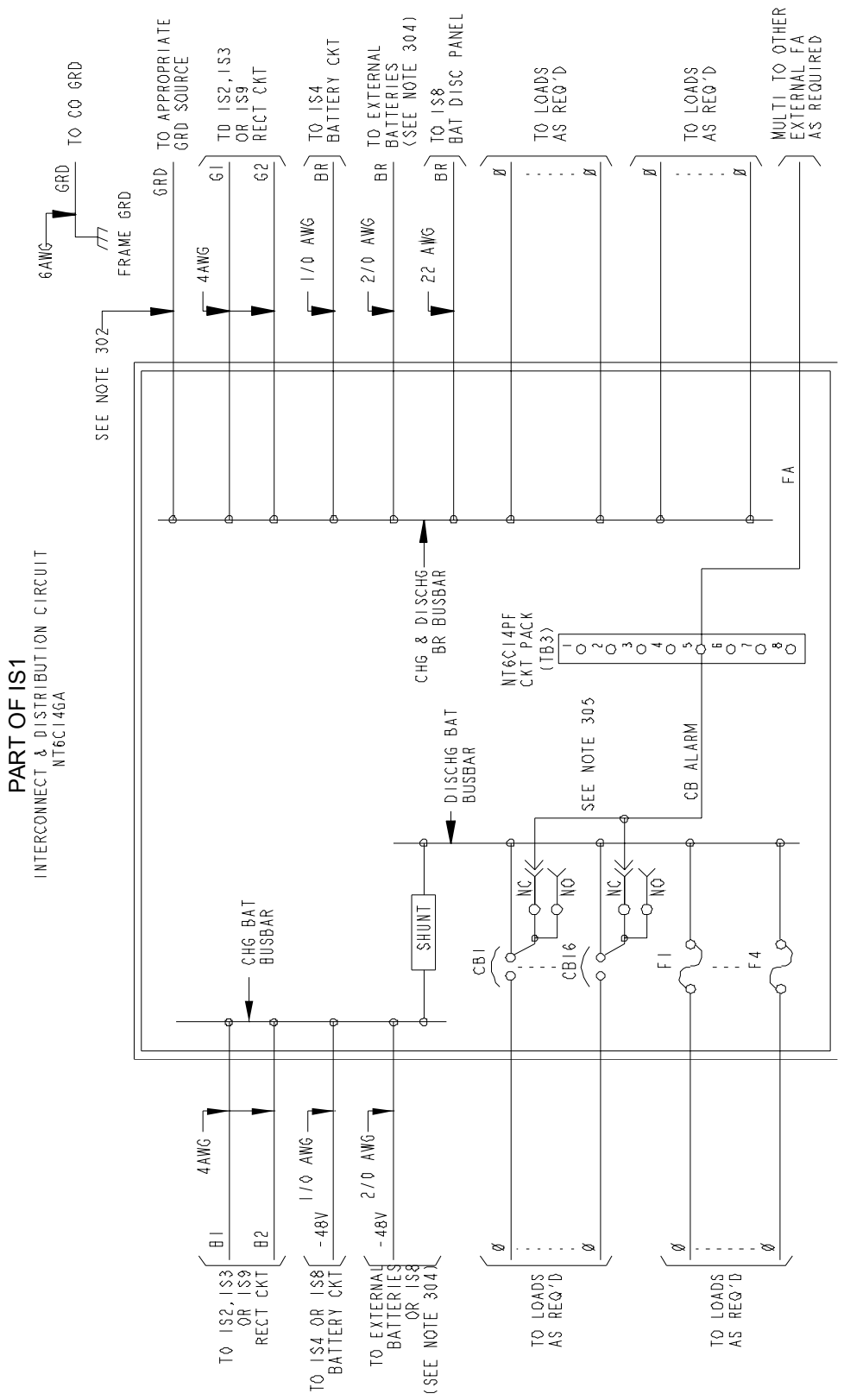
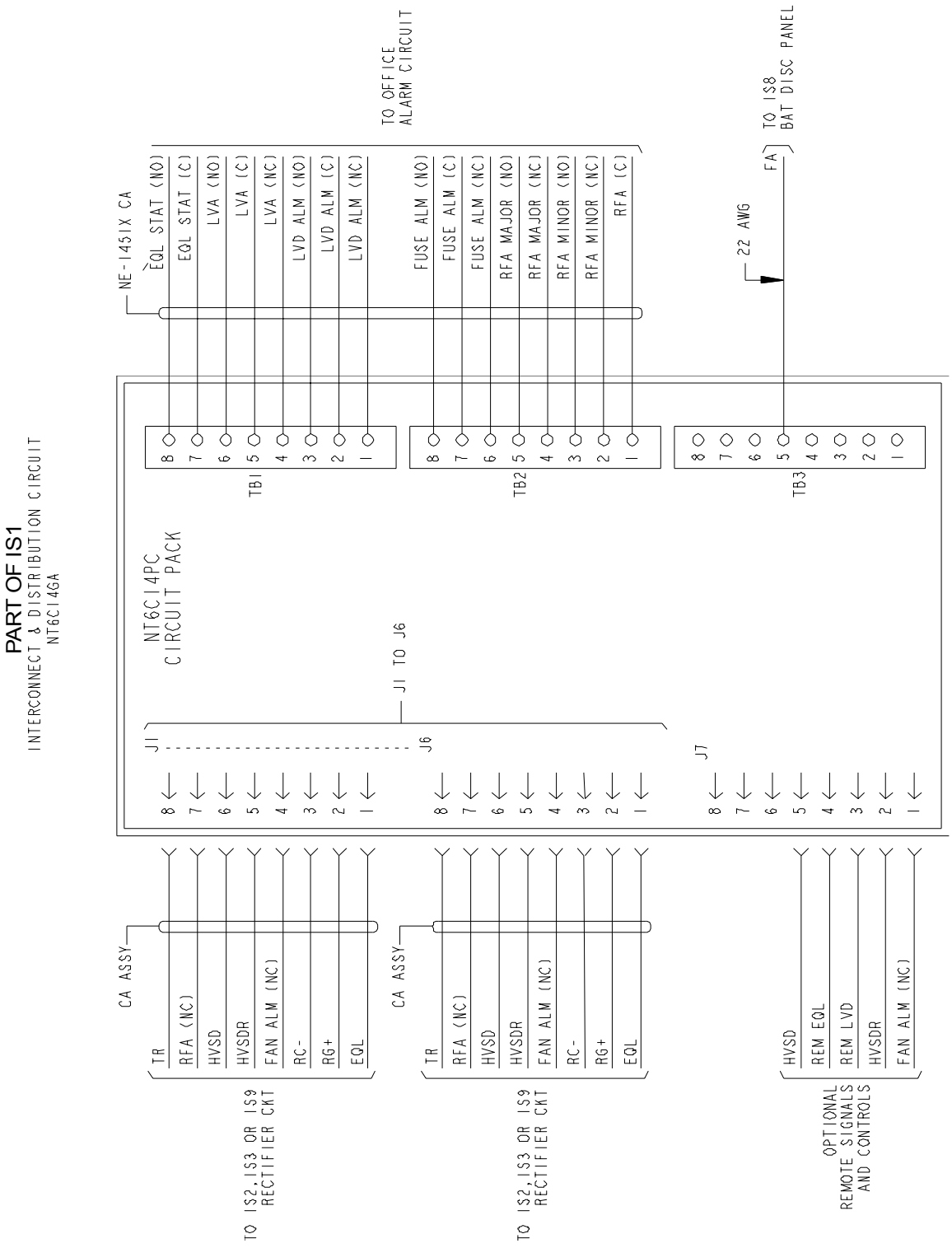
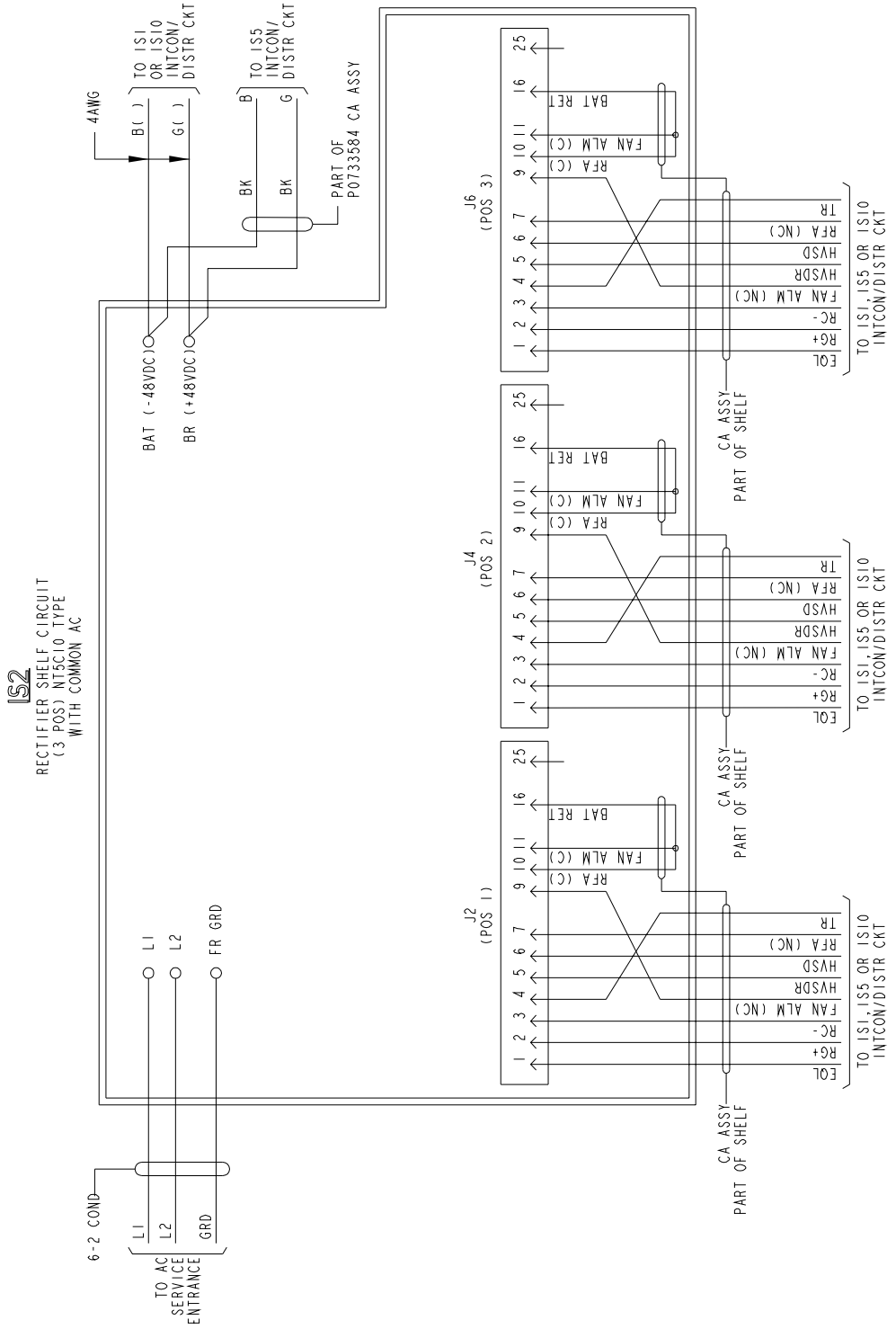
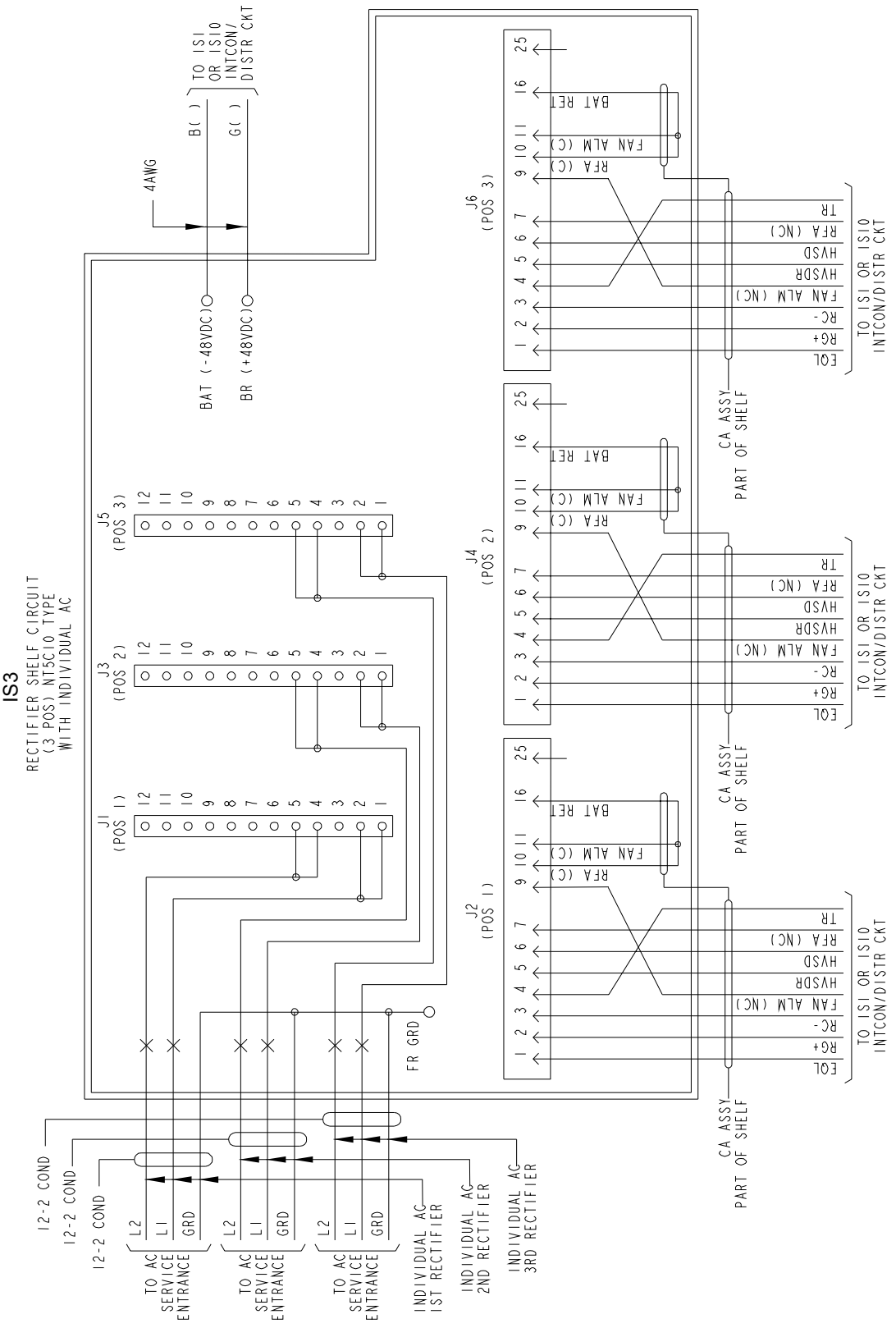
Appendix A : Associated schematics

