NetSure™ IPE Series
-48 VDC Outdoor Rectifier

Installation and User Manual

Specification Number: 1R482000C2-4, 1R482000C2-5
Model Number: R48-2000C2
BOM: 31014338

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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 Vertiv.com for local 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 and Battery Voltages

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

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 "shock hazard and arc flash hazard" 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, such as 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.

Maintenance and Replacement Procedures

CAUTION! When performing any step in the procedures that requires removal or installation of hardware, use caution to ensure no hardware is dropped and left inside the unit; otherwise service interruption or equipment damage may occur.

NOTE! *When performing any step in the procedures that requires removal of existing hardware, retain all hardware for use in subsequent steps, unless otherwise directed.*

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

1.1 General

The Vertiv™ NetSure™ IPE Series Outdoor Rectifier supplies -48 VDC power to critical infrastructure in harsh environments. The hardened rectifier is mounted inside an environmentally protective enclosure that can be wall or pole mounted.

These instructions apply to the following rectifier versions:

- Spec. No. 1R482000C2-4: Quick Connect Type, no controller.
- Spec. No. 1R482000C2-5: PG Terminal Type, no controller.

1.2 Packing List

1.2.1 1R482000C2-4 Packing List

Refer to Table 1.1.

Table 1.1 1R482000C2-4 Packing List

Description	Qty	Notes
Rectifier, Quick Connect Type, without controller	1	--
Mounting Bracket – Part A	2	For pole and wall mounting (P/N: 63240ETT).
Mounting Bracket – Part B	1	For pole mounting only (P/N: 63240ETS).
Cross Recessed Countersunk Screw	2	For pole mounting.
Phillips Outer Hex Screw	6	For pole and wall mounting.
Pole Mounting Bands	2	Pole diameters from 60 mm to 120 mm OD.
User Manual	1	For 1R482000C2-4 and 1R482000C2-5.
Connector, DC 2kW Output (Customer Side)	2	One used for 2kW load, one used for 2kW battery landing, if required.
Connector, DC 1kW Output (Customer Side)	2	--
Connector, AC Input (Customer Side)	1	--
Connector, DB-15 Output (Customer Side)	1	--
Connector, DB-9 I/O (Customer Side)	1	--

NOTE! *The rectifier is equipped with plug-in customer cable connectors. Mating halves to these connectors are furnished as detailed above. Customer to supply and connect the cables to these mating half connectors. Cable assemblies with the appropriate mating half connector are available. See "Accessories" on page 2 for part numbers.*

1.2.2 1R482000C2-5 Packing List

Refer to Table 1.2.

Table 1.2 1R482000C2-5 Packing List

Description	Qty	Notes
Rectifier, PG Terminal Type, without controller	1	--
Mounting Bracket – Part A	2	For pole and wall mounting (P/N: 63240ETT).
Mounting Bracket – Part B	1	For pole mounting only (P/N: 63240ETS).
Cross Recessed Countersunk Screw	2	For pole mounting.
Phillips Outer Hex Screw	6	For pole and wall mounting.
Pole Mounting Bands	2	Pole diameters from 60 mm to 120 mm OD.
User Manual	1	For 1R482000C2-4 and 1R482000C2-5.

NOTE! *The rectifier is equipped PG Terminal Type cable connectors. Customer to supply and connect the cables to these terminals.*

1.3 Accessories

Refer to Table 1.3.

Table 1.3 Mounting Kits

Part Number	Description
(included with rectifier)	Mounting Kit for Single Rectifier Installation (standard)

1.3.1 Customer Wiring Selection

Refer to Table 1.4 and Table 1.5.

Table 1.4 Customer Wiring Selection - China Market

P/N	Description	Usage
04119776	Cable set, 10m AC input cable.	AC input cable.
04119782	Cable set, 3m AC input cable.	
04119779	Cable set, 3m DC power cable, rectifier to customer load, 1kW.	1kW DC load cable.
04119780	Cable set, 3m DC power cable, rectifier to customer load, 2kW.	2kW DC load cable.
04119783*	Cable set, 10m comm cable, rectifier to customer, DB15.	4 x digital outputs (DO) for customer use.

* The raw cable used is NOT CE marked.

Table 1.5 Customer Wiring Selection - EMEA Market

P/N	Description	Usage
RPM629065-10	IP65 QC RECTIFIER TO BATTERY 2X10 0.8M	Battery charge and discharge, power cable.
RPM629065-11	IP65 QC MAIN R RS485_2 CAN DI DB9 0.8M	Used for main rectifier under parallel mode.
RPM629065-12	IP65 QC R-R DB9 CAN EXTN 0.8M	Used for CAN communication between rectifiers under parallel installation ONLY.
RPM629065-14	IP65 QC MAIN R DB15 4DO RS485_1 2.5M	4 x digital outputs (DO) and a north bound RS485 for customer use.

NOTE! *For 1kW load cables, 2kW load cable, and AC input cables:*
For PG Gland Rectifier: Customer to provide raw DC and AC power cords and wire ferrules for termination into rectifier.
For Quick Connect Rectifier: Customer to use connectors supplied with rectifier, and supply ferrules and raw cords. Customer to terminate wires in the field to the connectors furnished with the rectifier.

1.4 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 2000 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 -55.2 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 2000 W.
- Constant Power Mode: As load increases above approximately 2000 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 41.7 A down to 42 VDC output. If the load demand exceeds 41.7 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.)

1.5 Rectifier Specifications

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

1.5.1 DC Output Ratings

1. Voltage: -42 VDC to -58 VDC, positive ground. Output voltage is factory set at -55.2 VDC.

NOTE! Voltage cannot be adjusted.

2. Output Power and Current: 2000 W (41.7 A) @ 200 VAC to 250 VAC input and -48 VDC output.
3. Output Characteristics: Refer to Figure 1.1 for a graph of 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 (2000 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. Between 85 VAC and 176 VAC the output power derating linearly based on the input voltage as follows:

- At input voltage of 85 VAC with output >48 VDC, maximum output power is 1000 W.
- At input voltage of 176 VAC with output >48 VDC, maximum output power is 2000 W.

The relationship between the output power and input voltage is illustrated in Figure 1.2.

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 limit of the rectifier. Operation between +55 °C (+131 °F) 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, at a temperature above +75 °C (+167 °F). (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 +55 °C (+131 °F), the power delivered by the rectifier is 2000 W.

b) At an ambient temperature between +55 °C (+131 °F) and +75 °C (+167 °F) is power linear derating.

