NetSure™ IPE Series Rectifier

Installation and User Manual

Specification Number: 561664, 561665, 561666
Model Number: R48-1000C

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Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit https://www.vertiv.com/en-us/support/ for additional assistance.

Visit https://www.vertiv.com/en-emea/support/ for additional assistance.

Visit https://www.vertiv.com/zh-CN/support/ for additional assistance.

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Admonishments Used in this Document

DANGER! Warns of a hazard the reader ***will*** be exposed to that will ***likely*** result in death or serious injury if not avoided. (ANSI, OSHA)

WARNING! Warns of a potential hazard the reader ***may*** be exposed to that ***could*** result in death or serious injury if not avoided. This admonition is not used for situations that pose a risk only to equipment, software, data, or service. (ANSI)

CAUTION! Warns of a potential hazard the reader ***may*** be exposed to that ***could*** result in minor or moderate injury if not avoided. (ANSI, OSHA) This admonition is not used for situations that pose a risk only to equipment, data, or service, even if such use appears to be permitted in some of the applicable standards. (OSHA)

ALERT! Alerts the reader to an action that ***must be avoided*** in order to protect equipment, software, data, or service. (ISO)

ALERT! Alerts the reader to an action that ***must be performed*** in order to prevent equipment damage, software corruption, data loss, or service interruption. (ISO)

FIRE SAFETY! Informs the reader of fire safety information, reminders, precautions, or policies, or of the locations of fire-fighting and fire-safety equipment. (ISO)

SAFETY! Informs the reader of general safety information, reminders, precautions, or policies not related to a particular source of hazard or to fire safety. (ISO, ANSI, OSHA)

Important Safety Instructions

Safety Admonishments Definitions

Definitions of the safety admonishments used in this document are listed under “Admonishments Used in this Document” on page v.

General Safety

DANGER! YOU MUST FOLLOW APPROVED SAFETY PROCEDURES.
Performing the following procedures may expose you to hazards. These procedures should be performed by qualified technicians familiar with the hazards associated with this type of equipment. These hazards may include shock, energy, and/or burns. To avoid these hazards:

a) The tasks should be performed in the order indicated.

b) Remove watches, rings, and other metal objects.

c) Prior to contacting any uninsulated surface or termination, use a voltmeter to verify that no voltage or the expected voltage is present. Check for voltage with both AC and DC voltmeters prior to making contact.

d) Wear eye protection.

e) Use certified and well maintained insulated tools. Use double insulated tools appropriately rated for the work to be performed.

Voltages

AC Input Voltages

DANGER! This system operates from AC input voltage capable of producing fatal electrical shock. AC input power must be completely disconnected from the branch circuits wiring used to provide power to the system before any AC electrical connections are made. Follow local lockout/tagout procedures to ensure upstream branch circuit breakers remain de-energized during installation. DO NOT apply AC input power to the system until all electrical connections have been completed and checked.

DC Output Voltages

DANGER! This system produces DC power. Although the DC voltage is not hazardously high, the rectifiers can deliver large amounts of current. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact an output terminal or exposed wire connected to an output terminal. NEVER allow a metal object, such as a tool, to contact more than one termination at a time, or to simultaneously contact a termination and a grounded object. Even a momentary short circuit can cause sparking, explosion, and injury.

DANGER! Follow local lockout/tagout procedures to ensure DC branch circuit protection devices remain de-energized during installation at loads, as required.

Personal Protective Equipment (PPE)

DANGER! ARC FLASH AND SHOCK HAZARD.
Appropriate PPE and tools required when working on this equipment. An appropriate flash protection boundary analysis should be done to determine the “hazard/risk” category, and to select proper PPE.

Only authorized and properly trained personnel should be allowed to install, inspect, operate, or maintain the equipment.

Do not work on LIVE parts. If required to work or operate live parts, obtain appropriate Energized Work Permits as required by the local authority, per NFPA 70E “Standard for Electrical Safety in the Workplace”.

Hazardous Voltage

DANGER! HAZARD OF ELECTRICAL SHOCK.
More than one disconnect may be required to de-energize the system before servicing.

Handling Equipment Containing Static Sensitive Components

ALERT! Installation or removal of equipment containing static sensitive components requires careful handling. Before handling any equipment containing static sensitive components, read and follow the instructions under “Static Warning” on page viii.

Static Warning

This equipment contains static sensitive components. The warnings listed below must be observed to prevent damage to these components. Disregarding any of these warnings may result in personal injury or damage to the equipment.

1. Strictly adhere to the procedures provided in this document.
2. Before touching any equipment containing static sensitive components, discharge all static electricity from yourself by wearing a wrist strap grounded through a one megohm resistor. Some wrist straps have a built-in one megohm resistor; no external resistor is necessary. Read and follow wrist strap manufacturer's instructions outlining use of a specific wrist strap.
3. Do not touch traces or components on equipment containing static sensitive components. Handle equipment containing static sensitive components only by the edges that do not have connector pads.
4. After removing equipment containing static sensitive components, place the equipment only on static dissipative surfaces such as conductive foam or ESD bag. Do not use ordinary Styrofoam or ordinary plastic.
5. Store and ship equipment containing static sensitive components only in static shielding containers.
6. If necessary to repair equipment containing static sensitive components, wear an appropriately grounded wrist strap, work on a conductive surface, use a grounded soldering iron, and use grounded test equipment.

1 Introduction

The Vertiv™ NetSure™ IPE Series provides a rectifier mounted inside an environmentally protective enclosure. The Vertiv™ NetSure™ IPE Series rectifier can be wall or pole mounted.

1.1 Ordering Structure

1.1.1 Configurations

The Vertiv™ NetSure™ IPE Series rectifier can be provided in three (3) configurations.

- Bulk Output: Spec. No. 561664 (R48-1000C-4).
- Output Fed through an Internal 30 A Circuit Breaker:
  Spec. No. 561665 (R48-1000C-5).
- Output Fed through an Internal 6-Position GMT Fuse Block: Spec. No. 561666 (R48-1000C-6).

1.1.2 Circuit breaker option

Spec. No. 561665 (R48-1000C-5): A 30 A internal circuit breaker is provided.

1.1.3 GMT fuse option

Spec. No. 561666 (R48-1000C-6): An internal 6-position GMT fuse block is provided.
Specify fuses from Table 1.1.

- Maximum GMT fuse size is 10 A.
- At +65 °C (+149 °F), a space is required between GMT fuses greater than 5 A.
- When used for power distribution, load should not exceed 80% of device rating, except 10 A fuses, for which load should not exceed 70% of device rating.

Table 1.1: GMT Fuses

Ampere Rating	Part Number	Fuse Color
1/4	248610200	Violet
1/2	248610300	Red
3/4	248610500	Brown
1-1/3	248610700	White
2	248610800	Orange
3	248610900	Blue
5	248611000	Green
7-1/2	248611300	Black-White
10	248611200	Red-White

1.1.4 What is in the box

Refer to Table 1.2.

Table 1.2:

Item	P/N 561664 (R48-1000C-4)	P/N 561665 (R48-1000C-5)	P/N 561666 (R48-1000C-6)
(1) 21503878 Mounting Bracket Kit	X	X	X
(2) 632404V1 Mounting Bracket (Big)	X	X	X
(1) 632404V2 Mounting Bracket (Small)	X	X	X
(2) 21101742 Sealing Cable Adapter (Single Large) (DC Input, Bulk DC Output, 30 A Breaker Output, AC Input)	X	X	X
(1) 21101743 Sealing Cable Adapter (Single Small) (AC Input)	X	X	X
(3) 21101744 Sealing Cable Adapter (Three Cables) (Alarm, GMT Output)	X	X	X
(1) 63126350 Door Hardware Tool	X	X	X
(2) 26011153 M8 Bolts w/ Flat Washer and Lock Washer	X	X	X
(4) 26011018 M5 Bolts w/ Flat Washer and Lock Washer	X	X	X
(2) 26011356 M5 Flat Head Screws	X	X	X
(2) 63126330 Pole Mount Band	X	X	X
(1) 14190607 AC Input Connector (Customer Side)	X	X	X
(2) 14190609 DC Output Connector for GMT Fuse Option (Customer Side)	--	--	X
(1) 14190611 Alarm Connector (Customer Side)	X	X	X
(1) 14190615 DC Input Connector (Customer Side)	X	X	X
(1) 14190623 DC Output Connector for Bulk Output or Internal Circuit Breaker Option (Customer Side)	X	X	--
(6) 21101745 Sealing Pin for Unused Holes in Sealing Cable Adapters	X	X	X
(1) UM1R481000CNA Installation and User Manual	X	X	X

1.1.5 Replacement components

The input/output terminations are connectorized. For a replacement mating connector, order from Table 1.3. Refer also to Table 1.3 for other replacement components.

Table 1.3: Replacement Components

Part Number	Description
14190607	AC Input Connector (Customer Side)
14190609	DC Output Connector for GMT Fuse Option (Customer Side)
14190611	Alarm Connector (Customer Side)
14190615	DC Input Connector (Customer Side)
14190623	DC Output Connector for Bulk Output or Internal Circuit Breaker Option (Customer Side)
63126330	Pole Mount Band
21101742	Sealing Cable Adapter (Single Large) (DC Input, Bulk DC Output, 30 A Breaker Output, AC Input)
21101743	Sealing Cable Adapter (Single Small) (AC Input)
21101744	Sealing Cable Adapter (Three Cables) (Alarm, GMT Output)
21101745	Sealing Pin for Unused Holes in Sealing Cable Adapters
21101755	Door Gasket

1.2 Rectifier Overview

The rectifier provides load power during normal operating conditions. The rectifier is a constant power design. The rectifier is rated at its maximum output power. This means that, within the normal operating ambient temperature range and input voltage range, the maximum available output power is a constant 1000 W. Within these ranges, the rectifier operates in one of three modes, depending upon load demands. Transition between modes is completely automatic. If ambient temperature rises above or input voltage falls below acceptable values, the rectifier continues to operate but at derated output power levels.

- Constant Voltage Mode: For any initial output voltage setting from -42 VDC to -58 VDC (factory set at -54 VDC), output voltage remains constant regardless of load. This is the normal operating condition, in which loads are being supplied. The rectifier operates in the Constant Voltage Mode unless load increases to the point where the product of load current and output voltage is approximately 1000 W.
- Constant Power Mode: As load increases above approximately 1000 W (non-adjustable), output current continues to increase, but output voltage decreases as required to maintain constant output power. The rectifier operates in the Constant Power Mode unless load continues to increase to the point where the current limit setting is reached.
- Constant Current Mode: If load increases to the current limit setting, output voltage decreases linearly to maintain output current at the current limit setting.
- Fold Back: The fold back function is necessary to protect the rectifier against excessive load. The rectifier will deliver maximum current of 20.8 A down to 42 VDC output. If the load demand exceeds 20.8 A, the rectifier output will "fold back", reducing the voltage as shown in Figure 1.1 so as to limit the current and protect the rectifier. (The dotted line in Figure 1.1 represents the Fold Back.)

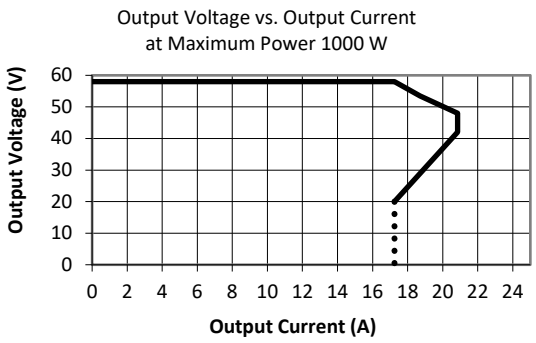
1.3 Rectifier Specifications

The specifications are for a single unit only, unless otherwise noted.

1.3.1 DC output ratings

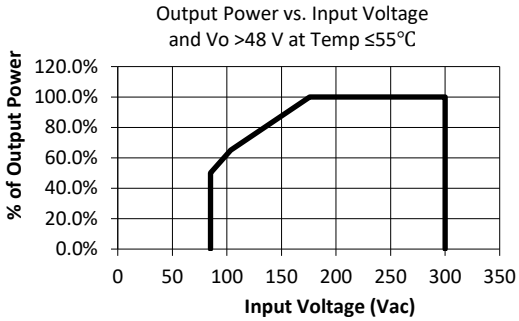
1. Voltage: -42 VDC to -58 VDC, positive ground. Output voltage is factory set at -54 VDC.
2. Output Power and Current:
   a) 1000 W (20.83 A) @ 200 VAC to 250 VAC input and -48 VDC output.
   b) 700 W (14.58 A) @ 120 VAC input and -48 VDC output.
3. Output Characteristics: Refer to Figure 1.1 for a graph of output voltage vs. output current.

Figure 1.1: Output Voltage vs. Output Current



4. Power Derating Based on Input Voltage: The rectifier power varies with changes in input voltage. It uses an advanced power limitation method. The lower input threshold is 85 VAC. The rectifier can provide its maximum rated power (1000 W) as long as the input voltage is within the range of 176 VAC to 300 VAC. Below 176 VAC, and down to 85 VAC, the rectifier will continue to operate normally but will be in a power derating mode. The relationship between the output power and input voltage is illustrated in Figure 1.2.

Figure 1.2: Power Derating Based on Input Voltage



5. Power Derating Based on Temperature: The rectifier delivers full power when operating at an ambient temperature of +55 °C (+131 °F) or below. The rectifier continuously monitors the ambient temperature surrounding the power conversion circuit. If this temperature for any reason (such as a high ambient temperature) increases above approximately +55 °C (+131 °F), the rectifier will not shut down. Rather, the rectifier limits its maximum output power to maintain the temperature of the power conversion circuit within design parameters. Operation between +55 °C (+131 °C) and +75 °C (+167 °F) will result in output power being decreased. Full power capability is restored when the temperature decreases to below approximately +55 °C (+131 °F). Refer to Figure 1.3 to view the relationship between the output power and the ambient temperature.

WARNING! The module is rated for continuous operation at full output power up to +55 °C (+131 °F). Operation between +55 °C (+131 °F) and +75 °C (+167 °F) will result in output power decrease. Operation above +75 °C (+167 °F) is considered abnormal and should be used on a temporary[1] basis only.

[1] Temporary Operation at Abnormal Temperature: Temporary operation is defined as a period of not more than eight consecutive hours per day, and a total of not more than 15 days in a year. (This refers to a total of 120 hours in any given year, but no more than 15 occurrences in that one-year period.)