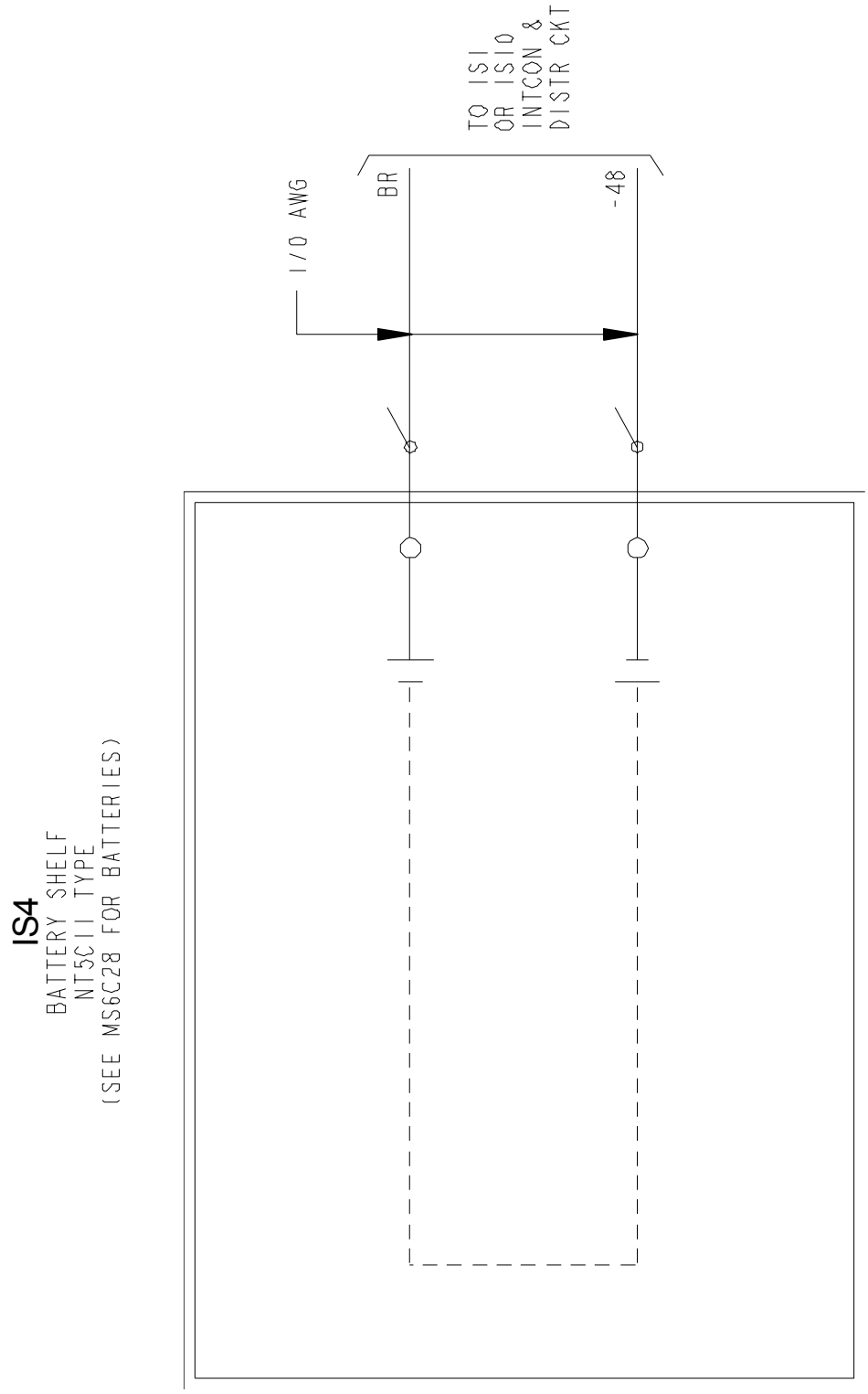
Drawing number	Description
IS6C28CA	Interconnect Schematic