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

Figure 1.1 Output Voltage vs. Output Current

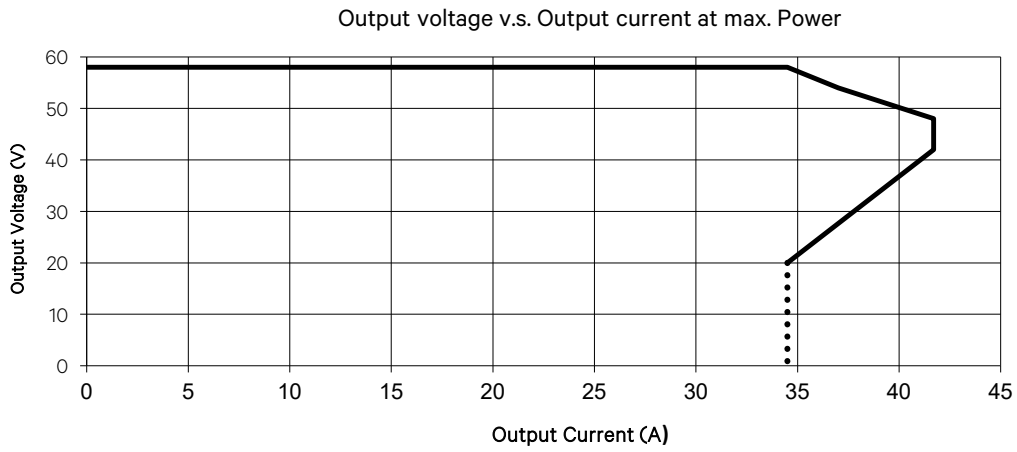


Figure 1.2 Power Derating Based on Input Voltage

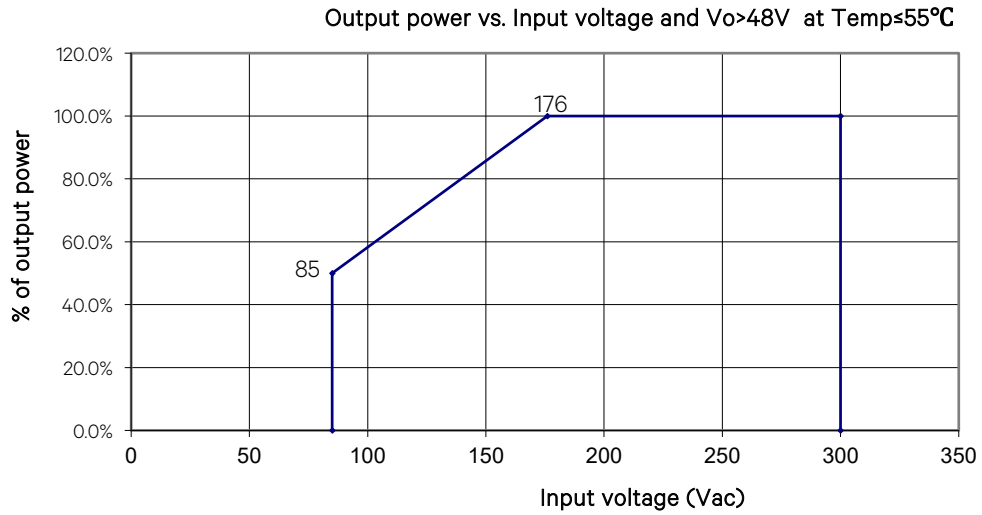
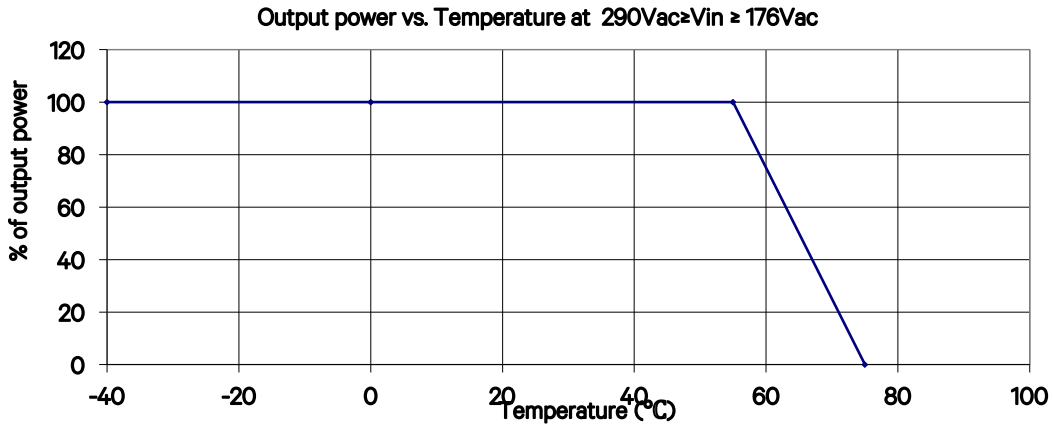


Figure 1.3 Power Derating Based on Temperature



6. Regulation:

   a) Static: Steady state regulation is ±0.6% as controlled within the rectifier for any and all combinations of load from 5% to 100% 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 microseconds, per Telcordia GR-947-CORE, the maximum voltage transient will not exceed 5% of the initial steady state voltage within 50±10 microseconds. Recovery to within 1% of the initial steady state voltage does not exceed 1 millisecond.

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.

1.5.2 AC Input Ratings

1. Voltage: Nominal 100 VAC to 250 VAC, 50 Hz / 60 Hz, with an operating range of 85 VAC to 300 VAC. The rated input voltage is 220 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 to 240 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.
4. Typical Input Data: 50 Hz input.
   a) Refer to Table 1.6.
   b) Maximum Input Current: Refer to Table 1.7.
   c) Efficiency Curve: Refer to Figure 1.4.
5. Typical Input Data: 60 Hz input.
   a) Refer to Table 1.8.
   b) Maximum Input Current: Refer to Table 1.9.
   c) Efficiency Curve: Refer to Figure 1.5.

Table 1.6 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 W
120	0	0.387	46.65	16.93			16.930
	25	4.233	507.03	504.05	0.994	93.60	32.271
	50	8.364	999.04	996.08	0.997	94.99	49.907
	75	12.647	1505.74	1501.70	0.997	94.71	79.447
	100	--	--	--	--	--	--
220	0	0.622	137.00	17.33	0.231	--	17.330
	25	2.319	510.03	500.44	0.981	94.39	28.060
	50	4.509	991.15	984.13	0.993	96.18	37.550
	75	6.740	1480.05	1474.08	0.996	96.47	52.07
	100	9.793	2147.70	2143.99	0.998	96.10	83.691
240	0	0.673	16.16	17.14	0.106	--	17.140
	25	2.146	515.05	500.64	0.972	94.23	28.877
	50	4.143	993.62	983.46	0.990	96.27	36.691
	75	6.184	1481.90	1473.96	0.995	96.55	50.905
	100	8.971	2147.12	2141.83	0.998	96.23	80.7245

NOTE! *At 100% of full load with output at 55.2V as measured at the output terminals.*

Table 1.7 Maximum Input Current with 50 Hz Input

Nominal Input Voltage	Input Voltage	Input Current (Amperes)
100 VAC to 250 VAC	176 VAC	12

NOTE! *At 100% of full load with output at 55.2V as measured at the output terminals.*

Table 1.8 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 W
120	0	0.448	53.80	16.90	0.314	--	--
	25	4.234	507.12	503.98	0.994	93.54	32.546
	50	8.365	999.10	996.14	0.997	94.99	49.955
	75	12.644	1505.31	1501.07	0.997	94.74	78.924
	100	--	--	--	--	--	
220	0	0.757	166.83	29.66	0.170	--	29.662
	25	2.338	514.04	500.56	0.973	94.41	27.982
	50	4.519	993.32	984.16	0.991	96.19	37.531
	75	6.748	1481.92	1474.51	0.995	96.46	52.187
	100	9.806	2150.63	2146.230	0.998	96.17	82.168
240	0	0.804	193.16	17.36	0.089	--	17.360
	25	2.171	521.01	500.32	0.960	94.28	28.640
	50	4.157	996.94	983.31	0.986	96.26	36.801
	75	6.194	1484.25	1473.47	0.993	96.53	51.121
	100	8.980	2148.920	2142.43	0.997	96.27	79.869

NOTE! *At 100% of full load with output at 55.2V as measured at the output terminals.*