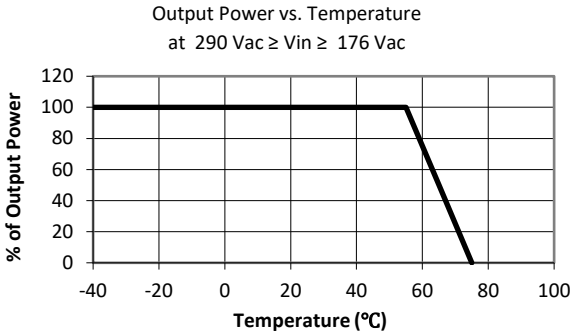
Other power rating values are as follows (refer to Figure 1.3):

a) At an ambient temperature of +65 °C (+149 °F), the power delivered by the rectifier is 500 W.

b) At an ambient temperature of +75 °C (+167 °F), the power delivered by the rectifier is 0 W.

NOTE! *If used outdoors under full solar radiation, in an ambient of 46 °C the product is rated for 561 W per Telcordia GR-487-CORE.*

Figure 1.3: Power Derating Based on Temperature



6. Regulation:

   a) Static: Steady state regulation is ±0.6% as controlled within the rectifier for any and all combinations of load from no load to full load, input voltage, and input frequency at a constant ambient temperature.

   b) Dynamic: Response time ≤200 us and overshoot ≤5% for load changes at 50% - 25% - 50% and 50% - 75% - 50% at rated output current.

      For any step load change within the range of 10% to 90% of full load within 50 us, per Telcordia GR-947-CORE, the maximum voltage transient will not exceed 5% of the initial steady state voltage within 50±10 us. Recovery to within 1% of the initial steady state voltage does not exceed 1 milliseconds.

7. Filtering:

   a) Voice Band Noise: Peak-peak voltage is ≤200 mV at 0 MHZ to 20 MHZ and normal output voltage.

   b) Wide Band Noise: Wideband noise voltage is ≤50 mV at 3.4 kHz to 150 kHz and ≤20 mV at 0.15 MHz to 30 MHz.

   c) Discrete Noise Voltage: Discrete noise voltage is ≤5 mV at 3.4 kHz to 150 kHz, ≤3 mV at 150 kHz to 200 kHz, ≤2 mV at 200 kHz to 500 kHz, and ≤1 mV at 500 kHz to 30000 kHz.

   d) Psophometric Noise: Psophometric noise is ≤2 mV typical at 220 VAC input, 53.5 VDC output, and 30% to 90% of rated load for more than one rectifier.

1.3.2 AC input ratings

1. Voltage: Nominal 120 VAC / 208 VAC / 220 VAC / 230 VAC / 240 VAC, single phase, 3-wire, 50 Hz / 60 Hz, with an operating range of 85 VAC to 300 VAC. Acceptable input frequency range is 45 Hz to 65 Hz.

   Permitted Variation: 85 VAC to 300 VAC.

2. Harmonic Content (THD): Meets EN61000-3-2. ≤5% from 50% to 100% of rated output current at 220 VAC.

3. Inrush Current: Peak does not exceed 1.5 times of the peak value of the maximum steady-state input current at full load, 220 VAC input voltage, and for any duration of AC input interrupts. Under the above conditions, standard AC distribution circuit breakers will not trip.

4. Typical Input Data: 50 Hz input.

   a) Refer to Table 1.4.

   b) Maximum Input Current: Refer to Table 1.5.

c) Efficiency Curve: Refer to Figure 1.4.

5. Typical Input Data: 60 Hz input.

a) Refer to Table 1.6.

b) Maximum Input Current: Refer to Table 1.7.

c) Efficiency Curve: Refer to Figure 1.5 and Figure 1.6.

Table 1.4: Typical Input Data with 50 Hz Input

Nominal Input Voltage	Percent of Full Load	Input Current (Amperes)	Input VA	Input Watts	Power Factor	Efficiency %	Heat Dissipation BTU/Hr
208	0	0.286	55.84	4.73	0.10023	--	16.137
	25	1.26	258.754	245.374	0.94857	90.79	77.1101
	50	2.34	485.81	479.14	0.98624	94.33	92.6646
	75	3.489	725.77	721.56	0.99407	94.81	127.7476
	100	4.66	970.24	967.15	0.99682	94.76	172.9354
	110	5.01	1041.68	1038.95	0.99725	94.70	187.9968
240	0	0.33	73.4	4.908	0.06636	--	16.745
	25	1.12	265.36	244.52	0.92218	91.16	73.7573
	50	2.02	482.99	477.956	0.98977	94.59	88.2566
	75	3.015	724.2	719.46	0.99357	95.10	120.301
	100	4.033	969.3	966.68	0.99727	95.09	161.8856
	110	4.32	1037.32	1035.1	0.99778	95.05	174.7991

Note: *System output is initially adjusted to 54 volts DC as measured at the system sense point at 50% of full load and nominal input. "Percent of Full Load" refers to percent of 17.24 amperes.*

Table 1.5: Maximum Input Current with 50 Hz Input

Nominal Input Voltage	Input Voltage	Input Current (Amperes)
208/240	176	7.5

Note: *At 100% of full load with output adjusted to 58 volts DC as measured at the output terminals.*

Table 1.6: Typical Input Data with 60 Hz Input

Nominal Input Voltage	Percent of Full Load	Input Current (Amperes)	Input VA	Input Watts	Power Factor	Efficiency %	Heat Dissipation BTU/Hr
120	0	0.233	28.132	4.863	0.17286	--	16.59
	25	2.175	262.037	256.726	0.97973	90.76	80.96
	50	4.185	503.75	499.92	0.99241	93.09	117.85
	75	6.278	754.97	751.24	0.99505	92.94	181.02
	100	--	--	--	--	--	--
	110	--	--	--	--	--	--
208	0	0.34	67.243	4.713	0.07574	--	16.08
	25	1.284	263.654	245.112	0.92942	90.80	76.95
	50	2.35	487.82	478.89	0.98189	94.35	92.36
	75	3.49	726.85	721.46	0.99271	94.81	127.77
	100	4.66	970.53	966.92	0.99636	94.78	172.29
	110	5.006	1042.06	1038.81	0.99693	94.70	187.70
240	0	0.381	87.67	4.728	0.05362	--	16.13
	25	1.155	272.863	244.46	0.89528	91.15	73.79
	50	2.027	484.678	478.99	0.98601	94.37	91.97
	75	3.02	725.35	719.45	0.9919	95.10	120.31
	100	4.023	966.79	963.65	0.99679	95.12	160.58
	110	4.31	1037.72	1035.15	0.99752	95.05	174.97

Note: *System output is initially adjusted to 54 volts DC as measured at the system sense point at 50% of full load and nominal input. "Percent of Full Load" refers to percent of 17.24 amperes.*

Table 1.7: Maximum Input Current with 60 Hz Input

Nominal Input Voltage	Input Voltage	Input Current (Amperes)
208/240	176	7.5

Note: *At 100% of full load with output adjusted to 58 volts DC as measured at the output terminals.*

Figure 1.4: Efficiency Curve (@ 230 VAC, 50 Hz)

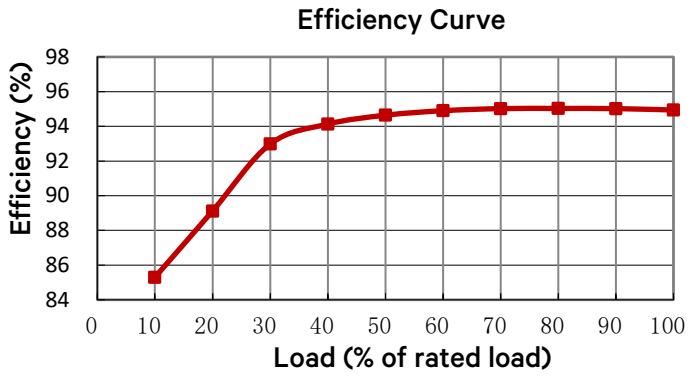


Figure 1.5: Efficiency Curve (@ 240 VAC, 60 Hz)

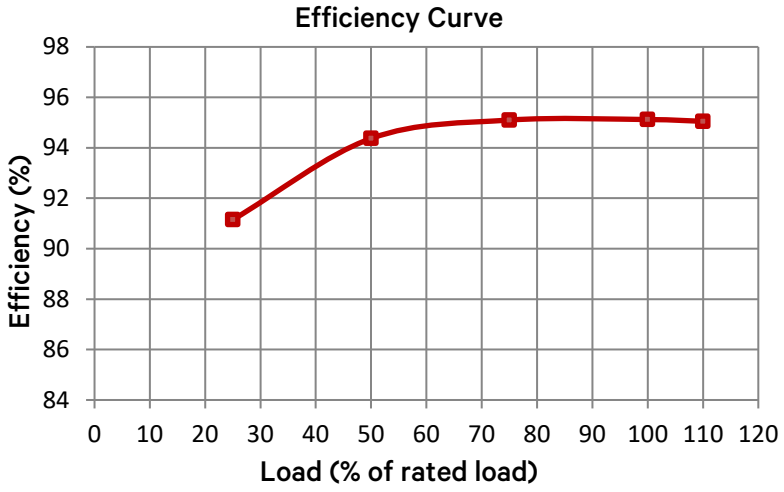
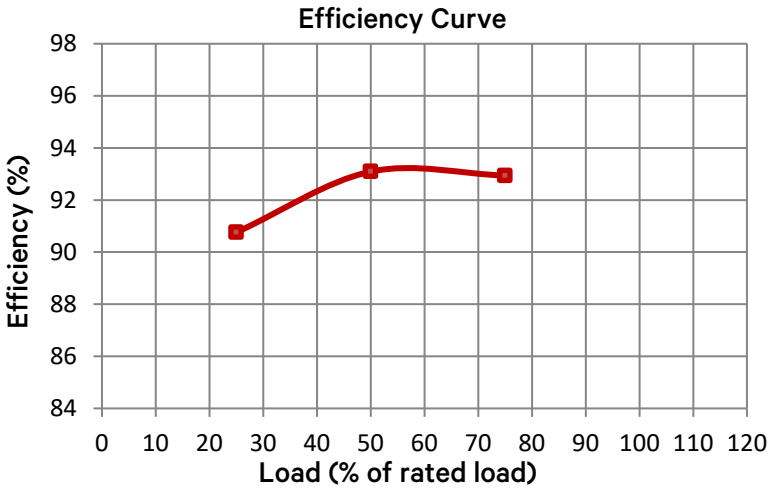


Figure 1.6: Efficiency Curve (@ 120 VAC, 60 Hz)



1.3.3 Environmental ratings

1. Operating Ambient Temperature Range:
   a) -40 °C (-40 °F) to +55 °C (+131 °F) with full power performance.
   b) +55 °C (+131 °F) to +75 °C (+167 °F) with derating output.
   c) Temperature Coefficient: 0.02% per degrees Celsius.
2. Storage Ambient Temperature Range: -40 °C (-40 °F) to +70 °C (+158 °F).
3. Relative Humidity: This rectifier is capable of operating in an ambient relative humidity range of 0% to 95%.
4. Altitude: -200 feet (- 61 m) to 13000 feet (3900 m).
5. Surge Protection: EN61000-4-5 up to level 4, Telcordia GR-1089-Core, IEEE C62.41-2002, YD/T 731-2002.

   Performance Criteria B.

   AC Power Terminals

Test Level		Source Impedance	Performance Criteria
Line to Line	Line to Ground		
± 4 kV	± 4 kV	2 ohms	B
NA	± 6 kV	12 ohms	B

   DC Power Terminals:

Test Level		Source Impedance	Performance Criteria
Line to Line	Line to Ground		
± 500 V	± 500 V	2 ohms	B
± 800 V	± 800 V	2 ohms	B

   The test method is described in EN 61000-4-5. In this test the DC-cables shall be 5 m long.
6. High Voltage Category (per UL60950): III
7. Power Distribution System: TN/TT/IT
8. EMI/RFI Suppression:
   a) The rectifier conforms to the requirements of FCC rules Part 15, Class B for radiated and conducted emissions limits.
   b) The rectifier conforms to the requirements of European Norm, EN55022, Class B for radiated and conducted emissions limits.

1.3.4 Compliance information

1. EMC: ETSI EN 300 386, FCC CFR 47 Part 15 class B, Telcordia GR-1089-CORE.
2. EMI Load Range: 10% to 100%.
3. Safety: IEC 60950, EN 60950.

4. Product is GR-3108 Class 4 compliant.

1.3.5 Standard features

1. Type of Power Conversion Circuit: High frequency.

2. Input Protection:

   a) Input Over/Under Voltage Protection: The rectifier will shut down at low or high voltage input; based on the following voltage levels:

      Low Voltage Disable Point: 80 VAC, ±5 V; hysteresis is at least 15 VAC for restart.

      High Voltage Disable Point: 305 VAC, ±5 V; hysteresis is at least 10 VAC for restart.

   b) Between 85 VAC and 176 VAC the output power will be derated linearly based on the input voltage as follows:

      At input voltage of 85 VAC with output >48 VDC, maximum output power is 500 W.

      At input voltage of 176 VAC with output >48 VDC, maximum output power is 1000 W.

3. Output Protection:

   a) Overload / Reverse Current: The rectifier has a 28 A fuse wire in the negative output DC bus. This fuse is not customer replaceable.

   b) Current Limiting: The rectifier has a current limit function. The current limit point is factory set at 20.83 A. The current limit accuracy is ±1.5 A when the output voltage ranges from 42 VDC to 48 VDC.

   c) Advanced Current Limit Function: The rectifier has an enhanced non settable current limit function. When a short circuit occurs at the rectifier output terminals, the rectifier will limit the current to 17 A ± 6 A. This function effectively protects the rectifier and the equipment connected to the rectifier. When the short circuit is cleared, the rectifier will automatically restore back to normal operation.

   d) High Voltage Shutdown:

      - Fixed Control: If rectifier output voltage exceeds a factory set value of 59.5 VDC and the rectifier is delivering more than 10% of its rated current, the rectifier shuts down. (The restart hysteresis is 0.5 V ±0.2 V.)

        The rectifier then restarts and a HVSD restart timer starts (factory set at 5 minutes). If output voltage again exceeds the high voltage shutdown value before the HVSD restart timer expires, the rectifier shuts down and locks out. Manual restart is then required (by turning power to the rectifier off , waiting until the LEDs on the rectifier extinguish, then turning power to the rectifier on). If the rectifier does not experience a high voltage condition before the HVSD restart timer expires, the restart circuit is reset.

        If two or more rectifiers are paralleled, only the rectifier causing the high voltage condition shuts down.