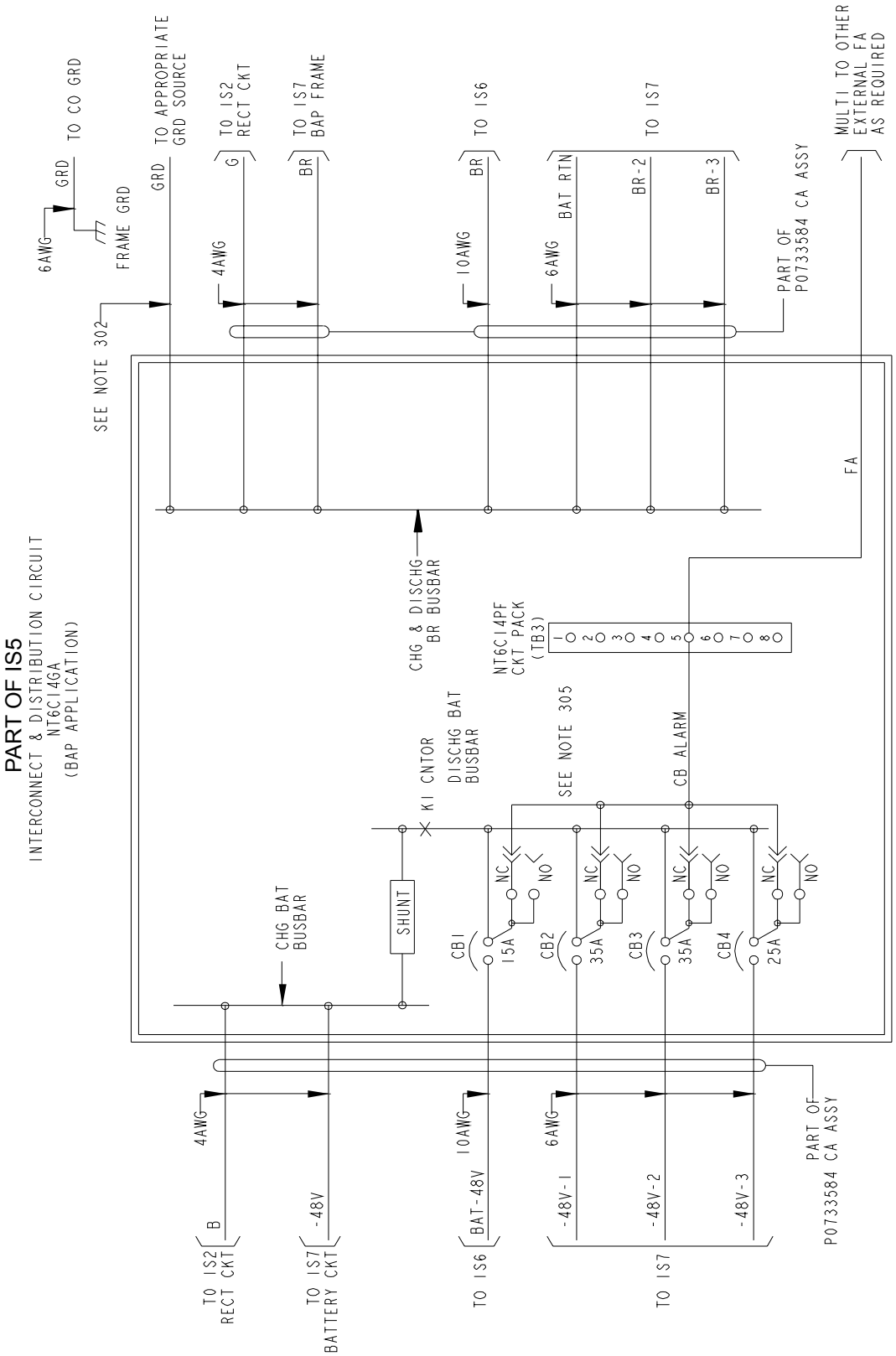

PART OF IS1
INTERCONNECT & DISTRIBUTION CIRCUIT
NT6C14GA
6AWG
GRD
TO CO GRD
FRAME GRD
SEE NOTE 302
GRD
TO APPROPRIATE GRD SOURCE
4AWG
G1
TO IS2, IS3 OR IS9 RECT CKT
G2
1/0 AWG
BR
TO IS4 BATTERY CKT
2/0 AWG
BR
TO EXTERNAL BATTERIES (SEE NOTE 304)
22 AWG
BR
TO IS8 BAT DISC PANEL
Ø
TO LOADS AS REQ'D
Ø
TO LOADS AS REQ'D
Ø
MULTI TO OTHER EXTERNAL FA AS REQUIRED
FA
CHG & DISCHG BR BUSBAR
NT6C14PF CKT PACK (TB33)
1 2 3 4 5 6 7 8
SEE NOTE 305
CB ALARM
DISCHG BAT BUSBAR
CHG BAT BUSBAR
SHUNT
NC
NO
NC
NO
CB1
CB16
F1
F4
4AWG
B1
B2
TO IS2, IS3 OR IS9 RECT CKT
1/0 AWG
-48V
TO IS4 OR IS8 BATTERY CKT
2/0 AWG
-48V
TO EXTERNAL BATTERIES OR IS8 (SEE NOTE 304)
Ø
TO LOADS AS REQ'D
Ø
TO LOADS AS REQ'D

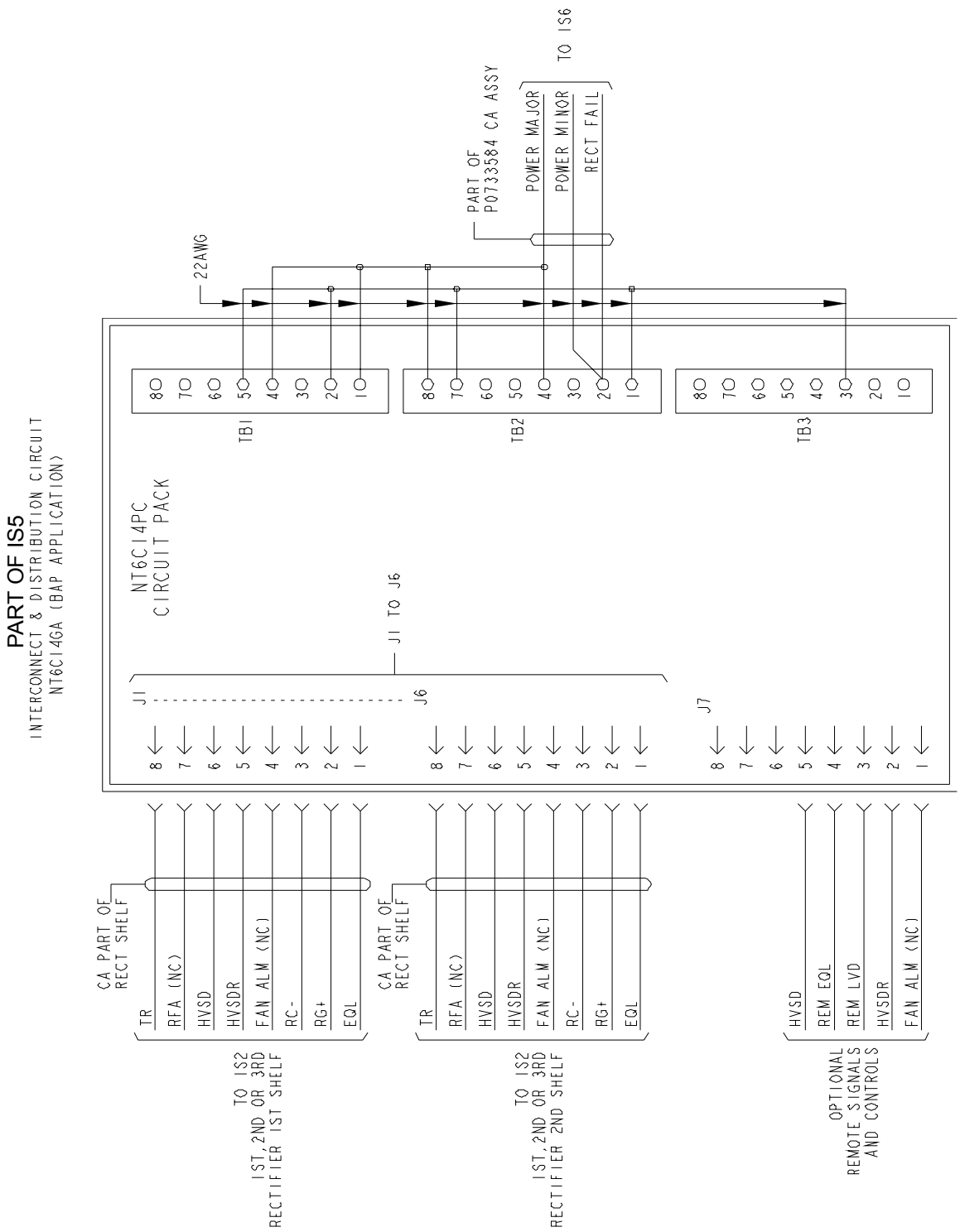

PART OF IS1
INTERCONNECT & DISTRIBUTION CIRCUIT
NT6C14GA
NT6C14PC
CIRCUIT PACK
NE-1451X CA
EQL STAT (NO)
EQL STAT (C)
LVA (NO)
LVA (C)
LVA (NC)
LVD ALM (NO)
LVD ALM (C)
LVD ALM (NC)
TO OFFICE
ALARM CIRCUIT
FUSE ALM (NO)
FUSE ALM (C)
FUSE ALM (NC)
RFA MAJOR (NO)
RFA MAJOR (NC)
RFA MINOR (NO)
RFA MINOR (NC)
RFA (C)
22 AWG
FA
TO IS8
BAT DISC PANEL
TB1
TB2
TB3
J1
J1 TO J6
J6
J7
CA ASSY
TR
RFA (NC)
HVSD
HVSDR
FAN ALM (NC)
RC-
RG+
EQL
TO IS2,IS3 OR IS9
RECTIFIER CKT
CA ASSY
TR
RFA (NC)
HVSD
HVSDR
FAN ALM (NC)
RC-
RG+
EQL
TO IS2,IS3 OR IS9
RECTIFIER CKT
HVSD
REM EQL
REM LVD
HVSDR
FAN ALM (NC)
OPTIONAL
REMOTE SIGNALS
AND CONTROLS