Table 1.9 Maximum Input Current with 60 Hz Input

Nominal Input Voltage	Input Voltage	Input Current (Amperes)
100 VAC to 250 VAC	176 VAC	12

NOTE! *At 100% of full load with output at 55.2V as measured at the output terminals.*

Figure 1.4 Efficiency Curve (@ 220 VAC, 50 Hz)

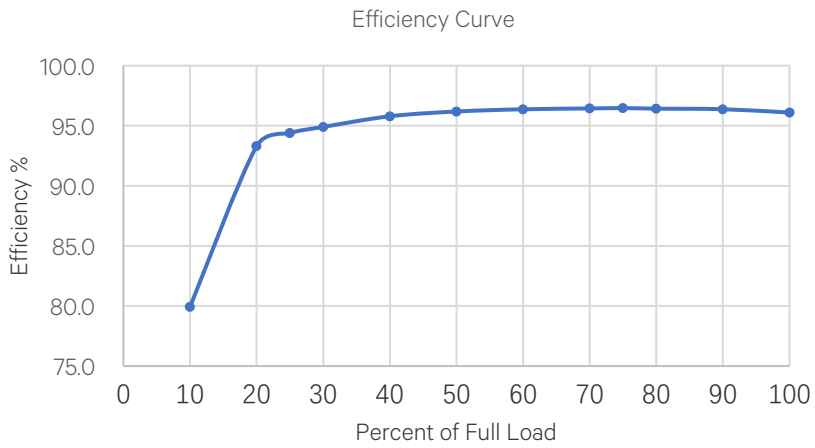
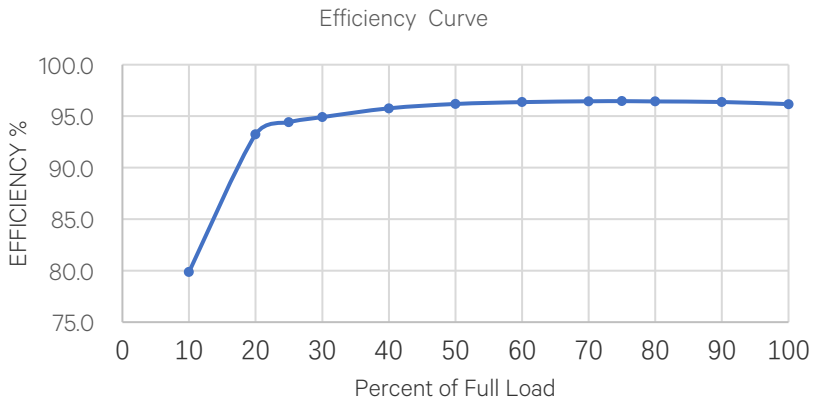


Figure 1.5 Efficiency Curve (@ 220 VAC, 60 Hz)



1.5.3 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) Output Regulation Temperature Coefficient: ±0.02% per degrees Celsius.

2. Storage Ambient Temperature Range: -25 °C (-13 °F) to +55 °C (+131 °F).

3. Relative Humidity: This rectifier is capable of operating in an ambient relative humidity range of 0% to 95%.

4. Altitude: 3000 m (9842 feet). Derating operating ambient temperature range by 3 °C per 300 m above 3000 m.

5. Surge Protection: EN61000-4-5 up to level 4, Telcordia GR-1089-Core issue 7:2017, IEEE C62.41-1999, B3.

   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

   AC Power Port, Diff Mode and Common Mode (2 ohms impedance):

Minimum Peak Voltage (volts)	Voltage Maximum Rise/Minimum Decay Time (µs)	Minimum Peak Current per Conductor (amperes)	Current Maximum Rise/Minimum Decay Time (µs)	Repetitions, each Polarity
± 6000	1.2/50	3000	8/20	5

   Criteria:
   The EUT (Equipment Under Test) shall not be damaged and shall continue to operate properly after the application of the first-level surge.
   The rectifier will be designed to fulfill ANSI IEEE, C62.41-1999, B3.
   The test wave is 1.2/50us and 8/20us mixed 6kV/3kA.

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.

DC Power Port, Common Mode (12 ohms impedance):

Minimum Peak Voltage (volts)	Voltage Maximum Rise/Minimum Decay Time (μs)	Minimum Peak Current per Conductor (amperes)	Current Maximum Rise/Minimum Decay Time (μs)	Repetitions, each Polarity
± 1000	1.2/50	\	8/20	5

The EUT (Equipment Under Test) shall not be damaged and shall continue to operate properly after the application of the first-level surge.

Requirements on CAN-bus Signals Are:

Minimum Peak Voltage (volts)	Voltage Maximum Rise/Minimum Decay Time (μs)	Minimum Peak Current per Conductor (amperes)	Current Maximum Rise/Minimum Decay Time (μs)	Repetitions, each Polarity
± 1000 (lines to ground)	10/700	\	5/320	5

Requirements on CAN-bus signals are 1kV diff. /2kV com. criteria B with 42ohms source impedance.

According Telcordia GR-1089-CORE issue 7:2017:

Requirements on CAN-bus signals are:

Surge	Minimum Peak Voltage (volts)	Minimum Peak Current per Conductor (amperes)	Maximum Rise/ Minimum Decay Time for Voltage and Current (us)	Repetitions, each Polarity	Performance criterion
1	800	100	2/10	5	B
2	1500	100	2/10	5	B

6. Single Rectifier Audible Noise: At 25 °C ≤42 dB(A). Measurement made at 0.6 m distance in front of rectifier and at the center of the rectifier.
7. Overvoltage Category (per IEC/UL62368-1): III
8. Power Distribution System: TN/TT/IT
9. EMI/RFI Suppression:
    a) The rectifier conforms to the requirements of FCC rules Part 15, Class B for radiated and input conducted emissions limits.
    b) The rectifier conforms to the requirements of European Norm, EN55032, Class B for radiated and input conducted emissions limits.
10. Pollution Degree: Degree 3, as per UL/ IEC/EN62368-1.

1.5.4 Digital Output (DO) Dry Relay Contacts

Refer to Figure 1.6 and Table 1.10 for the dry contact settings.

NOTE! *The contact operation can be changed by moving the jumpers for each of the connectors to the alternate location.*