      - Backup: If rectifier output voltage exceeds 59.5 VDC ±0.5 V (non-adjustable), the rectifier shuts down. The rectifier then restarts and a HVSD restart timer starts (factory set at 5 minutes). If output voltage again exceeds the high voltage shutdown value before the HVSD restart timer expires, the rectifier shuts down and locks out. Manual restart is then required (by turning power to the rectifier off, waiting until the LEDs on the rectifier extinguish, then turning power to the rectifier on).

4. Over-Temperature Protection: The rectifier provides over temperature protection by derating output power and recovers automatically.

5. Active Load Sharing: The rectifier uses advanced digital active load sharing technology that maintains balancing to within 5% of rated current.

6. Paralleling: Up to three (3) rectifiers can be connected in parallel in one system. Do not exceed the load rating of a single rectifier. See “Paralleling Rectifiers” on page 32.

7. Rectifier Output Current Imbalance:

   a) When the average current of all rectifier modules is greater than 20% of full rated current, and the difference between local rectifier current and average current is greater than 16% of full rated current, the yellow protection indicator will illuminate.

   b) When the average current of all rectifier modules is greater than 10% of full rated current, and local rectifier current is less than 2% of full rated current, then the red fault indicator will illuminate.

8. Monitoring Function: The rectifier has a built-in advanced DSP that monitors and controls the operation of the rectifier.

1.3.6 Mechanical specifications

1. Dimensions and Weight: Refer to Figure 1.7.

2. Indicators (located behind door):

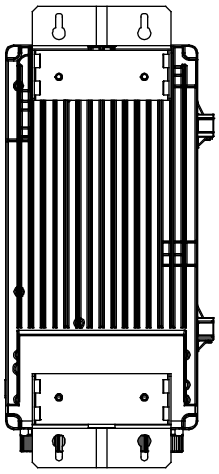
   a) Power (Green LED)

   b) Protection (Yellow LED)

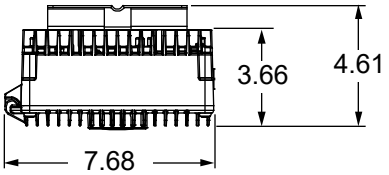
   c) Alarm (Red LED)

Figure 1.7: Overall Dimensions

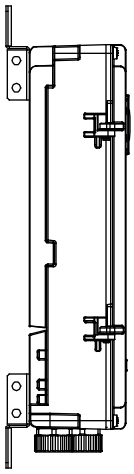
Notes:
1. Dimensions are in inches, unless otherwise specified.
2. Finish: Aluminum with Powder Painted.
3. Weight:
   Net: 5 kg (11 lbs.)
   Shipping:



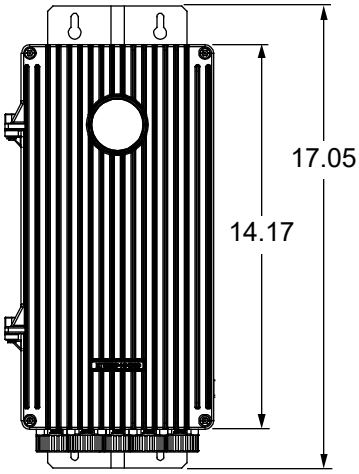
Rear View



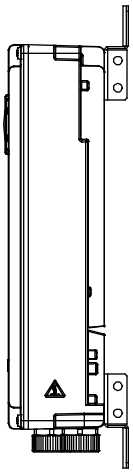
Top View



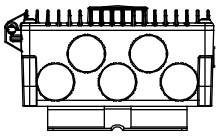
Left Side View



Front View



Right Side View



Bottom View

2 Installation

2.1 General Requirements

CAUTION! PREVENT EQUIPMENT DAMAGE, FROM CONDENSATION

Until the product is turned up for service, the top cover of the product should remain closed as delivered from the factory. If the top cover of the product is opened when in storage, it shall be placed in its sealed protective packaging with the provided desiccant bags to prevent condensation. Once the product is in service, the heat generated by the product is sufficient to prevent humidity build up.

- This product is intended for installation in network telecommunications facilities (CO, vault, hut or other electronic equipment enclosure) or as an outside plant cabinet.
- This product is intended to be connected to the common bonding network in a network telecommunications facility (CO, vault hut or other equipment enclosure).
- The DC return connection to this system can remain isolated from system frame and chassis (DC-I). The DC return is not connected to the power supply chassis from the factory.
- This product is suitable for installation as part of the Common Bonding Network (CBN).

2.2 Tools and Test Equipment Required for Installation

The following tools, test equipment and materials are required for the physical installation of the product:

- Non-Contact Voltage Detector
- Digital Multimeter (DMM), 0 VDC to 200 VDC, 0 VAC to 300 VAC
- Torque Wrench
- Ratchet, 1/2", 3/8" and 1/4" Drives
- Socket Set Range from M4 to M13
- 3" and 6" Extensions, 1/4" and1/2" Drive
- Carpenters Level
- Lineman's Scissors
- Lineman's Strippers
- Lineman's Cutters
- Crimping Tool with Dies for 6 AWG to 14 AWG
- Electrician's Insulated Screwdrivers, Phillips, No. 1 and 2
- Electrician's Insulated Screwdrivers, Flat Blade, Small and Large
- NO-OX-ID or Approved Equivalent

2.3 Installing the Rectifier

2.3.1 General

The rectifier can be pole mounted or secured to a suitable wall.

For mounting; use a corrosion inhibiting compound (CIC) that is conductive inside the tapped mounting holes to keep water away, or use organically plated stainless steel bolts. See Figure 2.3 and Figure 2.7.

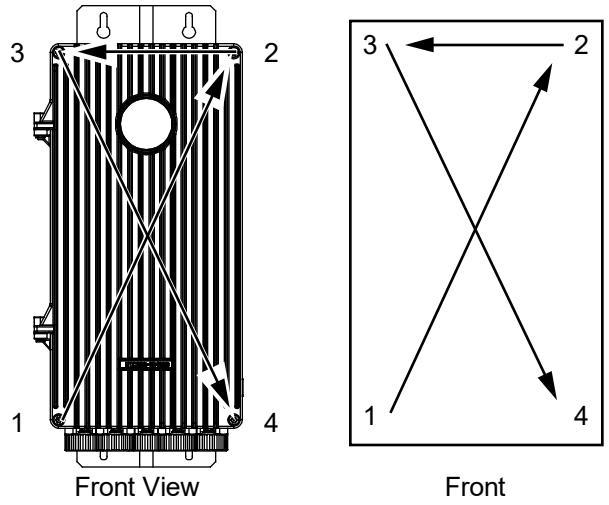
2.3.2 Front door

If the front door is opened during installation, perform the following procedure to properly close and secure the door.

Procedure

1. Close the door.
2. Hand tighten each screw, ensuring the screw and washer beneath it are centered in the mounting hole.
3. Torqued each screw in the following order (**Figure 2.1**) to 29 Kgf cm (2.9 Nm) (25 in-lbs).

Figure 2.1: Torque Sequence



2.3.3 Pole installation procedure

NOTE! *Torque all hardware to the values shown in the illustrations.*

1. Unpack the rectifier and mounting accessories.
2. Install the mounting bracket (big) in the appropriate top position on the pole with the supplied pole mount band. Tighten the pole mount band to the pole (torque to 45 in-lbs). The pole mount band accommodates poles from 6" to 12" in diameter. Refer to Figure 2.2.
3. Install mounting brackets to the rear panel of the rectifier with the supplied hardware. Refer to Figure 2.3.
4. Secure the top of the rectifier to the pole by securing the mounting bracket (small) to the mounting bracket (big) with the supplied M8 bolts. Refer to Figure 2.4.

5. Secure the bottom of the rectifier to the pole by securing the mounting bracket (big) to the pole with the supplied pole mount band. Torque to 45 in-lbs . Refer to Figure 2.5.

Figure 2.2: Installing the Mounting Bracket to the Pole with the Pole Mount Band

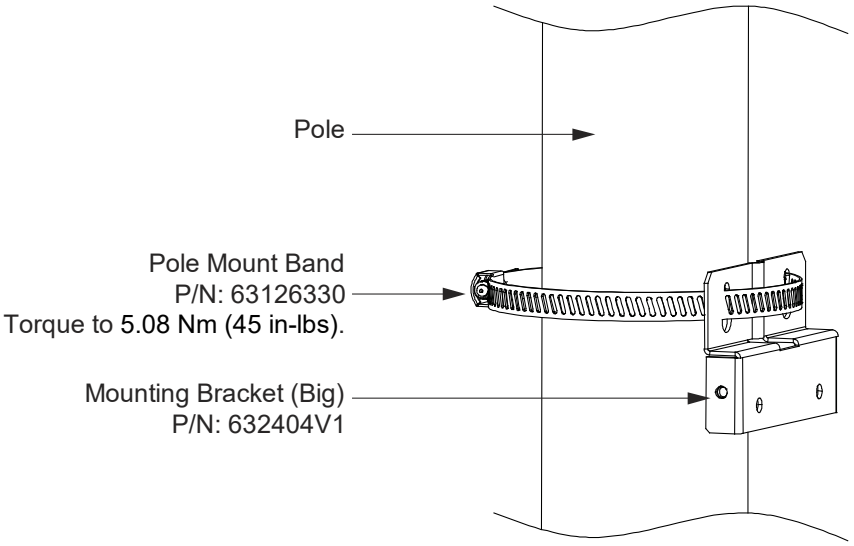


Figure 2.3: Installing the Mounting Brackets to the Rectifier

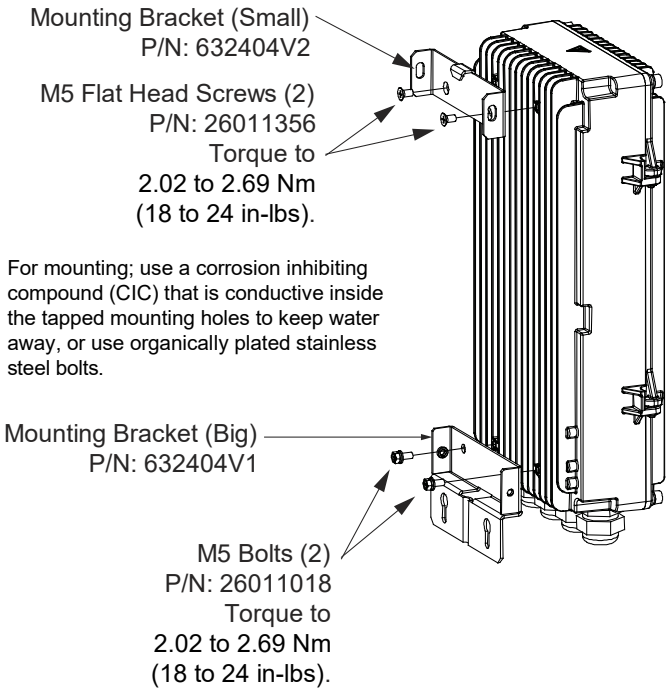


Figure 2.4: Securing the Rectifier to the Pole at the Top

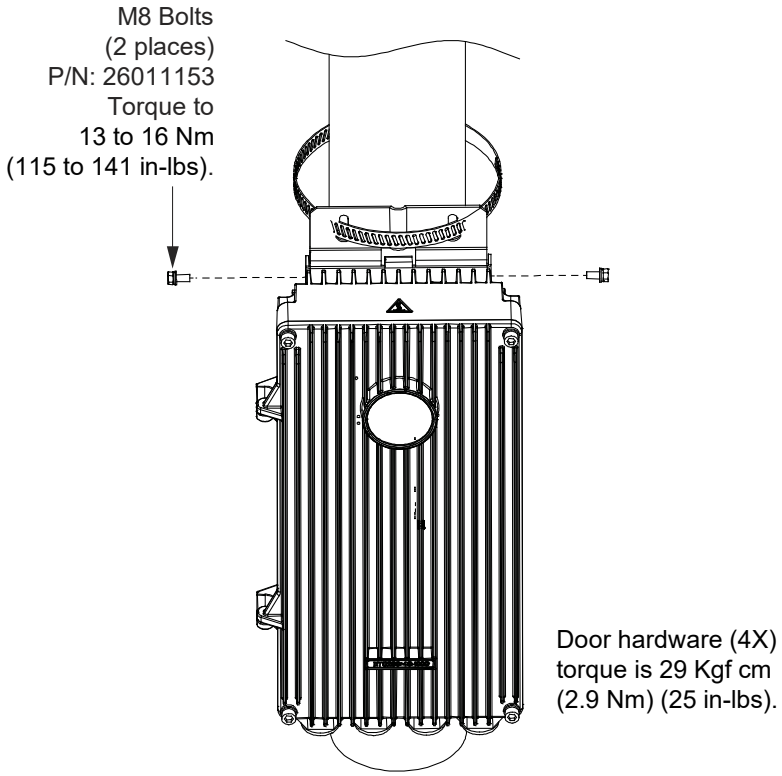
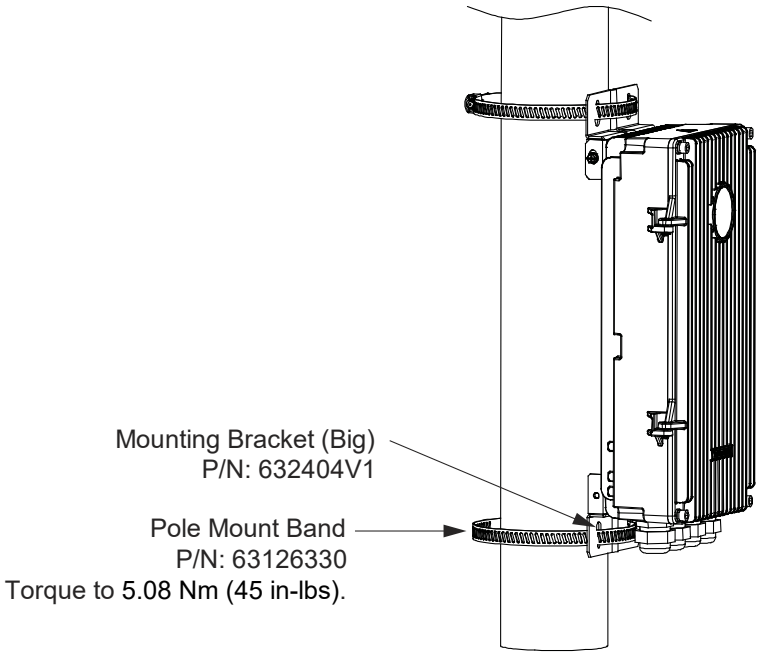


Figure 2.5: Securing the Rectifier to the Pole at the Bottom



2.3.4 Wall installation procedure

1. Drill appropriately sized holes for the customer provided M5 wall anchors being used into the wall as shown in Figure 2.6. Note that the rectifier can be mounted horizontal or vertical. Figure 2.6 shows horizontal mounting. Install the M5 wall anchors into the holes.
2. Install mounting brackets to the rear panel of the rectifier. Refer to Figure 2.7.
3. Secure the rectifier to the wall using the wall anchors previously installed. Refer to Figure 2.8.