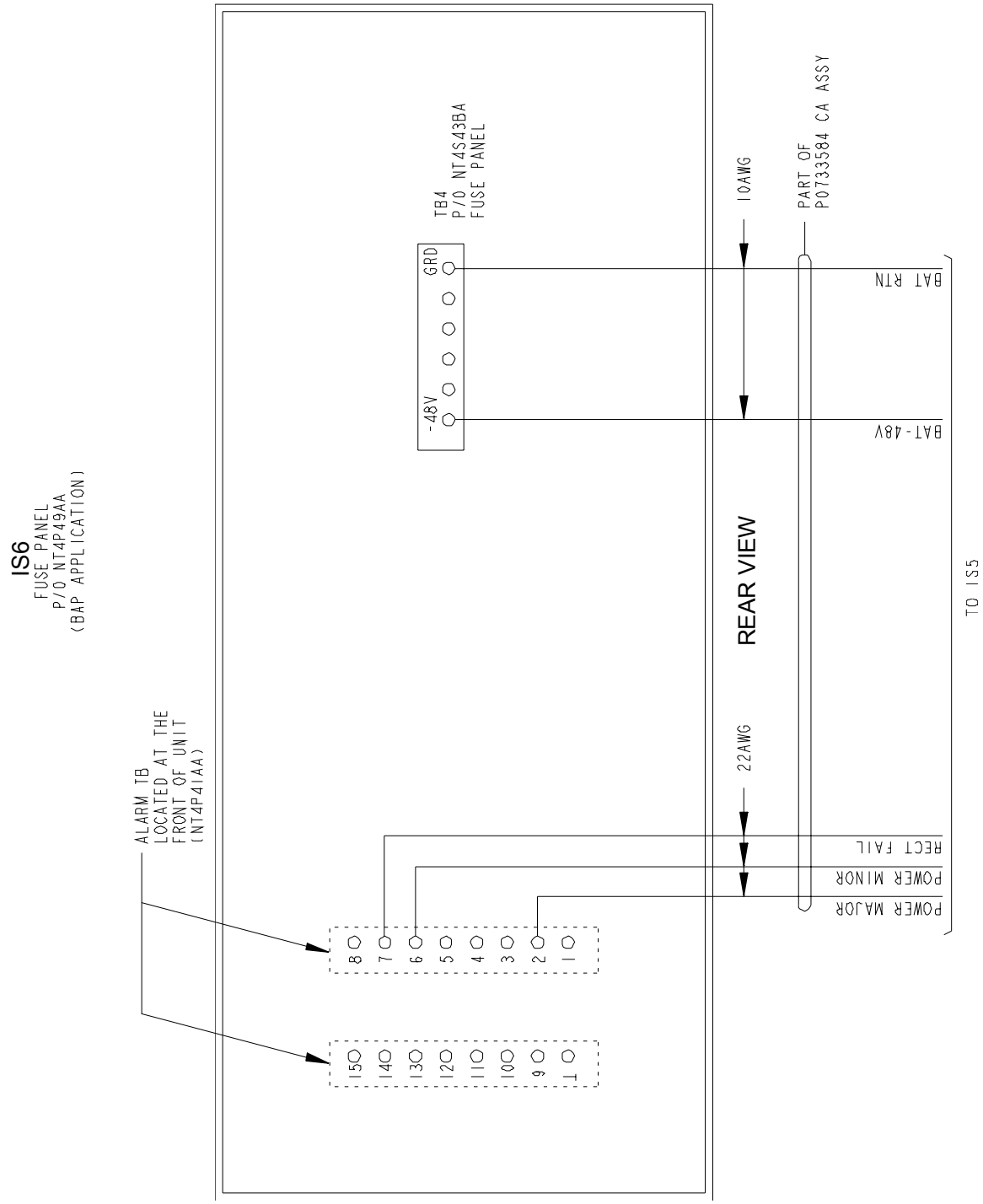

IS2
RECTIFIER SHELF CIRCUIT
(3 POS) NT5C10 TYPE
WITH COMMON AC
4AWG
B( )
G( )
TO IS1
OR IS10
INTCON/
DISTR CKT
BK
B
G
TO IS5
INTCON/
DISTR CKT
PART OF
P0733584 CA ASSY
BAT (-48VDC)
BR (+48VDC)
J6
(POS 3)
J4
(POS 2)
J2
(POS 1)
BAT RET
FAN ALM (C)
RFA (C)
EQL
RG+
RC-
FAN ALM (NC)
HVSDR
HVSD
RFA (NC)
TR
TO IS1,,IS5 OR IS10
INTCON/DISTR CKT
CA ASSY
PART OF SHELF
L1
L2
FR GRD
6-2 COND
GRD
TO AC
SERVICE
ENTRANCE

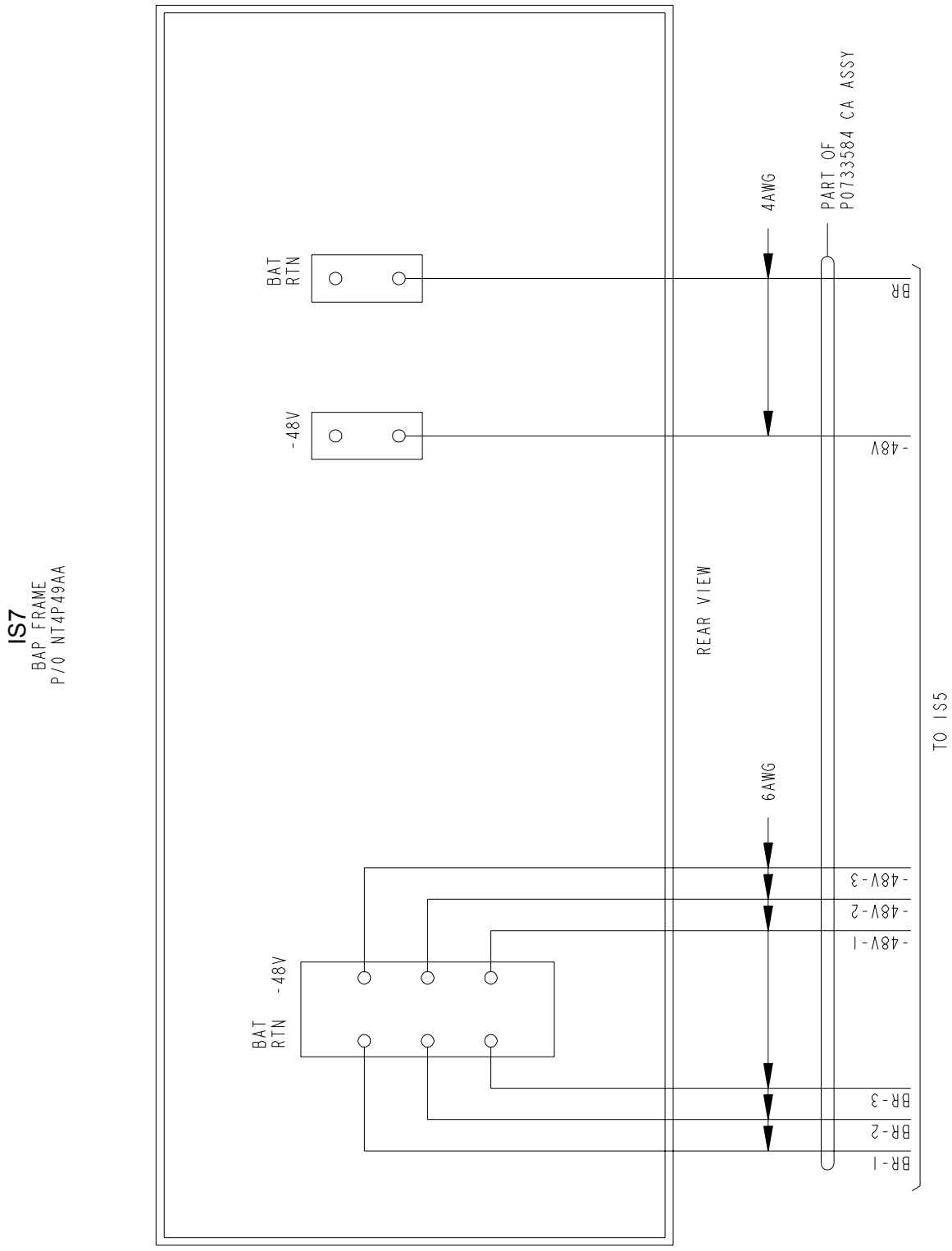

IS3
RECTIFIER SHELF CIRCUIT
(3 POS) NT5C10 TYPE
WITH INDIVIDUAL AC
4AWG
B( )
G( )
TO ISI
OR IS10
INTCON/
DISTR CKT
BAT (-48VDC)
BR (+48VDC)
J1
(POS 1)
J2
(POS 1)
J3
(POS 2)
J4
(POS 2)
J5
(POS 3)
J6
(POS 3)
BAT RET
FAN ALM (C)
RFA (C)
EQL
RG+
RC-
FAN ALM (NC)
HVSDR
HVSD
RFA (NC)
TR
CA ASSY
PART OF SHELF
TO ISI OR IS10
INTCON/DISTR CKT
FR GRD
I2-2 COND
I2-2 COND
I2-2 COND
L2
L1
GRD
TO AC
SERVICE
ENTRANCE
INDIVIDUAL AC
1ST RECTIFIER
INDIVIDUAL AC
2ND RECTIFIER
INDIVIDUAL AC
3RD RECTIFIER