Figure 1.6 Dry Contact and Connector Circuit

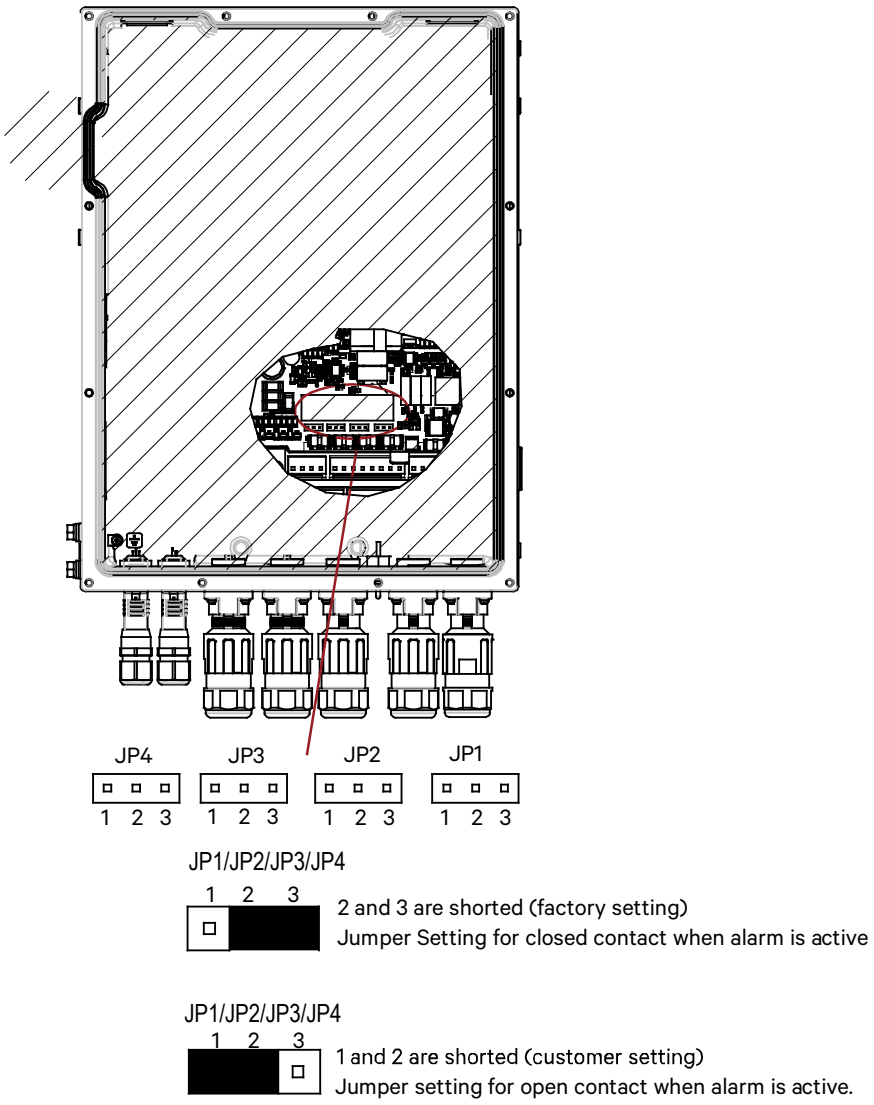


Table 1.10 Dry Contact and Connector Circuit

Dry Contact	Implication	Jumper Connection	Dry Contact State when Alarm is Active
DO1	Fuse / Breaker Fail	JP1, short pin 1 and 2	Open
		JP1, short pin 2 and 3	Closed
DO2	SPD Alarm Fail	JP2, short pin 1 and 2	Open
		JP2, short pin 2 and 3	Closed
DO3	AC OV or AC UV	JP3, short pin 1 and 2	Open
		JP3, short pin 2 and 3	Closed
DO4	Rectifier Fail	JP4, short pin 1 and 2	Open
		JP4, short pin 2 and 3	Closed

1.5.5 Compliance Information

1. EMC: ETSI EN 300 386, FCC CFR 47 Part 15 Class B, Telcordia GR-1089-Core issue 7:2017.
2. EMI Load Range: 5% to 100%.
3. Safety: CE, UL 62368-1, UL 62368-22, EN 62368-1, IEC 62368-1.

1.5.6 Standard Features

1. Type of Power Conversion Circuit: High efficiency and high switching 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.

3. Output Protection:

   a) Overload / Reverse Current: The rectifier has three (3) fuses in the negative output DC bus and one (1) in the battery input. These fuses are customer replaceable.

   b) Output Current Limiting: The rectifier has a current limit function. The current limit point is factory set at 41.7 A. The current limit accuracy is ±1.5 A when the output voltage is in the range of 42 VDC to 58 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 34.5 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 59.5 VDC, 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 30 seconds or more, 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.

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

CAUTION! Double pole/neutral fusing.

1.5.7 Mechanical Specifications

Dimensions

a) Millimeters: 400 (Height) X 300 (Width) X 62 (Depth)

b) Inches: 15.7 (Height) X 11.8 (Width) X 2.4 (Depth)

Weight

<9 kg.

Color

Vertiv EG123, per RAL9003 Signal white, or equivalent.

Indicators

The following indicators are located behind a clear plastic window on the left-hand side of the rectifier. See also “Rectifier Local Indicators” on page 39.

- Power (Green LED)
- Protection (Yellow LED)
- Alarm (Red LED)

2 Installation

2.1 General

WARNING! Rectifier warranty will be VOID if any perimeter screw is tampered with. DO NOT loosen or remove any perimeter screw. Removal of outer perimeter screws is a safety hazard.

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

If the access panel is opened during installation, ensure the access panel is securely closed and the screws are torqued to 2.5 Nm.

2.2 Tools Required for Installation

Refer to Table 2.1 for a list of tools required for installation.

Table 2.1 Tools Required for Installation

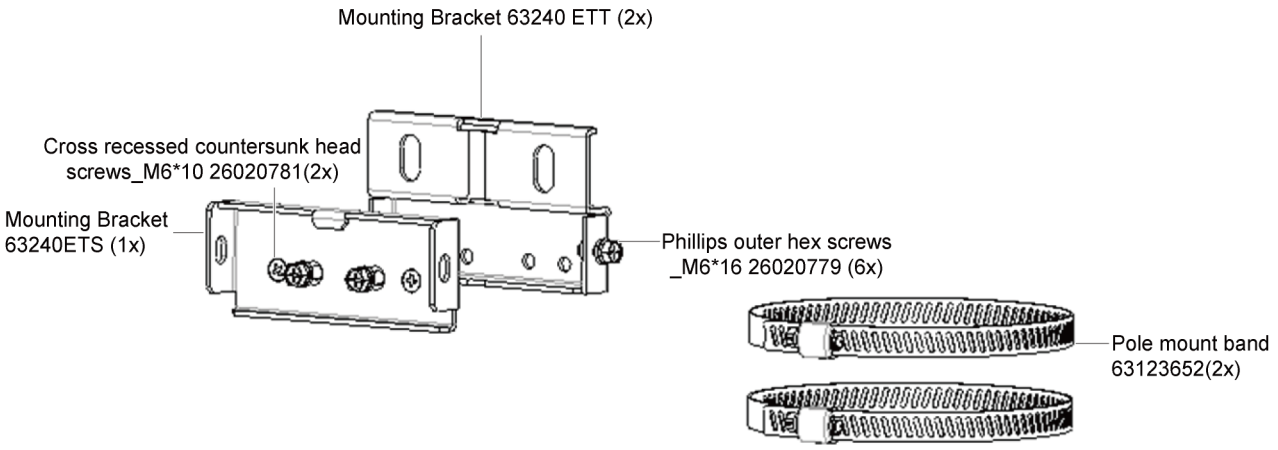
Tool	Specification		Tool	Specification
Combination wrench (hatch, club)	Wrench set (10#, 13#, 16#, 18#, 21#)		Torque wrench	As required
Electrician diagonal pliers	150 mm		Insulated screwdriver set	Cross screwdriver: #1, #2 Slotted screwdriver: 3 mm, 5 mm
Electrician sharp nose pliers	150 mm		Non-contact voltage tester	/
Tape measure	5 m		Wire stripper	Max. 16mm2
Level	Normal type		Crimping tools	Max. 16mm2 (Both ferrule and lug crimping tools)
Ladder	As required		Digital multimeter	Three-and-a-half-bit digital display
Lifting equipment	As required		Impact electric drill	As required
Lifting sling	As required		ESD wrist strap	/
Cable gland wrench	As required			

2.3 Mounting Kits

2.3.1 Standard Mounting Kit for Single Rectifier Installation

The rectifier comes standard with this mounting kit. This kit allows the rectifier to be mounted to a pole or wall in either a “flag” or “flat” orientation. See Figure 2.1

Figure 2.1 Standard Mounting Kit for Single Rectifier Installation



2.4 Mounting the Rectifier to a Pole or Wall Using the Standard Rectifier Mounting Kit

2.4.1 General

The rectifier can be pole mounted or secured to a suitable wall using the standard rectifier mounting kit. See “Mounting Kits” on page 13.