Figure 2.6: Wall Mounting Hole Positions

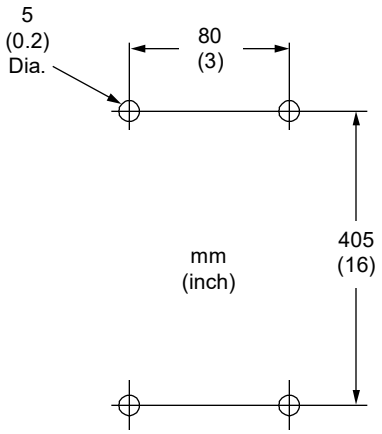


Figure 2.7: Installing the Mounting Brackets to the Rectifier

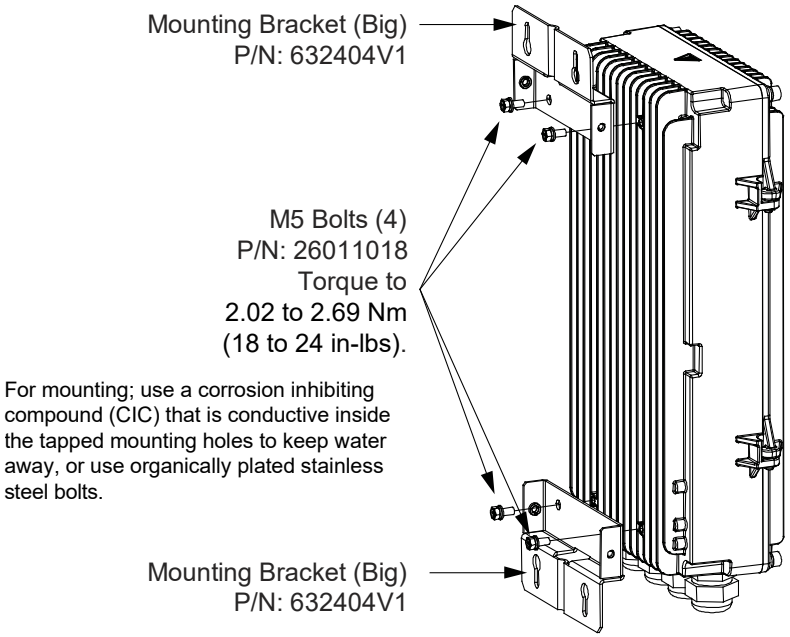
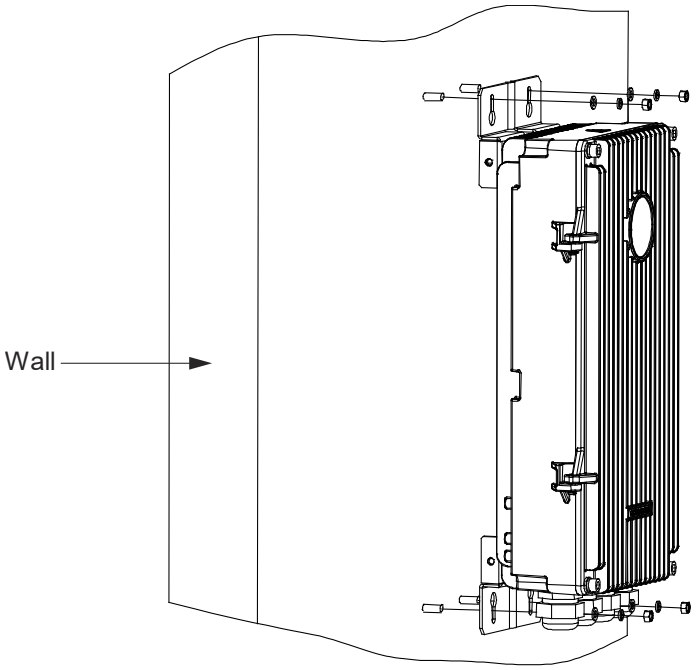


Figure 2.8: Securing the Rectifier to the Wall



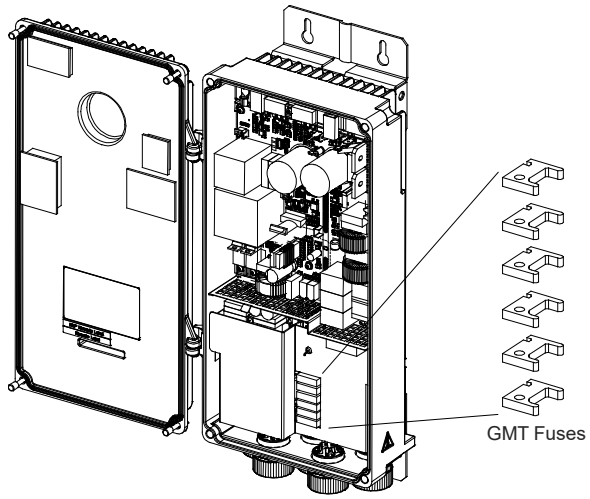
2.4 Installing GMT Fuses (P/N 561666 [R48-1000C-6] Only)

If the rectifier is equipped with an optional internal 6-position GMT fuse block, install appropriately sized GMT fuses into this fuse block.

Procedure

1. Loosen the screws on the rectifier front door (four) and open the front door, as show in Figure 2.9.
2. Install the GMT fuses. Record fuse information on the label next to the fuse block.
3. Close the rectifier front door by following the procedure in “Front door” on page 15.

Figure 2.9: Installing GMT Fuses (P/N 561666 [R48-1000C-6] Only)



3 Making Electrical Connections

3.1 Important Safety Instructions

DANGER! Adhere to the “Important Safety Instructions” presented at the front of this document.

3.2 Wiring Considerations

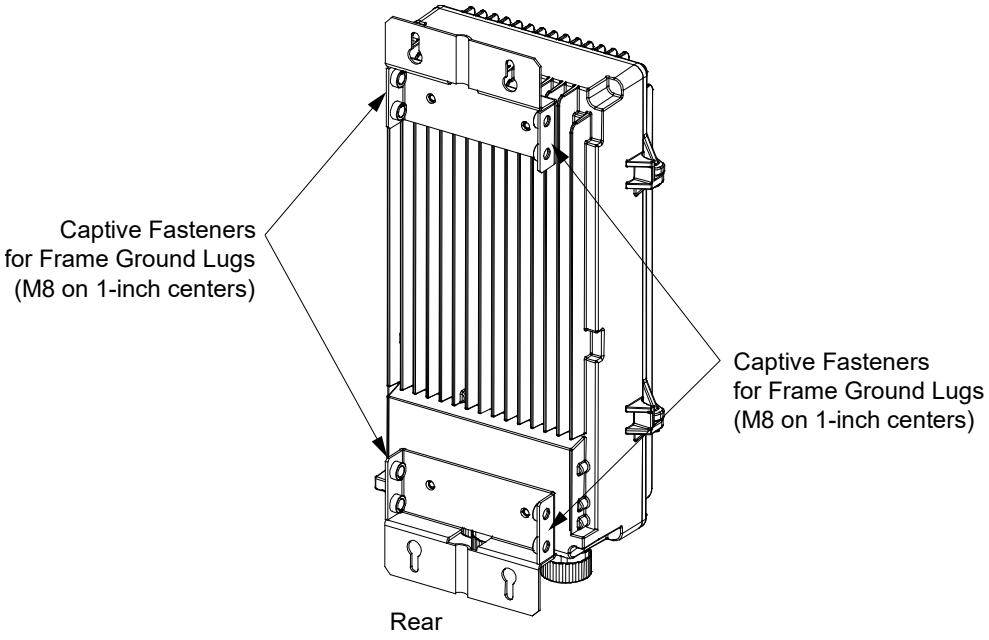
All wiring and branch circuit protection should follow the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC), and applicable local codes. For operation in countries where the NEC is not recognized, follow applicable codes.

3.3 Frame Ground Connection

For grounding requirements, refer to the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association’s (NFPA) National Electrical Code (NEC), applicable local codes, and your specific site requirements.

Captive fasteners (for M8 bolts) for frame ground lugs are located on each mounting bracket. Holes are spaced on 1-inch centers. Refer to Figure 3.1 for location.

Figure 3.1: Frame Grounding Location



3.4 Customer Wiring to the Mating Connectors

Procedure

NOTE! *Refer to Figure 3.2 through Figure 3.6 as this procedure is performed.*

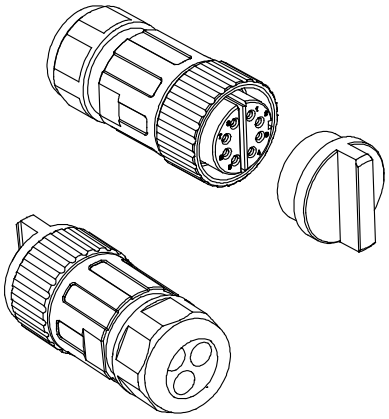
NOTE! *If the sleeve and sealing cable adapter housing are not separated before installing the cable, the cable may twist inside the connector housing as the sleeve is tightened to the connector housing. Perform these steps in the correct order to prevent this from happening.*

1. Strip 7.5 ± 0.5 mm (0.3 ± 0.02 inch) of insulation off the wires.
2. With the dust cap installed, unscrew the sleeve from the connector housing to expose the wiring terminals.
3. Remove the rear pressing nut.
4. Separate the sleeve from the sealing cable adapter housing.
5. Slide the cable(s) through the rear pressing nut, then through the appropriate opening(s) in the sealing cable adapter installed in the sealing cable adapter housing, and finally through the sleeve.

NOTE! *If multiple sealing cable adapters are furnished, select and install the appropriate sealing cable adapter.*

6. Slide the appropriate wires into the appropriate pins of the connector housing. Tighten the screw in the connector housing to secure the wire. Torque to 0.8 Nm (7 in-lbs).
7. Tighten the sleeve to the connector housing.
8. Slide the sealing cable adapter housing into the sleeve.
9. Tighten the rear pressing nut to the sleeve. Torque to 6.5 Nm (58 in-lbs).

Figure 3.2: Customer Wiring to the Mating Connector P/N 14190611 (Alarm Connector) (Mates to Connector Labeled Y in Figure 3.7 to Figure 3.9)



Sealing cable adapter provided.

Maximum cable diameter is 6.1 mm to 8.1 mm (0.24” to 0.32”).

Insert provided plug into any empty cable hole. If this connector is not used, place dust cap onto connector.

The following are some cable choices that fit this connector:

Alarm Contact Cabling:

Belden Waterdog 5504G1 (6/C) 22AWG, 300V

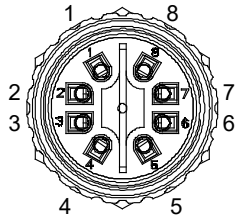
CAN Bus Cabling:

Belden Waterdog 5502G1 (4/C) 22AWG, 300V

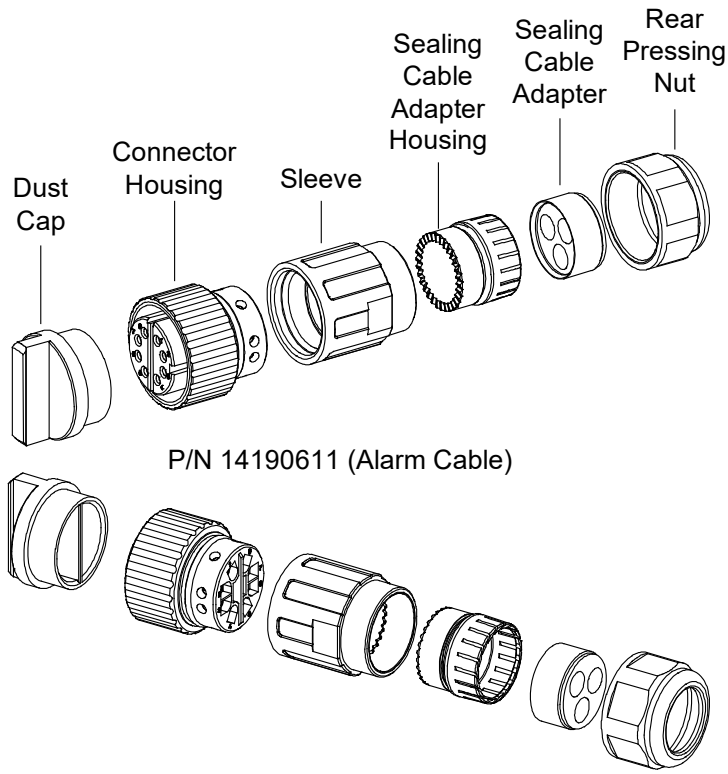
Note: Cable choices should be based on the environment that the power system is located as well as any National Electrical Code and local regulations. Choices above are just examples of cables that will fit.

ALARM

Rectifier Fail to terminals 1 and 2.
AC Fail to terminals 3 and 4.
Fuse or Circuit Breaker Alarm to terminals 7 and 8 (if available).
CAN_H to terminal 5.
CAN_L to terminal 6.



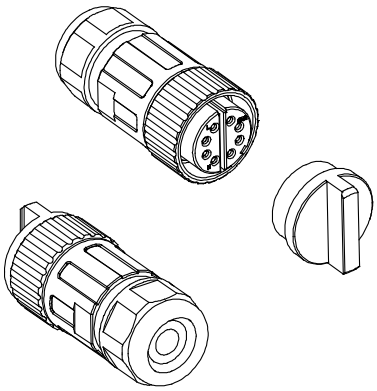
Pins for wire connections.
Accepts 22 AWG wires maximum.



NOTE! If the sleeve and sealing cable adapter housing are not separated before installing the cable, the cable may twist inside the connector housing as the sleeve is tightened to the connector housing. Perform these steps in the correct order to prevent this from happening.