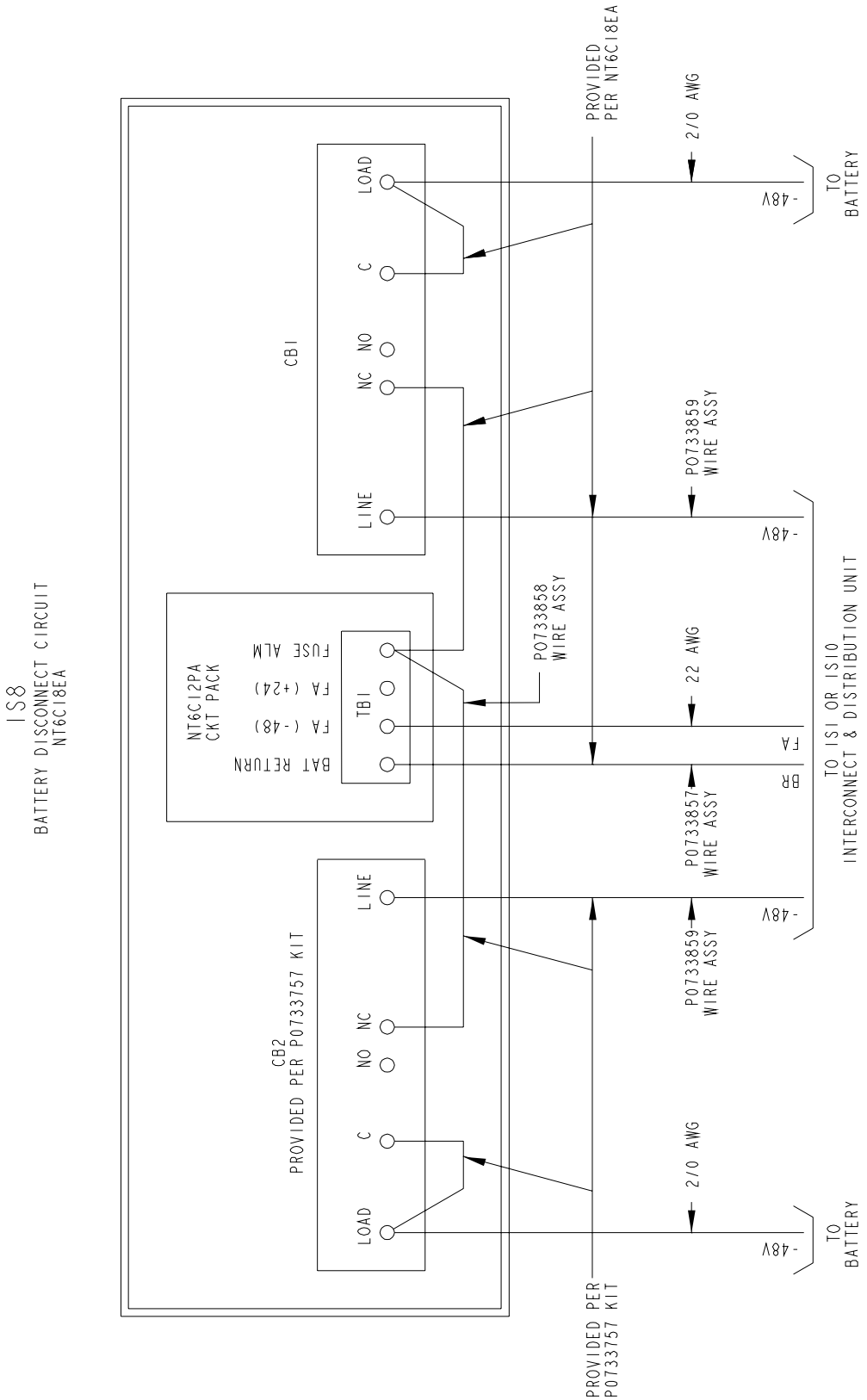

TO IS1
OR IS10
INTCON &
DISTR CKT
BR
-48
1/0 AWG
IS4
BATTERY SHELF
NT5C11 TYPE
(SEE MS6C28 FOR BATTERIES)

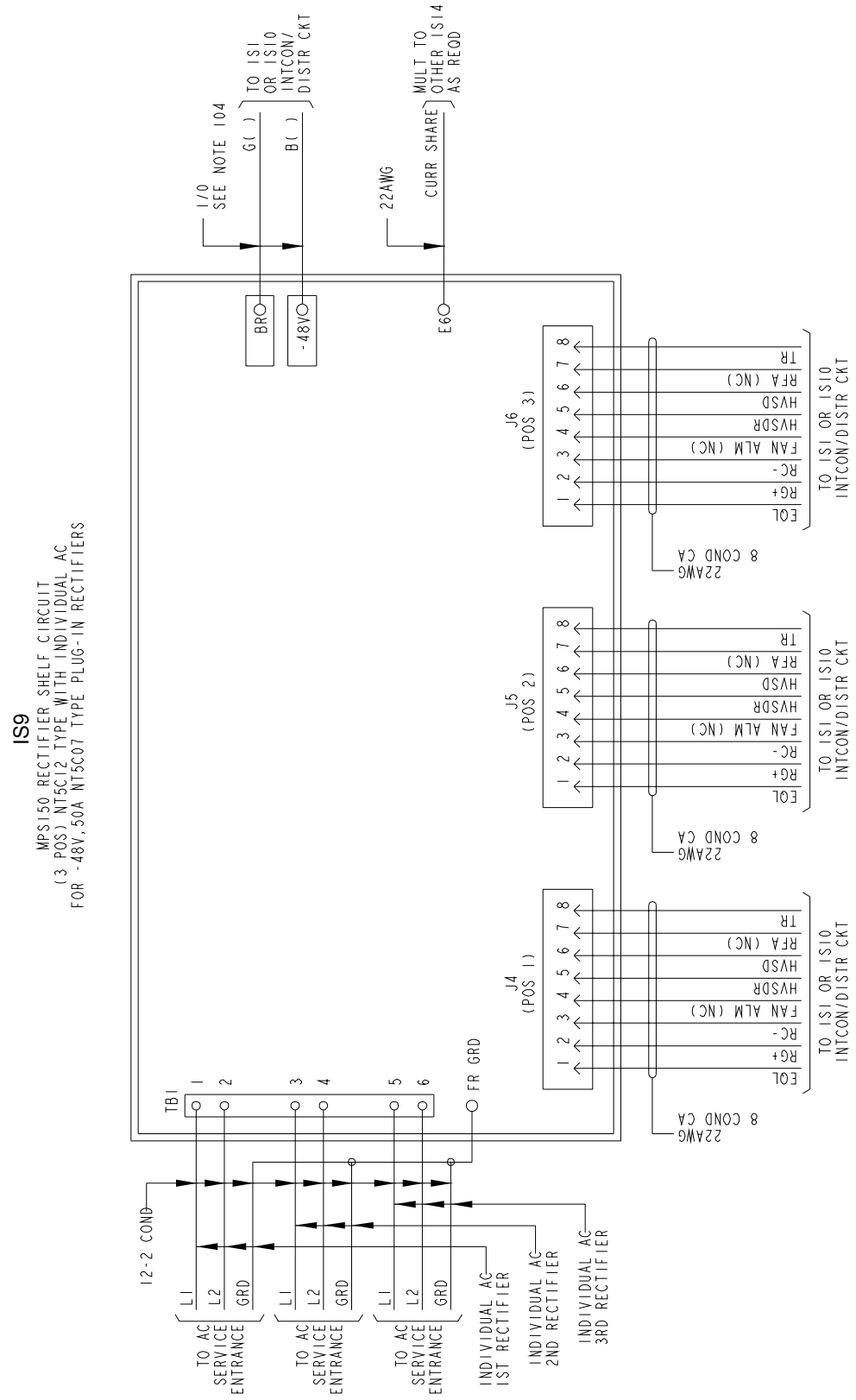

PART OF IS5
INTERCONNECT & DISTRIBUTION CIRCUIT
NT6C14GA
(BAP APPLICATION)
6AWG
GRD
TO CO GRD
FRAME GRD
GRD
TO APPROPRIATE GRD SOURCE
4AWG
G
TO IS2 RECT CKT
BR
TO IS7 BAP FRAME
10AWG
BR
TO IS6
6AWG
BAT RTN
BR-2
BR-3
TO IS7
PART OF P0733584 CA ASSY
MULTI TO OTHER EXTERNAL FA AS REQUIRED
SEE NOTE 302
FA
CHG & DISCHG BR BUSBAR
NT6C14PF CKT PACK (TB3)
1 2 3 4 5 6 7 8
SEE NOTE 305
CB ALARM
K1 CNTOR
DISCHG BAT BUSBAR
CHG BAT BUSBAR
SHUNT
CB1 15A
CB2 35A
CB3 35A
CB4 25A
NC
NO
4AWG
B
TO IS2 RECT CKT
-48V
TO IS7 BATTERY CKT
10AWG
BAT-48V
TO IS6
6AWG
-48V-1
-48V-2
-48V-3
TO IS7
PART OF P0733584 CA ASSY