- For wall mounting, the customer needs to supply four (4) wall anchors capable of supporting the weight of the rectifier.

NOTE! *If the rectifier’s front access panel is opened during installation, ensure the access panel is securely closed and the screws are torqued to 2.5 Nm.*

2.4.2 Pole Mounting Procedure

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

1. Unpack the rectifier and mounting accessories.
2. Install the mounting bracket (63240ETT) in the appropriate top position on the pole with the supplied pole mount band. Securely tighten the pole mount band to the pole. The pole mount band accommodates poles from 60mm to 120mm in diameter. Refer to Figure 2.2.
3. Install mounting brackets to the rear panel of the rectifier with the supplied hardware (do this on the ground first). Refer to Figure 2.3 and Figure 2.4.
4. Secure the top of the rectifier to the pole by securing the mounting bracket (63240ETS) to the mounting bracket (63240ETT) with the supplied M6 bolts. Refer to Figure 2.5 and Figure 2.6.
5. Secure the bottom of the rectifier to the pole by securing the mounting bracket (63240ETT) to the pole with the supplied pole mount band. Refer to Figure 2.7 and Figure 2.8.

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

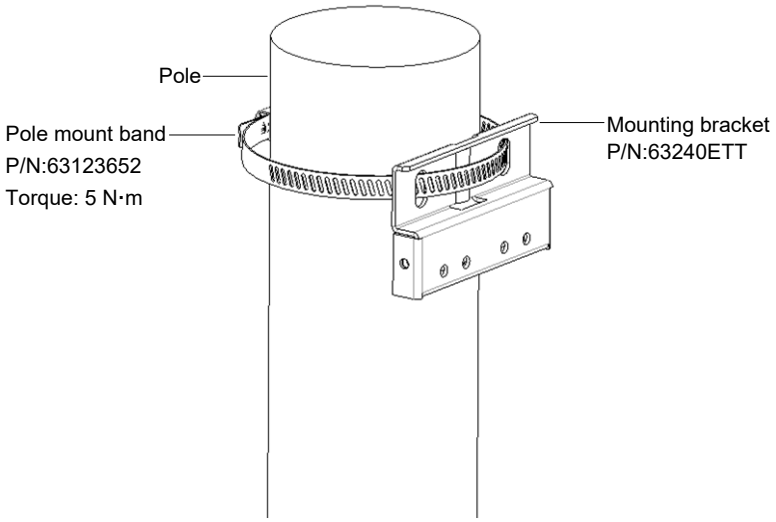


Figure 2.3 Installing the Mounting Brackets to the Rear Panel of the Rectifier (Flag)

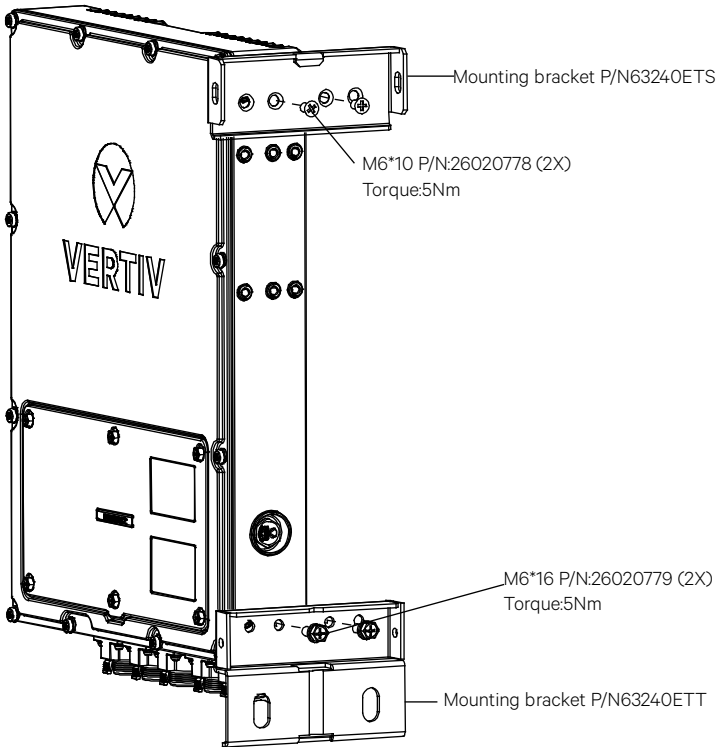


Figure 2.4 Installing the Mounting Brackets to the Rear Panel of the Rectifier (Flat)

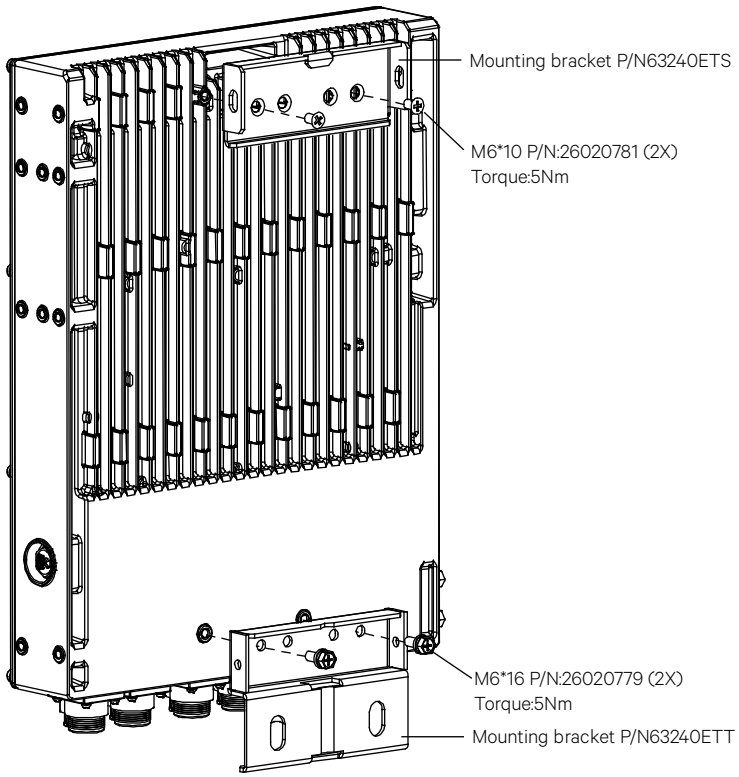


Figure 2.5 Securing the Rectifier to the Pole at the Top (Flag)