1. Strip 7.5 ± 0.5 mm (0.3 ± 0.02 inch) of insulation off the wires.
2. With the dust cap installed, unscrew the sleeve from the connector housing to expose the wiring terminals.
3. Remove the rear pressing nut.
4. Separate the sleeve from the sealing cable adapter housing.
5. Slide the cable(s) through the rear pressing nut, then through the appropriate opening(s) in the sealing cable adapter installed in the sealing cable adapter housing, and finally through the sleeve. NOTE: If multiple sealing cable adapters are furnished, select and install the appropriate sealing cable adapter.
6. Slide the appropriate wires into the appropriate pins of the connector housing. Tighten the screw in the connector housing to secure the wire. Torque to 0.8 N m (7 in-lbs).
7. Tighten the sleeve to the connector housing.
8. Slide the sealing cable adapter housing into the sleeve.
9. Tighten the rear pressing nut to the sleeve. Torque to 6.5 N m (58 in-lbs).

Figure 3.3: Customer Wiring to the Mating Connector P/N 14190607 (AC Input Connector) (Mates to Connector Labeled X in Figure 3.7 to Figure 3.9)



Two sealing cable adapters provided.

Maximum cable diameter is 8.92 mm to 9.45 mm (0.35” to 0.37”) for small cable adapter.

Maximum cable diameter is 12.5 mm to 16 mm (0.49” to 0.63”) large cable adapter.

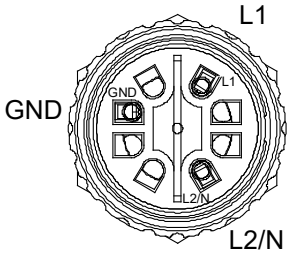
The following are some cable choices that fit this connector:

Southwire Royal SJ00W, 14/3, 300V

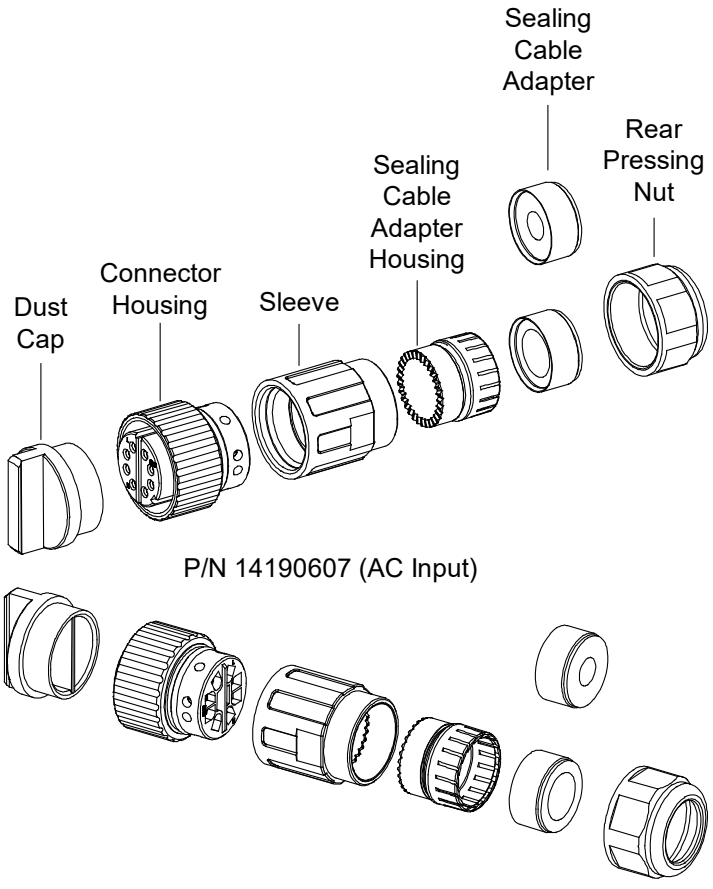
General Cable HF360 Carolprene SJ00W, 14/3, 300V

Note: Cable choices should be based on the environment that the power system is located as well as any National Electrical Code and local regulations. Choices above are just examples of cables that will fit.

AC INPUT
Line to terminal L1.
Line/Neutral to terminal L2/N.
Ground to terminal GND.



Pins for wire connections. Accepts wires in the range of 22 AWG to 11 AWG.

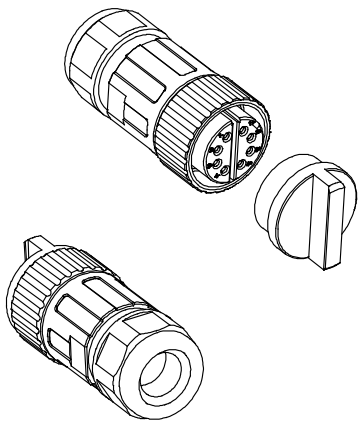


P/N 14190607 (AC Input)

NOTE! If the sleeve and sealing cable adapter housing are not separated before installing the cable, the cable may twist inside the connector housing as the sleeve is tightened to the connector housing. Perform these steps in the correct order to prevent this from happening.

1. Strip 7.5 ± 0.5 mm (0.3 ± 0.02 inch) of insulation off the wires.
2. With the dust cap installed, unscrew the sleeve from the connector housing to expose the wiring terminals.
3. Remove the rear pressing nut.
4. Separate the sleeve from the sealing cable adapter housing.
5. Slide the cable(s) through the rear pressing nut, then through the appropriate opening(s) in the sealing cable adapter installed in the sealing cable adapter housing, and finally through the sleeve. NOTE: If multiple sealing cable adapters are furnished, select and install the appropriate sealing cable adapter.
6. Slide the appropriate wires into the appropriate pins of the connector housing. Tighten the screw in the connector housing to secure the wire. Torque to 0.8 N m (7 in-lbs).
7. Tighten the sleeve to the connector housing.
8. Slide the sealing cable adapter housing into the sleeve.
9. Tighten the rear pressing nut to the sleeve. Torque to 6.5 N m (58 in-lbs).

Figure 3.4: Customer Wiring to the Mating Connector P/N 14190623 (-48 VDC Output Connector)
(Mates to Connector Labeled Z in Figure 3.7 and Figure 3.8) (this connector is not used with Spec. No. 561666)



Sealing cable adapter provided.

Maximum cable diameter is 12.5 mm to 16 mm (0.49” to 0.63”).

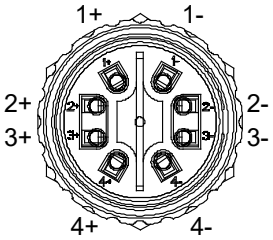
The following are some cable choices that fit this connector:

WR-VG102ST-BRDA, 10/2, 600V from Rosenberger

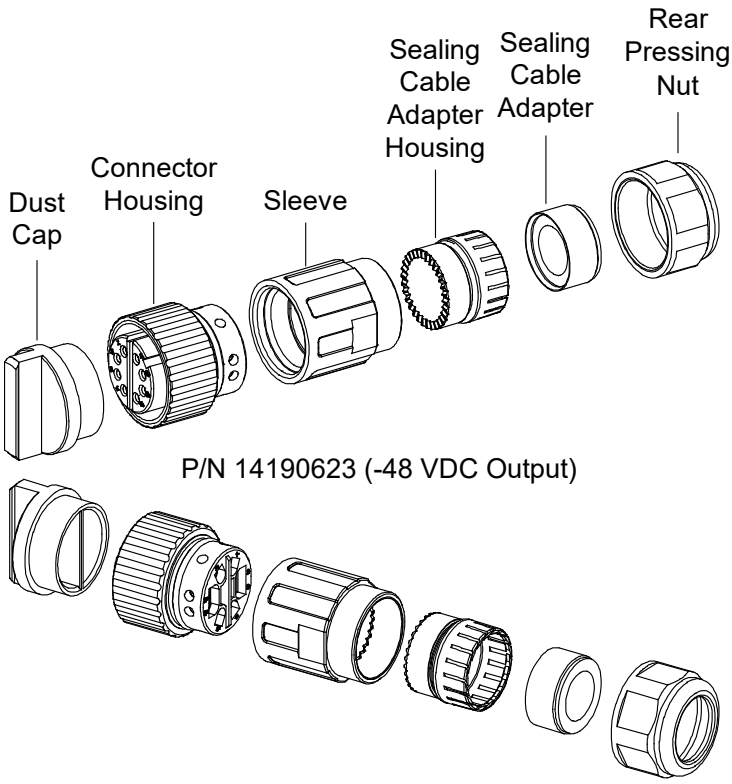
HF382 Carolprene SJ00W, 10/2, 300V from General Cable

Note: Cable choices should be based on the environment that the power system is located as well as any National Electrical Code and local regulations. Choices above are just examples of cables that will fit.

-48 VDC OUTPUT
Return to terminal 3+
-48 VDC to terminal 3-.



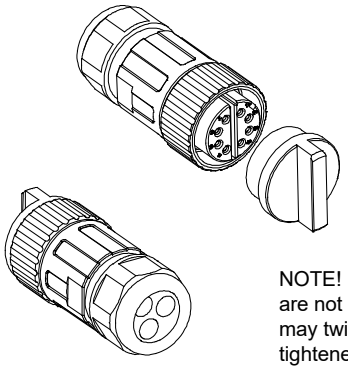
Pins for wire connections.
Accepts wires in the range of 22 AWG to 10 AWG.



NOTE! If the sleeve and sealing cable adapter housing are not separated before installing the cable, the cable may twist inside the connector housing as the sleeve is tightened to the connector housing. Perform these steps in the correct order to prevent this from happening.

1. Strip 7.5 ± 0.5 mm (0.3 ± 0.02 inch) of insulation off the wires.
2. With the dust cap installed, unscrew the sleeve from the connector housing to expose the wiring terminals.
3. Remove the rear pressing nut.
4. Separate the sleeve from the sealing cable adapter housing.
5. Slide the cable(s) through the rear pressing nut, then through the appropriate opening(s) in the sealing cable adapter installed in the sealing cable adapter housing, and finally through the sleeve.
   NOTE: If multiple sealing cable adapters are furnished, select and install the appropriate sealing cable adapter.
6. Slide the appropriate wires into the appropriate pins of the connector housing. Tighten the screw in the connector housing to secure the wire.
   Torque to 0.8 N m (7 in-lbs).
7. Tighten the sleeve to the connector housing.
8. Slide the sealing cable adapter housing into the sleeve.
9. Tighten the rear pressing nut to the sleeve.
   Torque to 6.5 N m (58 in-lbs).

Figure 3.5: Customer Wiring to the Mating Connector P/N 14190609 (-48 VDC GMT Output Connector) (Mates to Connector Labeled Z in Figure 3.9) (this connector is not used with Spec. No. 561664 or Spec. No. 561665)



Sealing cable adapter provided.

Maximum cable diameter is 6.1 mm to 8.1 mm (0.24” to 0.32”)”.

Insert provided plug into any empty cable hole.

The following are some cable choices that fit this connector:

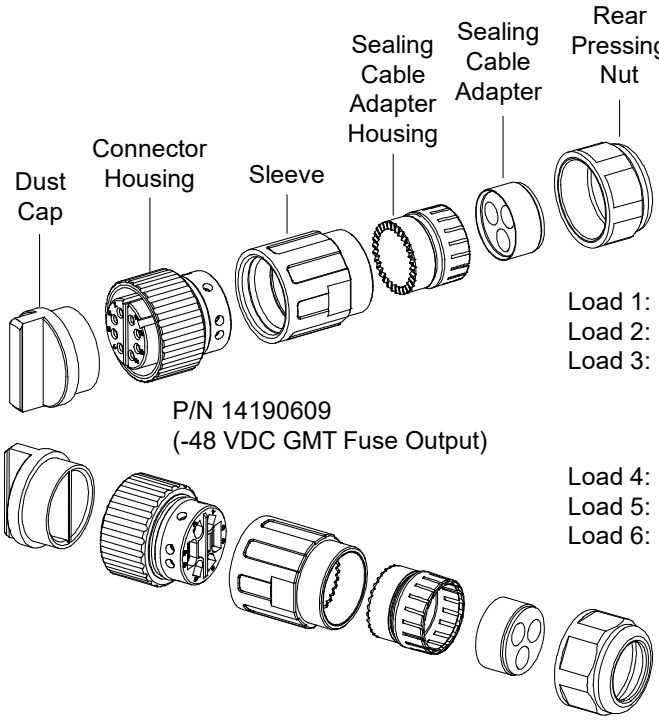
General Cable HF312 Carolprene SJ00W, 16/2, 300V

Belden Waterdog 5240U1 (2/C) 16AWG, 300V

Note: Cable choices should be based on the environment that the power system is located as well as any National Electrical Code and local regulations. Choices above are just examples of cables that will fit.

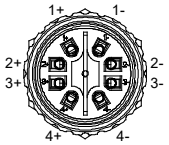
NOTE! If the sleeve and sealing cable adapter housing are not separated before installing the cable, the cable may twist inside the connector housing as the sleeve is tightened to the connector housing. Perform these steps in the correct order to prevent this from happening.

1. Strip 7.5 ± 0.5 mm (0.3 ± 0.02 inch) of insulation off the wires.
2. With the dust cap installed, unscrew the sleeve from the connector housing to expose the wiring terminals.
3. Remove the rear pressing nut.
4. Separate the sleeve from the sealing cable adapter housing.
5. Slide the cable(s) through the rear pressing nut, then through the appropriate opening(s) in the sealing cable adapter installed in the sealing cable adapter housing, and finally through the sleeve. NOTE: If multiple sealing cable adapters are furnished, select and install the appropriate sealing cable adapter.
6. Slide the appropriate wires into the appropriate pins of the connector housing. Tighten the screw in the connector housing to secure the wire. Torque to 0.8 N m (7 in-lbs).
7. Tighten the sleeve to the connector housing.
8. Slide the sealing cable adapter housing into the sleeve.
9. Tighten the rear pressing nut to the sleeve. Torque to 6.5 N m (58 in-lbs).



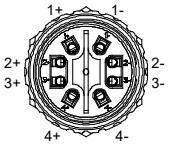
-48 VDC OUTPUT 1

Load 1: Return to terminal 1+, -48 VDC to terminal 1-.
Load 2: Return to terminal 3+, -48 VDC to terminal 3-.
Load 3: Return to terminal 4+, -48 VDC to terminal 4-.



-48 VDC OUTPUT 2

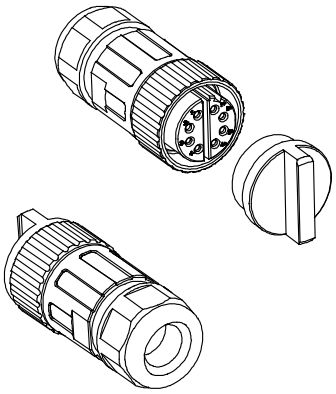
Load 4: Return to terminal 1+, -48 VDC to terminal 1-.
Load 5: Return to terminal 3+, -48 VDC to terminal 3-.
Load 6: Return to terminal 4+, -48 VDC to terminal 4-.