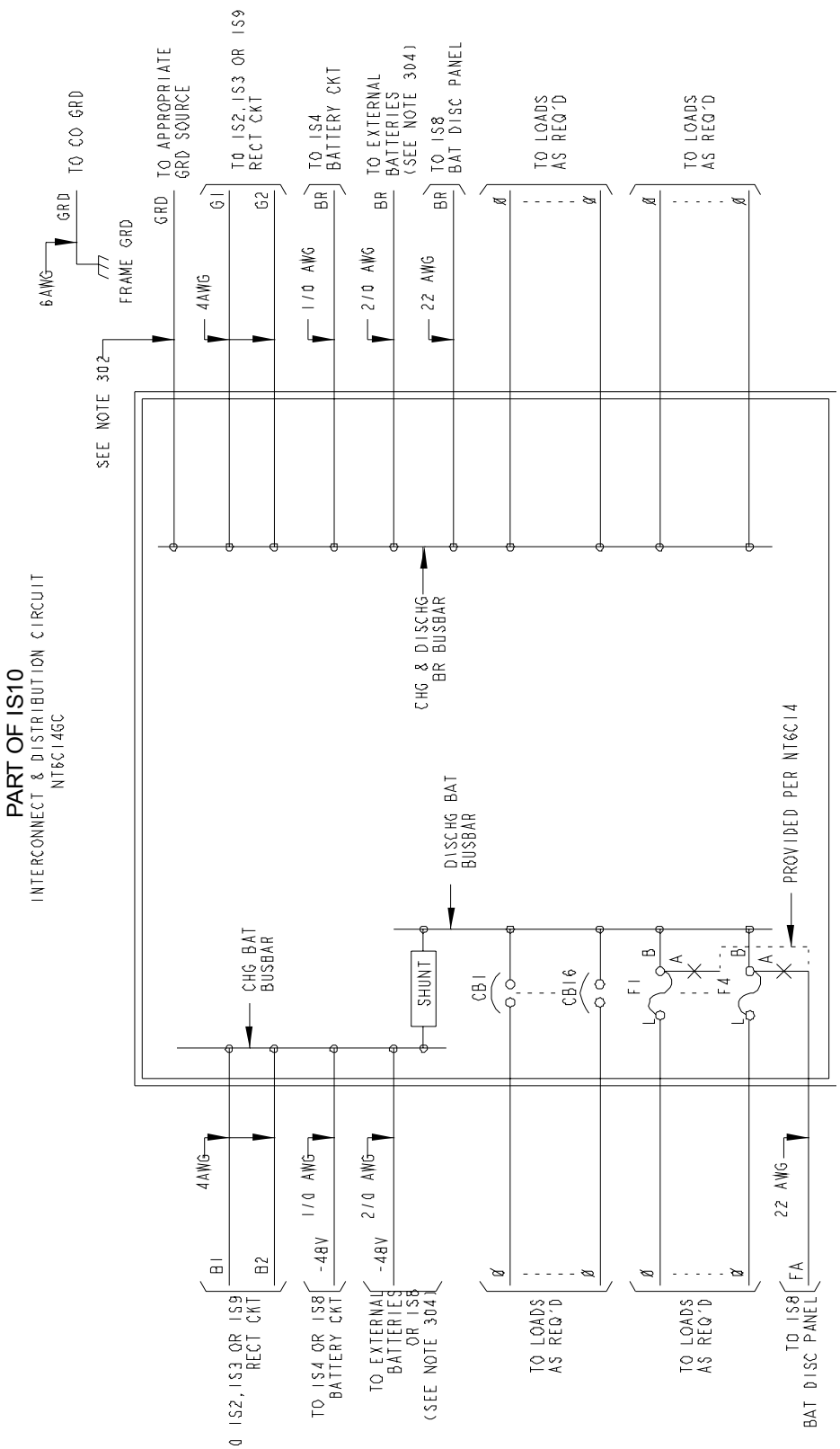

PART OF IS5
INTERCONNECT & DISTRIBUTION CIRCUIT
NT6C14GA (BAP APPLICATION)
NT6C14PC
CIRCUIT PACK
J1
J6
J1 TO J6
J7
TB1
TB2
TB3
22AWG
PART OF
P0733584 CA ASSY
POWER MAJOR
POWER MINOR
RECT FAIL
TO IS6
CA PART OF
RECT SHELF
TR
RFA (NC)
HVSD
HVSDR
FAN ALM (NC)
RC-
RG+
EQL
TO IS2
1ST, 2ND OR 3RD
RECTIFIER 1ST SHELF
CA PART OF
RECT SHELF
TR
RFA (NC)
HVSD
HVSDR
FAN ALM (NC)
RC-
RG+
EQL
TO IS2
1ST, 2ND OR 3RD
RECTIFIER 2ND SHELF
HVSD
REM EQL
REM LVD
HVSDR
FAN ALM (NC)
OPTIONAL
REMOTE SIGNALS
AND CONTROLS

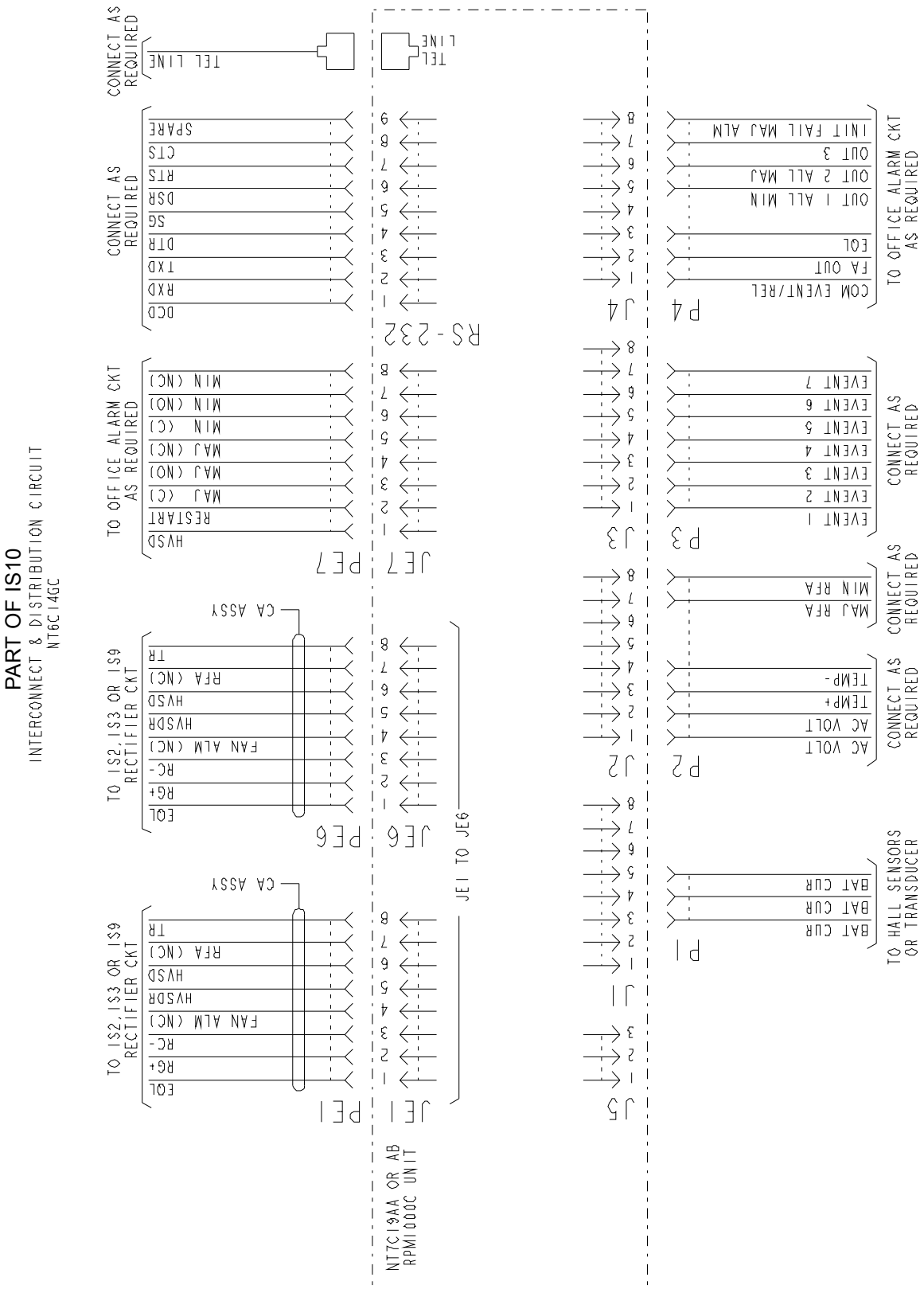

IS6
FUSE PANEL
P/O NT4P49AA
(BAP APPLICATION)
ALARM TB
LOCATED AT THE
FRONT OF UNIT
(NT4P41AA)
TB4
P/O NT4S43BA
FUSE PANEL
GRD
-48V
10AWG
22AWG
PART OF
P0733584 CA ASSY
REAR VIEW
BAT RTN
BAT-48V
RECT FAIL
POWER MINOR
POWER MAJOR
TO IS5
1 2 3 4 5 6 7 8
1 9 10 11 12 13 14 15