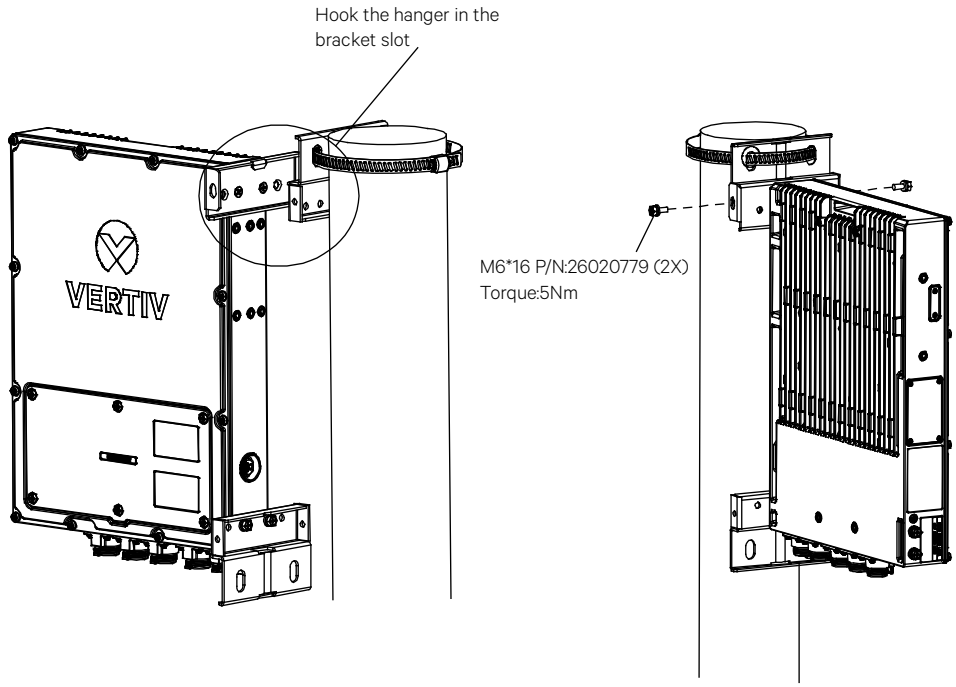


Figure 2.6 Securing the Rectifier to the Pole at the Top (Flat)

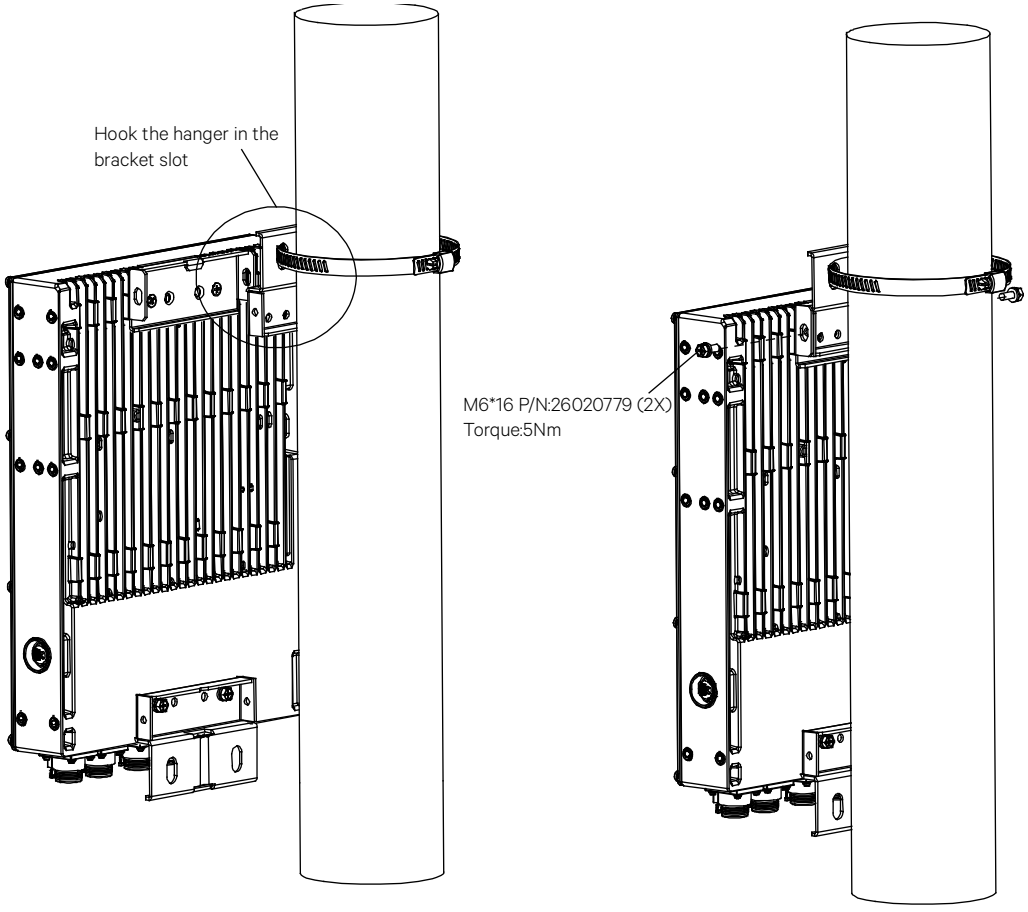


Figure 2.7 Securing the Rectifier to the Pole at the Bottom (Flag)

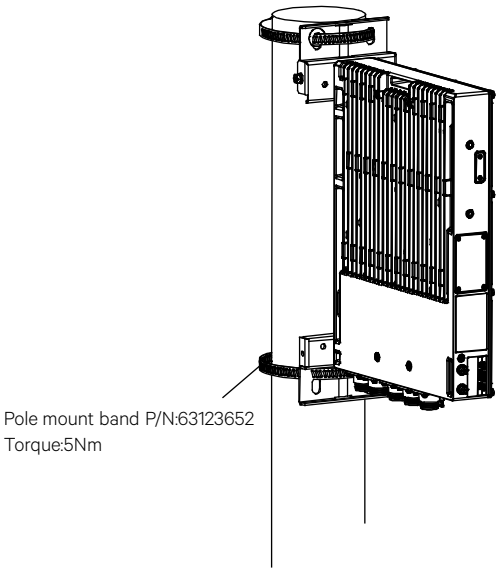
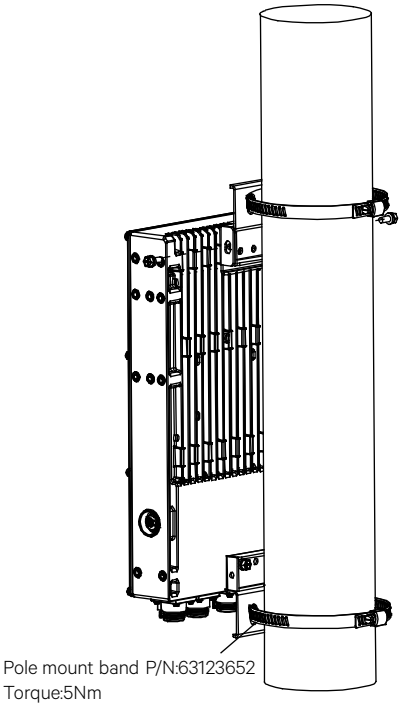


Figure 2.8 Securing the Rectifier to the Pole at the Bottom (Flat)



2.4.3 Wall Mounting Procedure

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

1. Unpack the rectifier and mounting accessories.
2. Drill appropriately sized holes for the customer provided M10 wall anchors being used into the wall as shown in Figure 2.9. Install the M10 wall anchors into the holes (Figure 2.10).
3. Install the mounting brackets to the rectifier. Refer to Figure 2.11 and Figure 2.12.
4. Install the rectifier to the wall. Refer to Figure 2.13 and Figure 2.14.