Pins for wire connections. Accepts wires in the range of 22 AWG to 16 AWG.

Figure 3.6: Customer Wiring to the Mating Connector P/N 14190615 (-48 VDC Input Connector) (Mates to Connector Labeled W in Figure 3.7 to Figure 3.9)

Note: Since this rectifier does not contain a controller capable of controlling batteries, we do not recommend connecting anything to the DC input.



Sealing cable adapter provided.

Maximum cable diameter is 12.5 mm to 16 mm (0.49” to 0.63”).

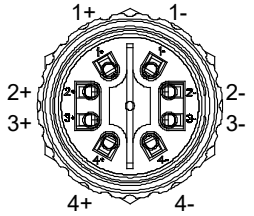
The following are some cable choices that fit this connector:

WR-VG102ST-BRDA, 10/2, 600V from Rosenberger

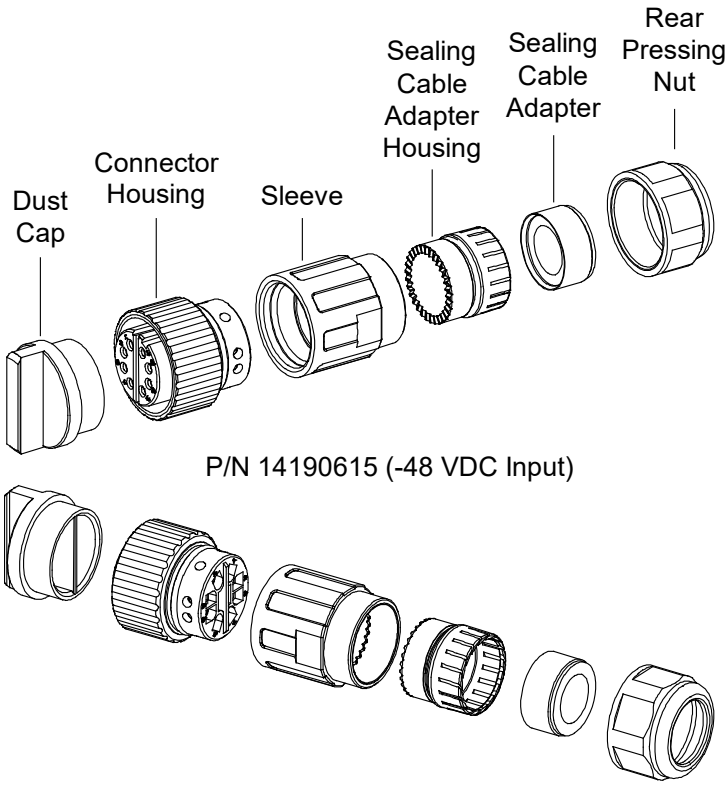
HF382 Carolprene SJ00W, 10/2, 300V from General Cable

Note: Cable choices should be based on the environment that the power system is located as well as any National Electrical Code and local regulations. Choices above are just examples of cables that will fit.

-48 VDC INPUT
Return to terminal 3+.
-48 VDC to terminal 3-.



Pins for wire connections. Accepts wires in the range of 22 AWG to 10 AWG.



P/N 14190615 (-48 VDC Input)

NOTE! If the sleeve and sealing cable adapter housing are not separated before installing the cable, the cable may twist inside the connector housing as the sleeve is tightened to the connector housing. Perform these steps in the correct order to prevent this from happening.

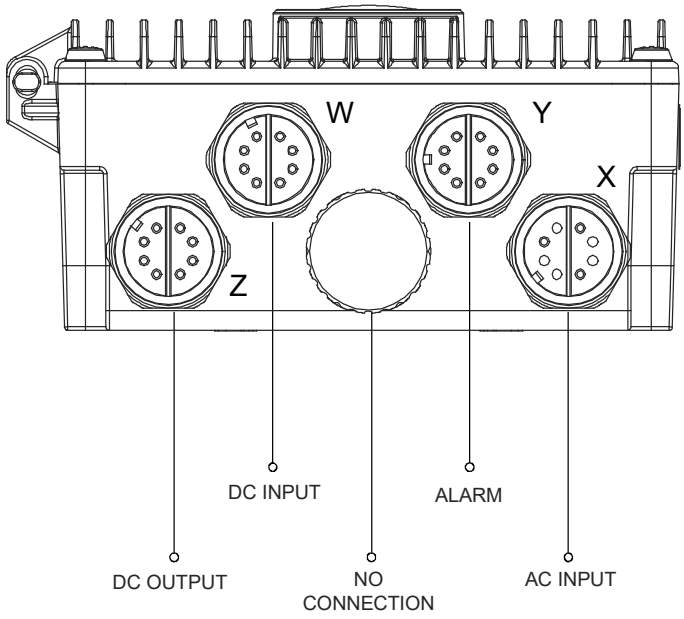
1. Strip 7.5 ± 0.5 mm (0.3 ± 0.02 inch) of insulation off the wires.
2. With the dust cap installed, unscrew the sleeve from the connector housing to expose the wiring terminals.
3. Remove the rear pressing nut.
4. Separate the sleeve from the sealing cable adapter housing.
5. Slide the cable(s) through the rear pressing nut, then through the appropriate opening(s) in the sealing cable adapter installed in the sealing cable adapter housing, and finally through the sleeve. NOTE: If multiple sealing cable adapters are furnished, select and install the appropriate sealing cable adapter.
6. Slide the appropriate wires into the appropriate pins of the connector housing. Tighten the screw in the connector housing to secure the wire. Torque to 0.8 N m (7 in-lbs).
7. Tighten the sleeve to the connector housing.
8. Slide the sealing cable adapter housing into the sleeve.
9. Tighten the rear pressing nut to the sleeve. Torque to 6.5 N m (58 in-lbs).

3.5 Electrical Connections Diagrams

Refer to Figure 3.7 through Figure 3.9.

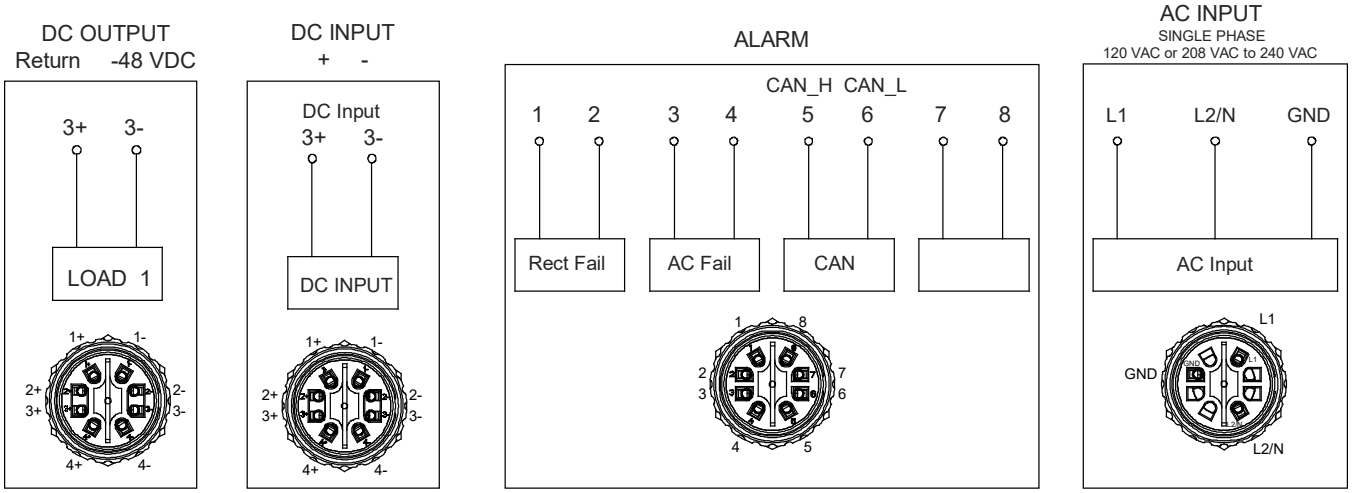
Figure 3.7: Electrical Connections Diagram - External, P/N 561664 (R48-1000C-4)

Customer Wiring



Connectors Information

Designation	Vertiv P/N	Mfgr P/N
AC Input	14190607	CT93-3TK1X
Alarm	14190611	CT93-8TK1Y
No Connection	No Connection	No Connection
DC Input	14190615	CT93-8TK1W A001
DC Output	14190623	CT93-8TK1Z A001



Vertiv P/N
14190623
Mfgr P/N
CT93-8TK1Z A001
(Z)

Vertiv P/N
14190615
Mfgr P/N
CT93-8TK1W A001
(W)

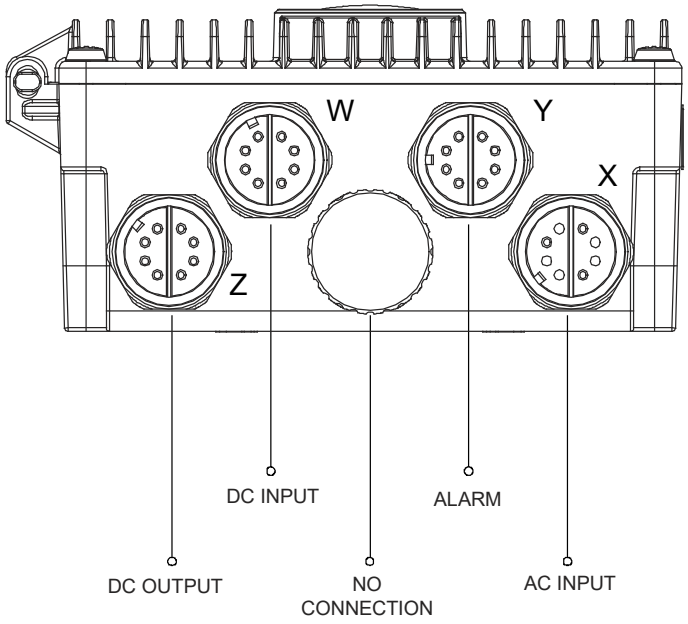
Note: Since this rectifier does not contain a controller capable of controlling batteries, we do not recommend connecting anything to the DC input.

Vertiv P/N
14190611
Mfgr P/N
CT93-8TK1Y
(Y)

Vertiv P/N
14190607
Mfgr P/N
CT93-3TK1X
(X)

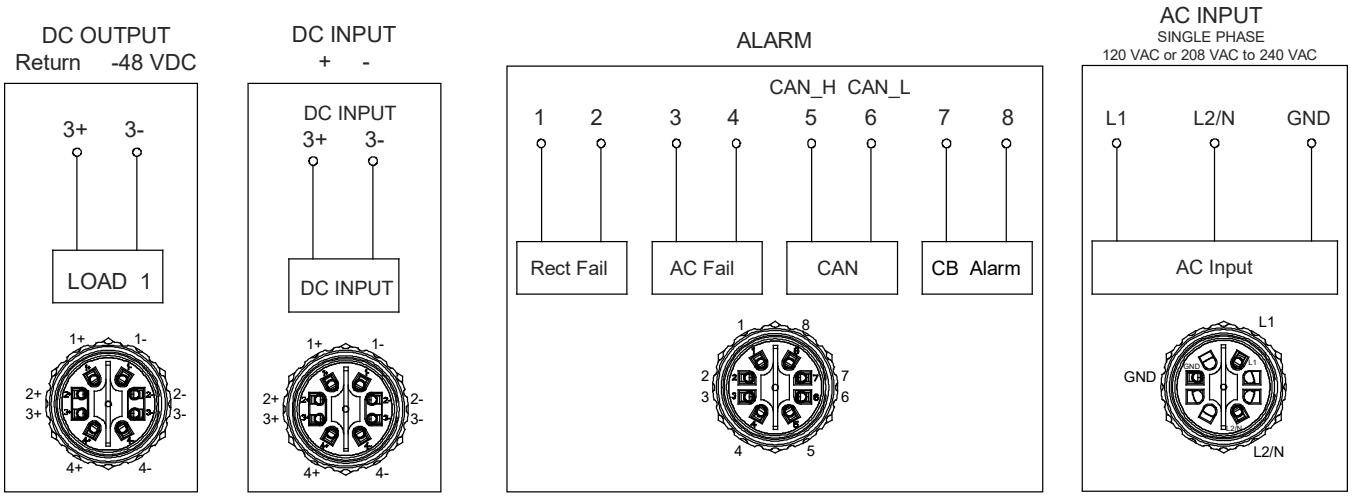
Figure 3.8: Electrical Connections Diagram - External, P/N 561665 (R48-1000C-5)

Customer Wiring



Connectors Information

Designation	Vertiv P/N	Mfgr P/N
AC Input	14190607	CT93-3TK1X
Alarm	14190611	CT93-8TK1Y
No Connection	No Connection	No Connection
DC Input	14190615	CT93-8TK1W A001
DC Output	14190623	CT93-8TK1Z A001



Vertiv P/N
14190623
Mfgr P/N
CT93-8TK1Z A001
(Z)

Vertiv P/N
14190615
Mfgr P/N
CT93-8TK1W A001
(W)

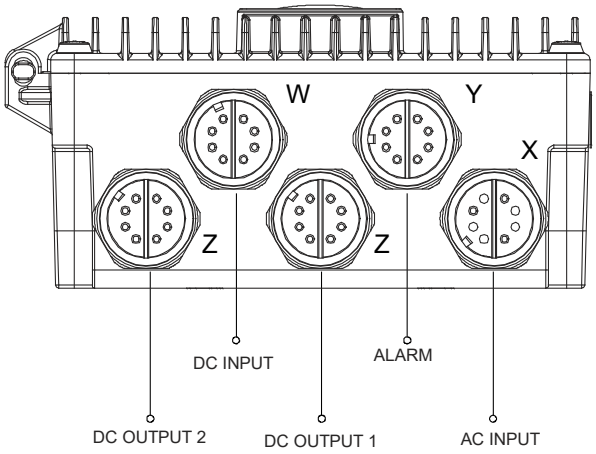
Note: Since this rectifier does not contain a controller capable of controlling batteries, we do not recommend connecting anything to the DC input.