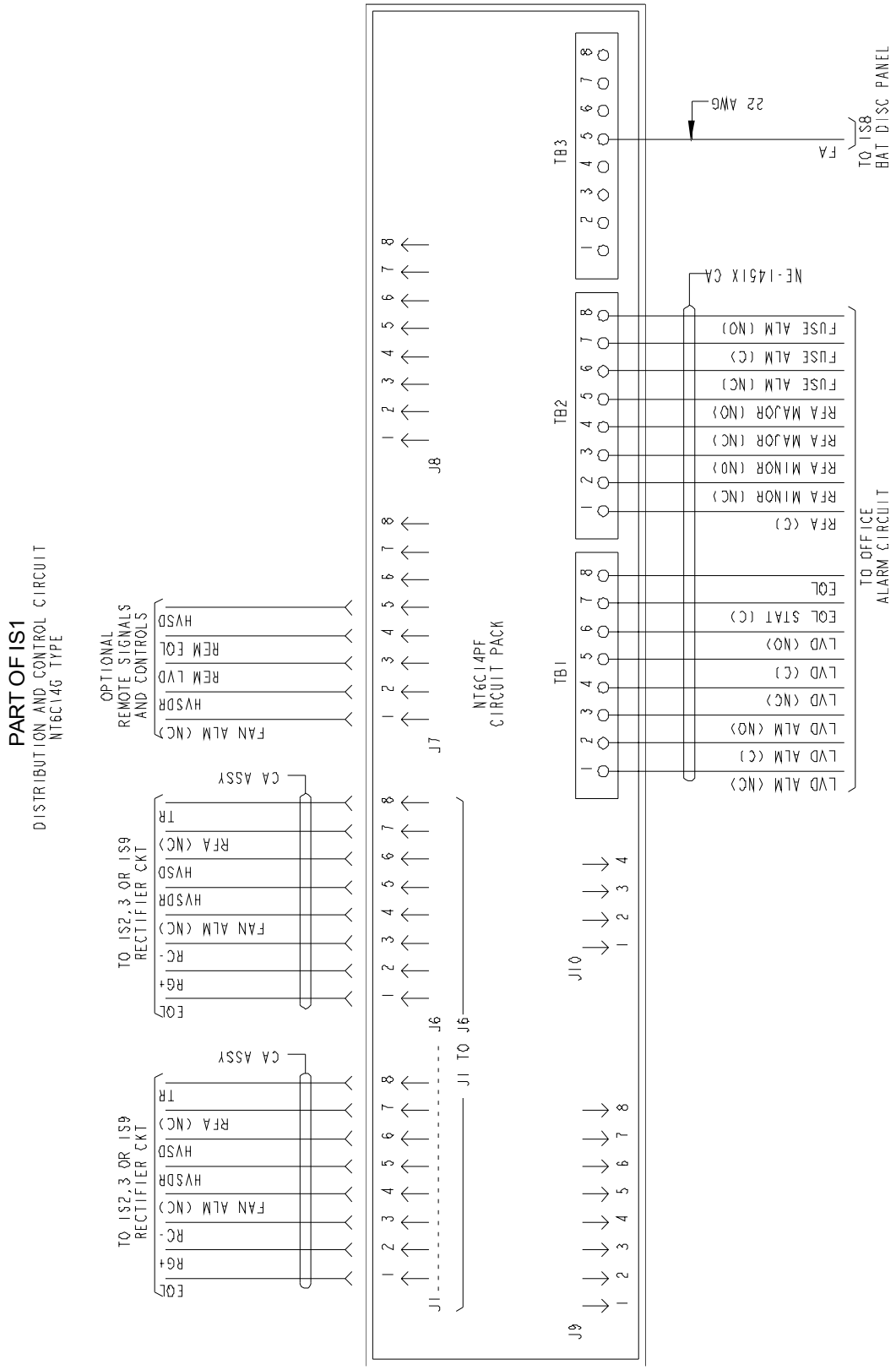

IS7
BAP FRAME
P/O NT4P49AA
REAR VIEW
BAT
RTN
-48V
4AWG
PART OF
P0733584 CA ASSY
BR
-48V
6AWG
BAT
RTN
-48V
-48V-3
-48V-2
-48V-1
BR-3
BR-2
BR-1
TO IS5


IS8
BATTERY DISCONNECT CIRCUIT
NT6C18EA
CB1
LOAD
C
NC NO
LINE
NT6C12PA
CKT PACK
TB1
FUSE ALM
FA (+24)
FA (-48)
BAT RETURN
CB2
PROVIDED PER P0733757 KIT
LOAD
C
NO NC
LINE
PROVIDED
PER NT6C18EA
2/0 AWG
-48V
TO
BATTERY
P0733859
WIRE ASSY
P0733858
WIRE ASSY
22 AWG
FA
BR
P0733857
WIRE ASSY
TO ISI OR ISI0
INTERCONNECT & DISTRIBUTION UNIT
PROVIDED PER
P0733757 KIT


IS9
MPS150 RECTIFIER SHELF CIRCUIT
(3 POS) NT5C12 TYPE WITH INDIVIDUAL AC
FOR -48V,50A NT5C07 TYPE PLUG-IN RECTIFIERS
I/O
SEE NOTE 104
G( )
B( )
TO ISI
OR ISIO
INTCON/
DISTR CKT
22AWG
CURR SHARE
MULT TO
OTHER ISI4
AS REQD
BR
-48V
E6
J6
(POS 3)
J5
(POS 2)
J4
(POS 1)
1 2 3 4 5 6 7 8
EQL
RG+
RC-
FAN ALM (NC)
HVSDR
HVSD
RFA (NC)
TR
TO ISI OR ISIO
INTCON/DISTR CKT
22AWG
8 COND CA
TBI
1
2
3
4
5
6
FR GRD
12-2 COND
L1
L2
GRD
TO AC
SERVICE
ENTRANCE
INDIVIDUAL AC
1ST RECTIFIER
INDIVIDUAL AC
2ND RECTIFIER
INDIVIDUAL AC
3RD RECTIFIER


PART OF IS10
INTERCONNECT & DISTRIBUTION CIRCUIT
NT6C14GC
6AWG
GRD
TO CO GRD
FRAME GRD
SEE NOTE 302
GRD
TO APPROPRIATE GRD SOURCE
4AWG
G1
G2
TO IS2, IS3 OR IS9 RECT CKT
1/0 AWG
BR
TO IS4 BATTERY CKT
2/0 AWG
BR
TO EXTERNAL BATTERIES (SEE NOTE 304)
22 AWG
BR
TO IS8 BAT DISC PANEL
Ø
TO LOADS AS REQ'D
CHG & DISCHG BR BUSBAR
DISCHG BAT BUSBAR
PROVIDED PER NT6C14
CHG BAT BUSBAR
SHUNT
CB1
CB16
F1
F4
B
A
B'
A'
L
4AWG
B1
B2
TO IS2, IS3 OR IS9 RECT CKT
1/0 AWG
-48V
TO IS4 OR IS8 BATTERY CKT
2/0 AWG
-48V
TO EXTERNAL BATTERIES OR IS8 (SEE NOTE 304)
TO LOADS AS REQ'D
TO LOADS AS REQ'D
22 AWG
FA
TO IS8 BAT DISC PANEL


PART OF IS10
INTERCONNECT & DISTRIBUTION CIRCUIT
NT6C14GC
NT7C19AA OR AB
RPM1000C UNIT
TEL LINE
CONNECT AS REQUIRED
TEL LINE
RS-232
DCD
RXD
TXD
DTR
SG
DSR
RTS
CTS
SPARE
J4
P4
COM EVENT/REL
FA OUT
EOL
OUT 1 ALL MIN
OUT 2 ALL MAJ
OUT 3
UNIT FAIL MAJ ALM
TO OFFICE ALARM CKT AS REQUIRED
TO OFFICE ALARM CKT AS REQUIRED
HVSD
RESTART
MAJ (C)
MAJ (NO)
MAJ (NC)
MIN (C)
MIN (NO)
MIN (NC)
JE7
PE7
J3
P3
EVENT 1
EVENT 2
EVENT 3
EVENT 4
EVENT 5
EVENT 6
EVENT 7
CONNECT AS REQUIRED
CA ASSY
TO IS2, IS3 OR IS9 RECTIFIER CKT
EQL
RG+
RC-
FAN ALM (NC)
HVSDR
HVSD
RFA (NC)
TR
JE6
PE6
J2
P2
MAJ RFA
MIN RFA
AC VOLT
AC VOLT
TEMP+
TEMP-
CONNECT AS REQUIRED
CONNECT AS REQUIRED
CA ASSY
TO IS2, IS3 OR IS9 RECTIFIER CKT
JE1 TO JE6
JE1
PE1
J1
P1
BAT CUR
BAT CUR
BAT CUR
TO HALL SENSORS OR TRANSDUCER
J5


PART OF IS1
DISTRIBUTION AND CONTROL CIRCUIT
NT6C14G TYPE
OPTIONAL
REMOTE SIGNALS
AND CONTROLS
FAN ALM (NC)
HVSDR
REM LVD
REM EQL
HVSD
TO IS2,3 OR IS9
RECTIFIER CKT
EQL
RG+
RC-
FAN ALM (NC)
HVSDR
HVSD
RFA (NC)
TR
CA ASSY
J1
J6
J7
J8
J9
J10
NT6C14PF
CIRCUIT PACK
TB1
TB2
TB3
LVD ALM (NC)
LVD ALM (C)
LVD ALM (NO)
LVD (NC)
LVD (C)
LVD (NO)
EQL STAT (C)
EQL
RFA (C)
RFA MINOR (NC)
RFA MINOR (NO)
RFA MAJOR (NC)
RFA MAJOR (NO)
FUSE ALM (NC)
FUSE ALM (C)
FUSE ALM (NO)
TO OFFICE
ALARM CIRCUIT
NE-1451X CA
22 AWG
FA
TO IS8
BAT DISC PANEL

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Appendix B : Replacement parts

Order the following replacement parts for the NT6C28C(x) MFA150 Power System.