Figure 2.9 Wall Mounting Hole Positions (Unit: mm)

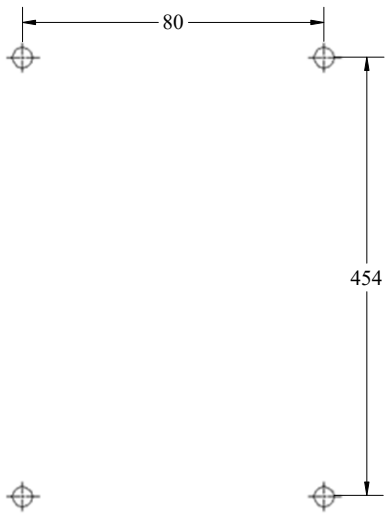
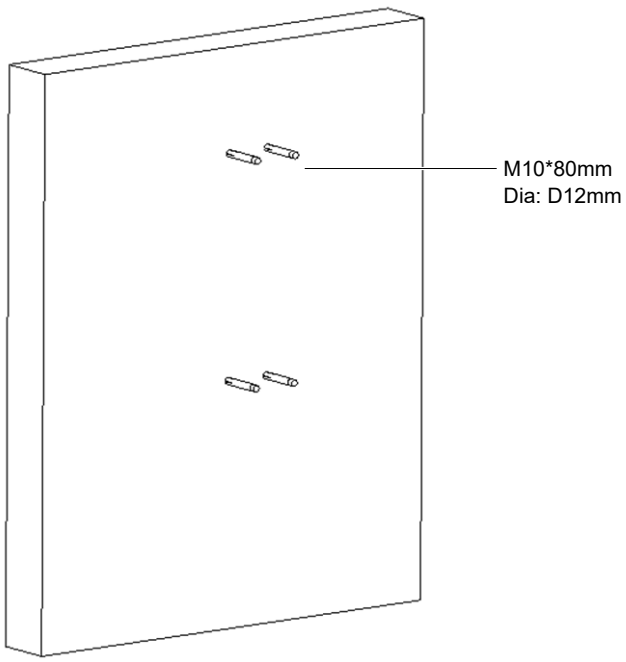


Figure 2.10 Expansion Bolt Installation



NOTE! *The expansion bolts are customer supplied.*

Figure 2.11 Installing the Mounting Brackets to the Rectifier (Flag)

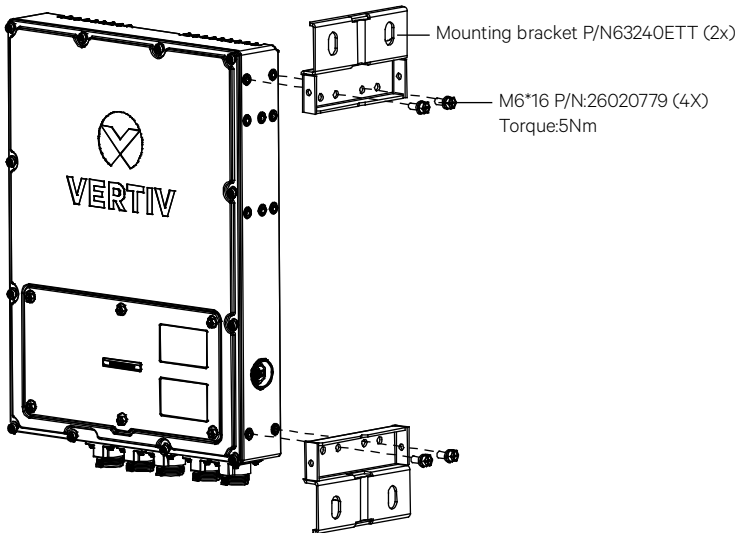


Figure 2.12 Installing the Mounting Brackets to the Rectifier (Flat)

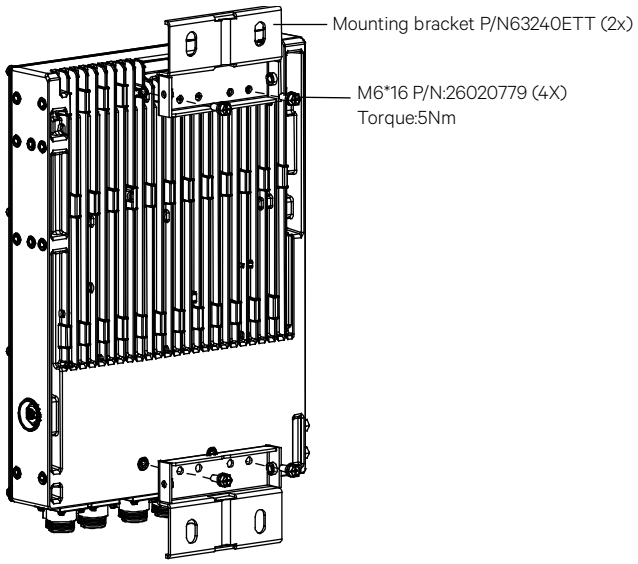


Figure 2.13 Installing the Rectifier to the Wall (Flag)

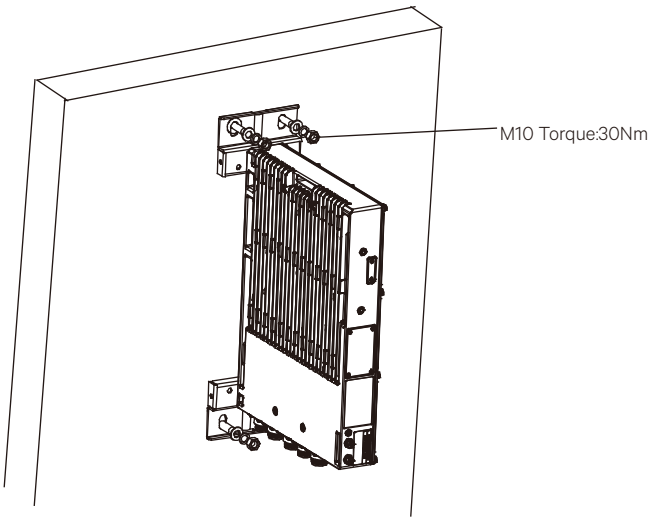
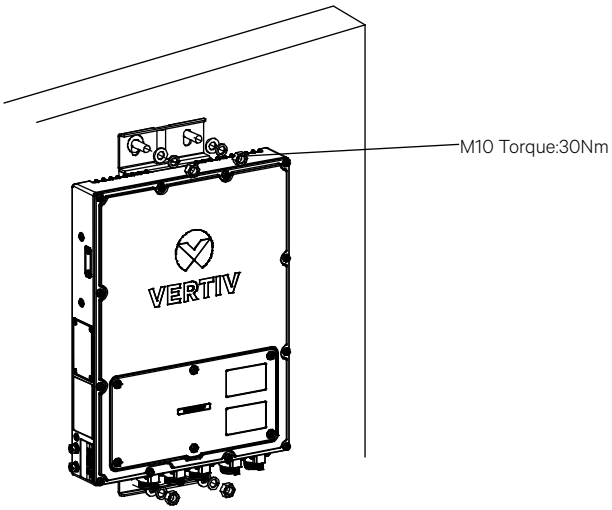


Figure 2.14 Installing the Rectifier to the Wall (Flat)



2.4.4 Lashing of Cords and Cables

Follow all local laws and practices for installation requirements and clearances from power facilities. Installation must meet all applicable laws, ordinances, rules, and codes.

All flexible power and signal cords attached to rectifier, battery and DC distribution boxes (if any), shall be lashed within 12" (305mm) of the cord connection, so as not to transfer tension or pull on the physical connector termination or joint.