Vertiv P/N
14190611
Mfgr P/N
CT93-8TK1Y
(Y)

Vertiv P/N
14190607
Mfgr P/N
CT93-3TK1X
(X)

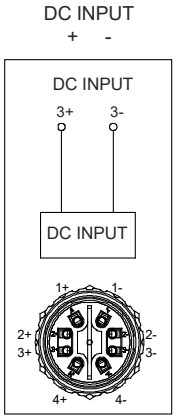
Figure 3.9: Electrical Connections Diagram - External, P/N 561666 (R48-1000C-6)

Customer Wiring



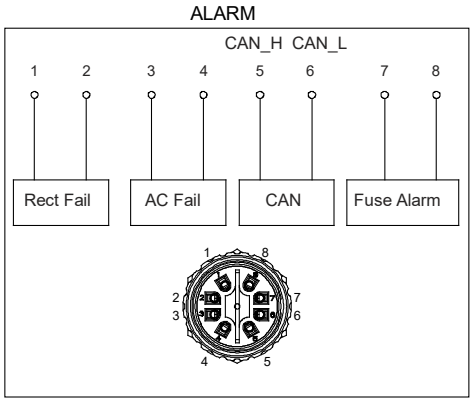
Connectors Information

Designation	Vertiv P/N	Mfgr P/N
AC Input	14190607	CT93-3TK1X
Alarm	14190611	CT93-8TK1Y
DC Output 1	14190609	CT93-8TK1Z
DC Input	14190615	CT93-8TK1W A001
DC Output 2	14190609	CT93-8TK1Z

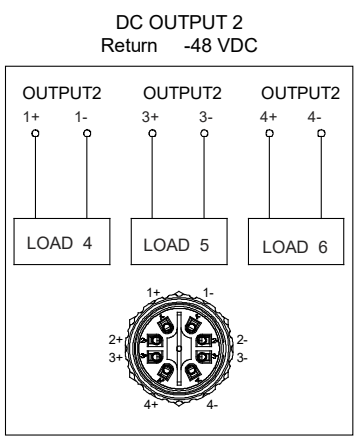


Vertiv P/N
14190615
Mfgr P/N
CT93-8TK1W A001
(W)

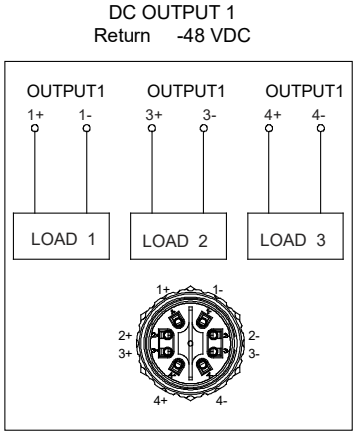
Note: Since this rectifier does not contain a controller capable of controlling batteries, we do not recommend connecting anything to the DC input.



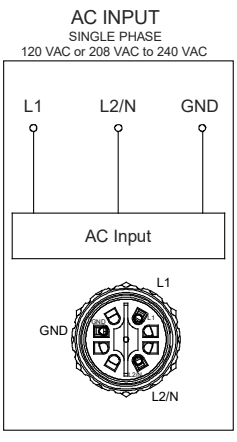
Vertiv P/N
14190611
Mfgr P/N
CT93-8TK1Y
(Y)



Vertiv P/N
14190609
Mfgr P/N
CT93-8TK1Z
(Z)



Vertiv P/N
14190609
Mfgr P/N
CT93-8TK1Z
(Z)



Vertiv P/N
14190607
Mfgr P/N
CT93-3TK1X
(X)

3.6 External Alarm and Control Connections

3.6.1 General

The rectifier is equipped with plug-in alarm connectors located on the bottom of the enclosure. Mating connectors are provided. Customer must provide wiring to the mating connector. Maximum wire size is 22 AWG. See Figure 3.2. Refer also to Figure 3.7 through Figure 3.9. See also "Customer Wiring to the Mating Connectors" starting on page 21.

Contact Ratings (UL / CSA Rating):

NOTE! *To remain NEBS compliant, the alarm contacts must remain below 60 volts and 100 VA.*

- Maximum Switching Power: 60 W, 125 VA.
- Maximum Switching Voltage: 220 VDC, 250 VAC.
- Maximum Switching Current: 2 A.
- Maximum Carrying Current: 2 A.

3.6.2 Alarm and Control Connections

Rectifier Fail Alarm

A rectifier fail alarm activates if any of the conditions listed in Table 5.1 on page 37 under "Red (Alarm)" indicator occur.
Contacts close between terminals 1 and 2 on the alarm connector during a rectifier fail alarm condition (factory default).
There is an option to change the alarm relay contact configuration to indicate an alarm when the contacts open.
Refer to "Changing the Alarm Relay Configuration for the Rectifier Fail Alarm and AC Fail Alarm" on page 31.

AC Fail Alarm

An AC fail alarm activates if AC input voltage is lost.
Contacts close between terminals 3 and 4 on the alarm connector during an AC fail alarm condition (factory default).
There is an option to change the alarm relay contact configuration to indicate an alarm when the contacts open.
Refer to "Changing the Alarm Relay Configuration for the Rectifier Fail Alarm and AC Fail Alarm" on page 31.

CAN

Terminal 5 on the Alarm Connector: CAN_H.
Terminal 6 on the Alarm Connector: CAN_L.

Circuit Breaker Alarm (P/N 561665 [R48-1000C-5] only)

A circuit breaker alarm activates if the internal circuit breaker opens.
Contacts close between terminals 7 and 8 on the alarm connector during a circuit breaker alarm condition.

Fuse Alarm (P/N 561666 [R48-1000C-6] only)

A fuse alarm activates if any of the internal GMT fuses open.
Contacts close between terminals 7 and 8 on the alarm connector during a fuse alarm condition.

3.6.3 Changing the Alarm Relay Configuration for the Rectifier Fail Alarm and AC Fail Alarm

The default rectifier fail alarm and AC fail alarm are as follows.

- Rectifier Fail Alarm: Contacts close during an alarm condition.
- AC Fail Alarm: Contacts close during an alarm condition.

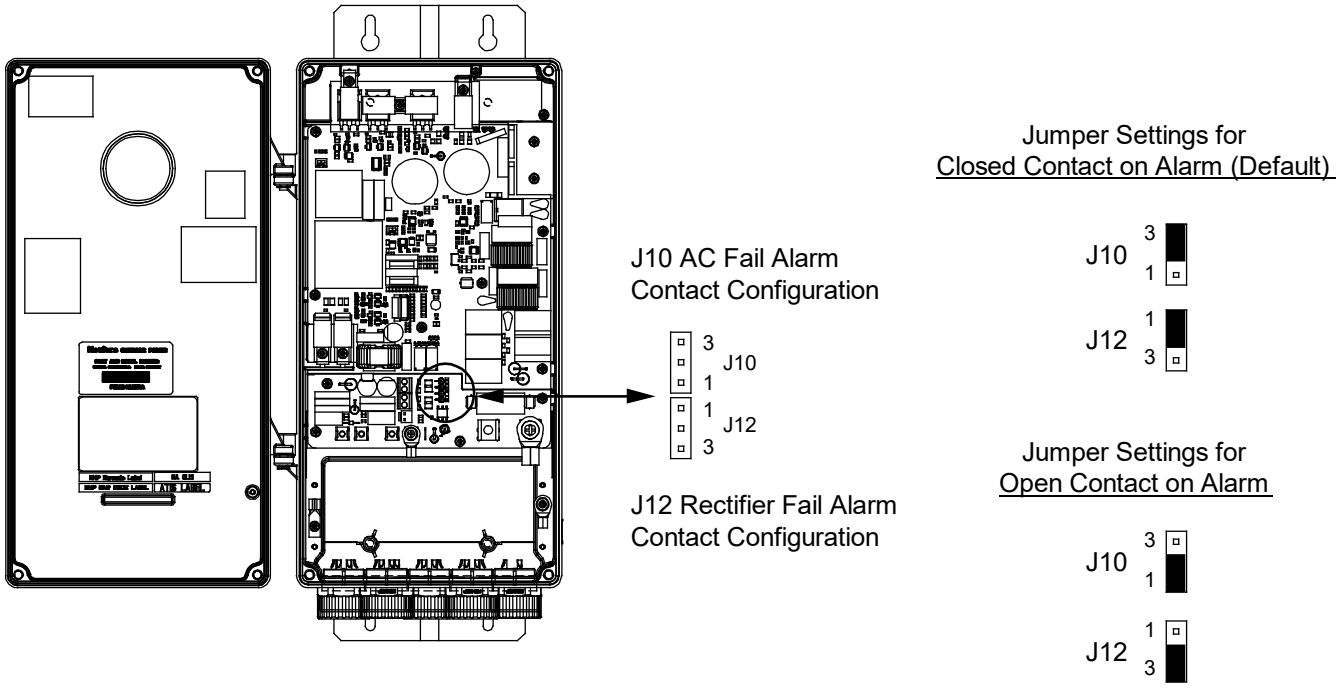
The alarm relay contact configurations can be changed. Refer to the following procedure.

Procedure

DANGER! Turn off AC input to unit before performing the following procedure.

1. Loosen the screws on the rectifier front door (four) and open the front door.
2. Locate the J10 and J12 jumpers. See Figure 3.10. J10 jumper is associated with the AC fail alarm. J12 jumper is associated with the rectifier fail alarm.
3. Refer to Figure 3.10 and set the J10 and J12 jumpers per site requirements.
4. Close the rectifier front door by following the procedure in “Front door” on page 15.

Figure 3.10: J10 and J12 Jumpers



3.7 Nominal 120 VAC / 208 VAC / 220 VAC / 230 VAC / 240 VAC Input and AC Input Equipment Grounding Connections

The rectifier is equipped with plug-in AC input connectors located on the bottom of the enclosure. Mating connectors are provided. Customer must provide wiring to the mating connector. See Figure 3.3. Refer also to Figure 3.7 through Figure 3.9. See also "Customer Wiring to the Mating Connectors" starting on page 21.

- Recommended AC input wire size is 14 AWG.
- This rectifier requires an external AC input branch circuit protective device rated for 15 A.

3.8 -48 VDC Output Connections

WARNING! Check for correct polarity before making connections.

CAUTION! Spec. No. 561665 (R48-1000C-5) includes an internal output circuit breaker. This circuit breaker is shipped in the "ON" position.

The rectifier is equipped with plug-in DC output connectors located on the bottom of the enclosure. Mating connectors are provided. Customer must provide wiring to the mating connector. See Figure 3.4 and Figure 3.5. Refer also to Figure 3.7 through Figure 3.9. See also "Customer Wiring to the Mating Connectors" starting on page 21.

- Spec. Nos. 561664 (R48-1000C-4) and 561665 (R48-1000C-5): Recommended DC output wire size is 10 AWG.
- Spec. No. 561666 (R48-1000C-6): Maximum DC output wire size is 16 AWG.

3.9 -48 VDC Input Connections

NOTE! *Since this rectifier does not contain a controller capable of controlling batteries, we do not recommend connecting anything to the DC input.*

3.10 Paralleling Rectifiers

NOTE! *Only the outputs of Spec. Nos. 561664 (R48-1000C-4) and 561665 (R48-1000C-5) can be paralleled.*

3.10.1 Two Paralleled Rectifiers or One Plus One with Redundancy

This is the recommended connections for paralleling two rectifiers. Note that the CAN Bus is wired from rectifier to rectifier. The rectifiers do not have a controller to monitor the rectifiers. This arrangement can be used in a 1 plus 1 redundant arrangement (total load is 1000 Watts) or as two rectifiers paralleled without redundancy (2000 Watts). Refer to Figure 3.11.

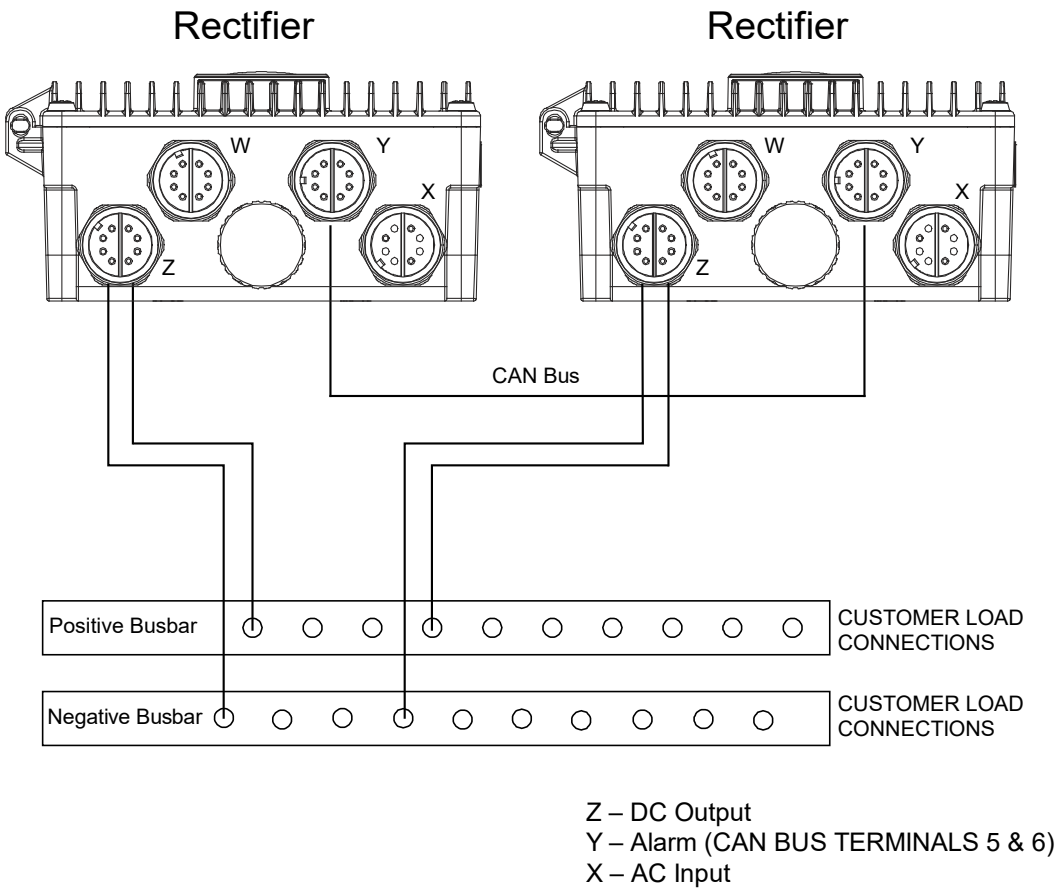
Procedure

NOTE! *Refer to "External Alarm and Control Connections" on page 30 as this procedure is performed.*

To parallel rectifiers, connect the CAN bus of each rectifier together. Connect CAN_H to CAN_H and CAN_L to CAN_L. To connect the CAN Bus terminals together, use a 2-conductor 22 AWG cable from rectifier to rectifier.