For the MPR15 and MPR25 rectifiers:

- Fan assembly : P0710139
- Air filter kit : A0370200
- Fuse, 3/4 A, 250 V : A0351850

For the Helios Rectifier 25/48:

- Fan assembly : P0710139
- Air filter kit : P0834732

For the Helios Rectifier 50/48:

- Fan assembly : P0734037
- Air filter kit : P0736368
- Replacement filter : P0734555
- Fuse, 3/4 A, 250 V A0351850

For the NT6C14GA/GB/GM or CE/CP distribution and control panel:

- NT6C14PF control circuit pack : A0400370
- NT6C14PG display circuit pack : A0403327
- Spare QFF fuses and circuit breakers as required (see Tables)

For the NT6C14GC/GD/GN or CG/CQ distribution and control panel:

- NT6C14PA LVD interface circuit pack : A0367086
- Spare QFF fuses and circuit breakers as required (see Tables)

For the RPM1000C:

- Memory back-up battery (Sanyo No. CR2430) : A0603214
- MSL2A fuse : A0285632
- 1-1/3 A QFF1A fuses as required : A0614339

Note 1: Circuit breakers rated 80 A or less may be installed side by side. Circuit breakers over 80 A may only be installed next to circuit breakers rated 65 A or less.

Note 2: Circuit breakers are ordered separately. Each circuit breaker is shipped with mounting hardware for mounting into the panel.

Table 31 – Standard trip circuit breakers e/w circuit breaker guard

CPC number	Description
P0743472	1A circuit breaker, 65/80 V dc maximum coil voltage
P0743473	2A circuit breaker, 65/80 V dc maximum coil voltage
P0743474	3A circuit breaker, 65/80 V dc maximum coil voltage
P0743475	5A circuit breaker, 65/80 V dc maximum coil voltage
P0743476	10A circuit breaker, 65/80 V dc maximum coil voltage
P0743477	15A circuit breaker, 65/80 V dc maximum coil voltage
P0743478	20A circuit breaker, 65/80 V dc maximum coil voltage
P0743483	25A circuit breaker, 65/80 V dc maximum coil voltage
P0743479	30A circuit breaker, 65/80 V dc maximum coil voltage
P0743480	35A circuit breaker, 65/80 V dc maximum coil voltage
P0743481	40A circuit breaker, 65/80 V dc maximum coil voltage
P0743482	50A circuit breaker, 65/80 V dc maximum coil voltage
P0878231	60A circuit breaker, 65/80 V dc maximum coil voltage
P0878232	70A circuit breaker, 65/80 V dc maximum coil voltage
P0878233	80A circuit breaker, 65/80 V dc maximum coil voltage
P0878234	90A circuit breaker, 65/80 V dc maximum coil voltage
P0878235	100A circuit breaker, 65/80 V dc maximum coil voltage

Note: Standard trip circuit breakers will generate an alarm when tripped manually or due to an overload.

Table 32 – Mid trip circuit breakers e/w circuit breaker guard

CPC number	Description
P0743225	1A circuit breaker, 53 delay curve
P0743226	2A circuit breaker, 53 delay curve
P0743227	3A circuit breaker, 53 delay curve
P0743228	5A circuit breaker, 53 delay curve
P0743229	10A circuit breaker, 53 delay curve
P0743230	15A circuit breaker, 53 delay curve
P0743231	20A circuit breaker, 53 delay curve
P0743465	25A circuit breaker, 53 delay curve
P0743232	30A circuit breaker, 53 delay curve
P0743233	35A circuit breaker, 53 delay curve
P0743234	40A circuit breaker, 53 delay curve
P0743235	50A circuit breaker, 53 delay curve
P0878236	60A circuit breaker, 52 delay curve
P0878237	70A circuit breaker, 52 delay curve
P0878238	80A circuit breaker, 52 delay curve
P0878239	90A circuit breaker, 52 delay curve
P0878240	100A circuit breaker, 52 delay curve

Note: Mid trip circuit breakers will generate an alarm only when tripped due to an overload. They will not generate an alarm when tripped manually.

Table 33 – QFF fuses and designation discs

Fuse CPC number	Description	Designation disc CPC number and color
A0614343	0.18 A QFF1E fuse	P097P239 (yellow)
A0614344	0.25 A QFF1F fuse	P097P240 (violet)
A0614345	0.50 A QFF1G fuse	P097P241 (red)
A0614346	0.75 A QFF1H fuse	P097P242 (brown)
A0614339	1.33 A QFF1A fuse	P097P235 (white)
A0614340	2.0 A QFF1B fuse	P097P236 (orange)
A0614341	3.0 A QFF1C fuse	P097P237 (blue)
A0614342	5.0 A QFF1D fuse	P097P238 (green)

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Appendix C : Technical service assistance

For technical assistance, 24-hours a day / 7 days a week, dial one of the following toll-free numbers. This service complements the services offered by field support organizations such as, the Emergency Technical Assistance Service (ETAS), and the Installation Technical Assistance Service (ITAS).

Local toll-free prefixes

The following prefixes give access to toll-free numbers in various countries. For further information please contact the local service provider.

Country	Prefix
Australia	0011
Belgium	00
Brazil	000815
Denmark	00
Finland	00 or 990
France	00
Germany	00
Hong Kong	001
Ireland	00
Japan	001 (KDD) 041 (ITJ) 0061 (IDC)
Korea	001 (Korea Telecom) 002 (Dacom) 003 (Once)
Malaysia	00
Netherlands	00
New Zealand	00
Singapore	001
Switzerland	00
United Kingdom	00

Toll-free technical assistance numbers

United States:	1-800-992-8417	**Canada:**	1-800-363-2288
In Europe:		**In Asia and the Pacific:**	
Austria	800-213-49156	Australia	800-213-49156
Belgium	800-213-49156	Hong Kong	800-213-49156
Denmark	800-213-49156	Japan	800-213-49156
Finland	800-213-49156	Malaysia	800-213-49156
France	800-213-49156	New Zealand	800-213-49156
Germany	800-213-49156	Philippines	1-800-1-110-0131
Ireland	800-213-49156	Singapore	800-213-49156
Italy	800-213-49156	South Korea	800-213-49156
Netherlands	800-213-49156	Taiwan	800-213-49156
Norway	800-213-49156		
Sweden	800-213-49156		
Switzerland	800-213-49156		
United Kingdom [*1]	800-213-49156		
In the Caribbean and Latin America (CALA):		**In the Middle-East:**	
Bahamas	1-800-389-0081	Israel	800-213-49156
Barbados	1-800-534-0225		
Brazil	7101-2288		
Colombia	980-192288		
Dominican Republic	1-888-7514232		
Jamaica	1-800-850-1755		
Mexico	001-800-514-2288		
Puerto Rico	1-888-680-2288		
Trinidad & Tobago	1-800-363-2288		

[*1] The United Kingdom includes England, Guernsey, the Isle of Man, Jersey, Northern Ireland, and Scotland.

For countries not covered by a toll-free service dial Canada (country code 001) at 514–832–0201.

Appendix D : Reference documents

Manual number	Description
UM6C18HB/HC	TCM/48 temperature compensation module
Voltage_level	Voltage level limits for Power Plants, Rectifiers and Controllers
UM7C19A	RPM1000C intelligent controller/monitor unit
IM6C28C	MFA150 Modular Front Access power system Installation manual
UM5C07	Helios Rectifier 50/48
UM5C06D	Helios Rectifier 25/48

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Abbreviations and acronyms

A	ampere
AC or ac	alternating current
AD	assembly drawing
ADJ	adjust
ALM	alarm
AMPS	amperes
AUD	audible
AWG	American wire gauging
BAT	battery
BAT RTN	battery return
BD	Battery disconnect
BMU	battery management unit
BOD	battery on discharge
BODA	battery on discharge alarm
BPG	building principal ground
BR	battery return
BRKR	breaker
BYP	bypass
C	Celsius
CAL	calibrate
CH	channel

CHG	charge
COM	common
CTRL	control
DC or dc	direct current
DISCH	discharge
EMI	electromagnetic interference
EQL	equalize
EQL STAT	equalize status
ESD	electrostatic discharge
F	Fahrenheit
F	fuse
FA	fuse alarm
FG	frame ground
FGB	floor ground bar
FS	forced sharing
ft	foot
ft-lb	foot-pound
GRD or GRND	ground
HV	high voltage
HVA	high voltage alarm
HVSD	high voltage shutdown
HVSDA	high voltage shutdown alarm
HVSDR	high voltage shutdown reconnect
in.	inch
in.-lb	inch-pound
IS	interconnect schematic
ISG	isolated system ground

L	line (AC)
lb	pound
LED	light emitting diode
LV	low voltage
LVA	low voltage alarm
LVD	low voltage disconnect
LVDA	low voltage disconnect alarm
LVDR	low voltage reconnect
m	meter
MAJ	major
MFA	modular front access
MGB	main ground bar
MIN	minor
MNL	manual
MOP	method of procedure
MPR	modular power rectifier
MPS	modular power shelf
mV	millivolt
NC	normally closed
N-m	Newton-meter
NO	normally open
NORM	normal
PLT	plant
psi	pound per square inch
RC	rectifier control
RECT	rectifier
REQ	remote equalize

RFA	rectifier failure alarm
RPM	remote power monitor
RST	reset
SH	shunt
SLS	slope load sharing
SPG	single point ground (connection)
SW	switch
TB	terminal block
TCM	temperature compensation module
TP	test point
TR	temporary release
UL	Underwriters Laboratories
V	volt
VRLA	valve regulated lead acid (batteries)
WD	wiring diagram

MFA150 Modular Front Access Power System—NT6C28C

User Manual

Emerson Energy Systems
2280 Alfred-Nobel Blvd
St-Laurent (Quebec) Canada
H4S 2A4

Manual Number : UM6C28C (167-9021-102)
Manual Issue : 11.00
Manual Status : Standard
Release Date : October 2001
P0728920

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