1. Two P/N 14190611 connectors are required (one for each rectifier). One 2-conductor 22 AWG cable is required (length to span between the two rectifiers being paralleled).
2. Connect one lead of the 22 AWG cable to terminal 5 of the first rectifier's 14190611 connector (this is the CAN_H lead, note the wire color). Connect the other lead of the 22 AWG cable to terminal 6 of the first rectifier's 14190611 connector (this is the CAN_L lead, note the wire color). Reassemble the 14190611 connector.
3. Connect the CAN_H lead at the other end of the 22 AWG cable (color noted above) to terminal 5 of the second rectifier's 14190611 connector. Connect the CAN_L lead at the other end of the 22 AWG cable (color noted above) to terminal 6 of the second rectifier's 14190611 connector. Reassemble the 14190611 connector.
4. Plug each 14190611 connector into the "Y" position on each rectifier. Refer to Figure 3.7 through Figure 3.9.
5. Connect the AC power to the "X" connector position. Refer to Figure 3.7 through Figure 3.9 for wiring information. Use 14 AWG wire for each of the connections.
6. Connect the load leads to the connector for the DC output connector on the rectifier. Refer to Figure 3.7 through Figure 3.9 for wiring information. Connect the other end of the load leads to the busbars for the customer loads.
7. Apply AC voltage to the input of the rectifiers and verify that the rectifiers power up and output 54 VDC.

Figure 3.11: Two Paralleled Rectifiers or One Plus One with Redundancy



3.10.2 Three Paralleled Rectifiers or Two Plus One with Redundancy

This is the recommended connections for paralleling three rectifiers. Note that the CAN Bus is wired from rectifier to rectifier. The rectifiers do not have a controller to monitor the rectifiers. This arrangement can be used in a 2 plus 1 redundant arrangement (total load is 2000 Watts) or as three rectifiers paralleled without redundancy (3000 Watts). Refer to Figure 3.12.

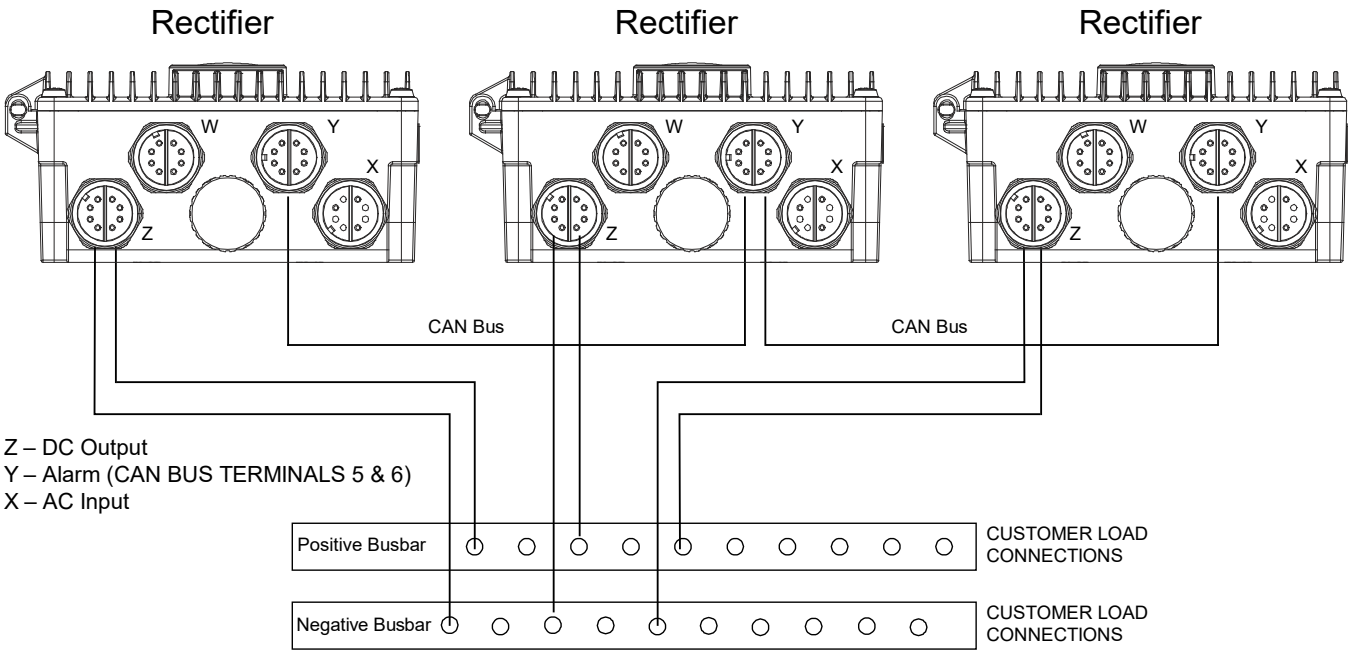
Procedure

NOTE! *Refer to "External Alarm and Control Connections" on page 30 as this procedure is performed.*

To parallel rectifiers, connect the CAN bus of each rectifier together. Connect CAN_H to CAN_H and CAN_L to CAN_L. To connect the CAN Bus terminals together, use a 2-conductor 22 AWG cable from rectifier to rectifier. Note that two cables are connected to the center rectifier.

1. Three P/N 14190611 connectors are required (one for each rectifier). 2-conductor 22 AWG cable is required (length to span between the three rectifiers being paralleled).
2. Connect one lead of the 22 AWG cable to terminal 5 of the first rectifier's 14190611 connector (this is the CAN_H lead, note the wire color). Connect the other lead of the 22 AWG cable to terminal 6 of the first rectifier's 14190611 connector (this is the CAN_L lead, note the wire color). Reassemble the 14190611 connector.
3. Connect the CAN_H lead at the other end of the 22 AWG cable (color noted above) to terminal 5 of the third rectifier's 14190611 connector. Connect the CAN_L lead at the other end of the 22 AWG cable (color noted above) to terminal 6 of the third rectifier's 14190611 connector. Reassemble the 14190611 connector.
4. Plug each 14190611 connector into the "Y" position on each rectifier (rectifiers 1 and 3). Refer to Figure 3.7 through Figure 3.9.
5. Cut each of the 22 AWG cables long enough to make a connection to the center (second) rectifier.
6. Disassemble the third P/N 14190611 and insert the two CAN Bus cables from the two other connectors through the red cable sealing adapter and the remaining loose parts.
7. Connect the CAN_H lead at the other end of the 22 AWG cable (color noted above) to terminal 5 of the second rectifier's 14190611 connector. Connect the CAN_L lead at the other end of the 22 AWG cable (color noted above) to terminal 6 of the second rectifier's 14190611 connector. Note that there are two wires in each connector. Reassemble the 14190611 connector.
8. Plug the 14190611 connector into the "Y" position on the rectifier (rectifier 2). Refer to Figure 3.7 through Figure 3.9.
9. Connect the AC power to the "X" connector position. Refer to Figure 3.7 through Figure 3.9 for wiring information. Use 14 AWG wire for each of the connections.
10. Connect the load leads to the connector for the DC output connector on the rectifier. Refer to Figure 3.7 through Figure 3.9 for wiring information. Connect the other end of the load leads to the busbars for the customer loads.
11. Apply AC voltage to the input of the rectifiers and verify that the rectifiers power up and output 54 VDC.

Figure 3.12: Three Paralleled Rectifiers or Two Plus One with Redundancy



3.11 Final Step

If any of the five (5) connectors located on the bottom of the unit are left unused, screw the provided connector dust cover onto the unused connector.

4 Initially Starting and Checking Rectifier Operation

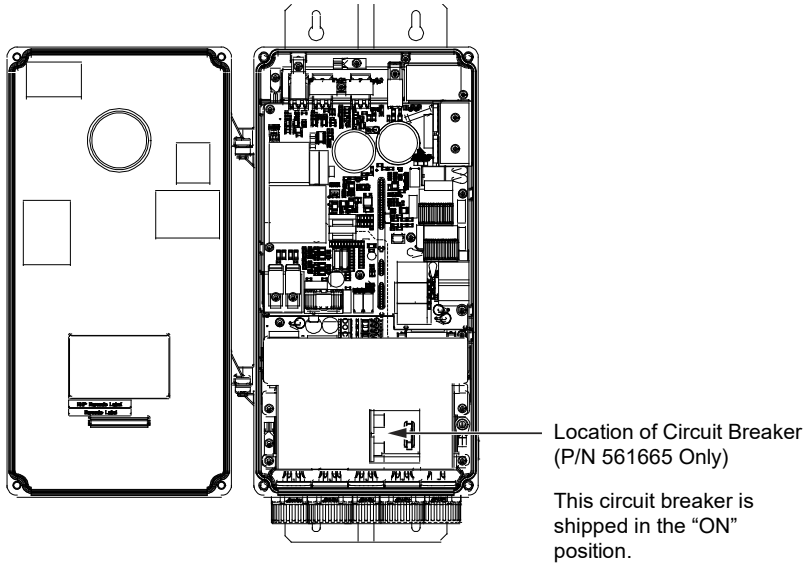
4.1 Initially Starting the Rectifier

Procedure

CAUTION! Spec. No. 561665 (R48-1000C-5) includes an internal output circuit breaker. This circuit breaker is shipped in the “ON” position. See Figure 4.1.

1. Apply rectifier AC input power to the system by closing the external AC disconnect or protective device. The rectifier automatically starts.

Figure 4.1: Circuit Breaker, Spec. No. 561665 (R48-1000C-5)



4.2 Checking System Status

DANGER! Hazardous voltages are exposed when the cover is opened and power is applied to the product.

Procedure

1. Observe the status of the rectifier’s local indicators. If operating normally, the status of these is as shown in Table 4.1. See Figure 5.1 for location.
2. If the front door is open, close the rectifier front door by following the procedure in “Front door” on page 15.

Table 4.1: Status and Alarm Indicators

Indicator	Normal State
Power (Green)	On
Protection (Yellow)	Flashing
Alarm (Red)	Off

5 Operation

5.1 Local Indicators

There are three (3) indicators located inside the rectifier enclosure. See Figure 5.1 for location and Table 5.1 for indicator functions.

NOTE! *AC voltage must be present at the rectifier input terminals for indicators to be functional.*

Figure 5.1: Local Indicator Locations

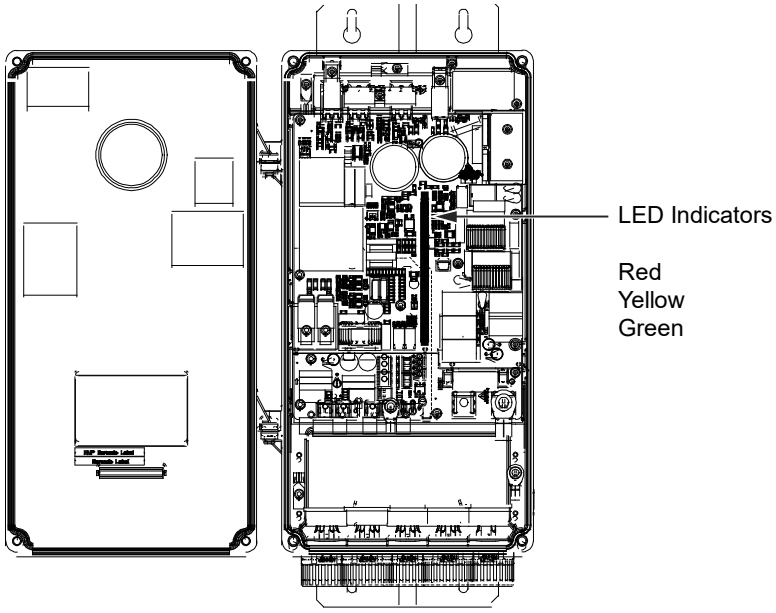


Table 5.1: Rectifier Indicators

Indicator	Normal State	Alarm State	Alarm Cause
Power (Green)	On	Off	No input voltage. Internal input fuse open.
Protection (Yellow)	Flashing Yellow (This is normal and is an indication that there is no controller connected to the CAN communication bus. This family of rectifiers is not designed for use with an external controller.)	On	AC input under/over voltage. PFC output under/over voltage. Moderate load sharing imbalance. Rectifier over-temperature protection. Rectifier operating in an output power derating mode (rectifier derates when rectifier temperature rises above or input voltage falls below acceptable values).
Alarm (Red)	Off	On	Severe load sharing imbalance. Rectifier output disabled for any reason, including overvoltage shutdown and internal output fuse open.

5.2 Rectifier High Voltage Shutdown and Lockout Restart

Procedure

1. Remove AC input power to the rectifier. Wait 30 seconds or more (until the LEDs on the rectifier extinguish). Re-apply AC input power to the rectifier.

6 Troubleshooting and Repair

6.1 Contact Information

Refer to Section 4154 (provided with your customer documentation) for support contact information.

6.2 Troubleshooting

Rectifier Current Sharing Imbalance

When multiple rectifiers are operating in parallel and the load is greater than 20%, if the current sharing imbalance among them is greater than 3%, replace the rectifier exhibiting the current imbalance.

Rectifier Fault Symptoms and Troubleshooting

The fault indicators that can be displayed by the rectifier are as follows. Refer to Table 6.1 for a list of possible causes and corrective actions.

- Power Indicator (Green) Off
- Protection Indicator (Yellow) ON
- Alarm Indicator (Red) ON

6.3 Repair

When a trouble symptom is localized to a faulty rectifier, the rectifier should be replaced in its entirety. No attempt should be made to troubleshoot or repair individual components inside the rectifier enclosure.

Table 6.1: Rectifier Troubleshooting

Symptom	Possible Cause(s)	Suggested Action(s)
Power Indicator (Green) Off	No input voltage.	Make sure there is input voltage.
	Internal input fuse open.	Replace the rectifier.
Protection Indicator (Yellow) On	AC input under/over voltage.	Correct the AC input voltage to within the acceptable range.
	PFC under/over voltage.	Replace the rectifier.
	Moderate load sharing imbalance.	Replace the rectifier.
	Rectifier over-temperature protection.	Ambient temperature too high.
Alarm Indicator (Red) On	Severe load sharing imbalance. Rectifier output disabled for any reason, including overvoltage shutdown and internal output fuse open.	Remove then re-apply AC input power to the rectifier. If rectifier fails to start or shuts down again; replace the rectifier.

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