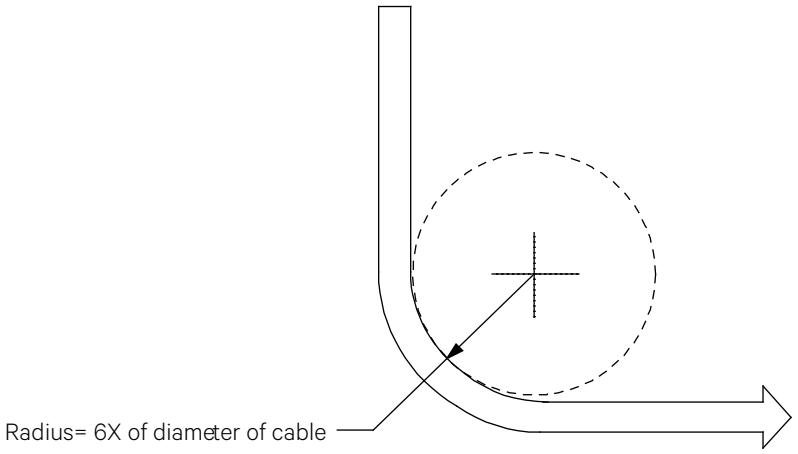
Connectors are IP65 rated when not accommodating installation cord or cable tension or pull.

At installation, use only approved outdoor rated devices and fittings, so as to protect all cords and cables from physical damage. Installer to use appropriate cable strain relief fittings/brackets as locally approved for pole and/or wall mounting.

Cords and cables shall be lashed and supported at intervals not exceeding 6 ft (1000 mm).

Vertiv recommends a minimum cable bend radius of 6X of the cable diameter. Example: 20mm cable outer diameter, shall be installed using a 6 x 20mm or 120mm inside bend radius, minimum.

Figure 2.15 Lashing of Cords and Cables



3 Making Electrical Connections

3.1 Important Safety Instructions

DANGER! Adhere to the “Important Safety Instructions” starting on page vi.

ALERT! Wear an ESD wrist strap (see “Static Warning” on page viii).

WARNING! Rectifier warranty will be VOID if any perimeter screw is tampered with. DO NOT loosen or remove any perimeter screw. Removal of outer perimeter screws is a safety hazard.

NOTE! *If the rectifier’s front access panel is opened during installation, ensure the access panel is securely closed and the screws are torqued to 2.5 Nm.*

3.2 Wiring Considerations

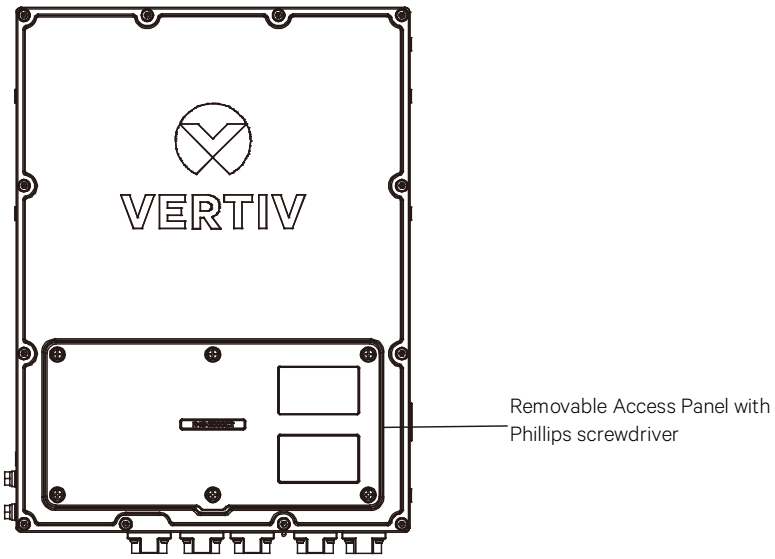
All wiring and branch circuit protection should follow the local national electrical building standards.

3.3 Rectifier Interface Overview Diagrams

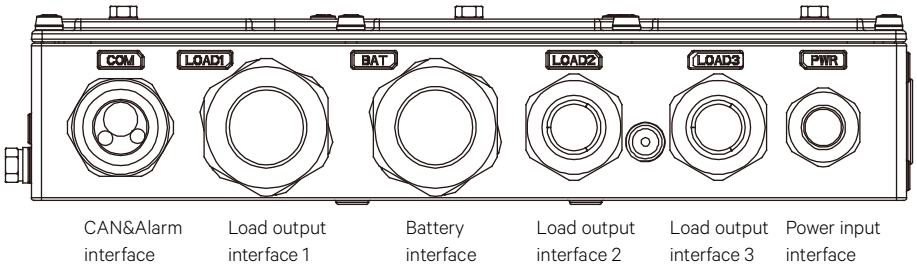
Refer to Figure 3.1 for rectifier interface overview diagrams showing electrical connection points.

Figure 3.1 Rectifier Interface Overview Diagrams

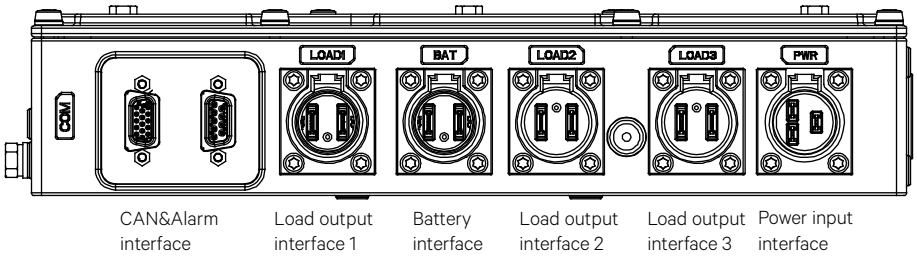
Front View



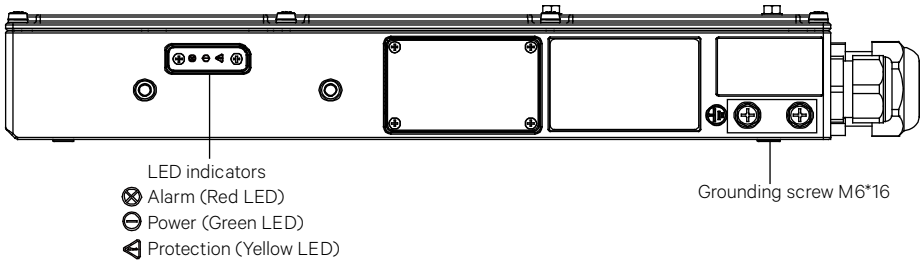
Bottom View (PG Terminal)



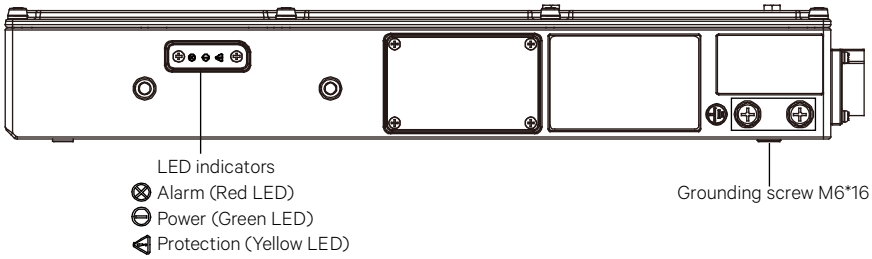
Bottom View (Quick Connect)



Side view (PG Terminal): Two grounding screws are pre-installed on the rectifier.



Side View (Quick Connect)



3.4 Rectifier Ground Connection

3.4.1 General

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.

3.4.2 Positive Grounding

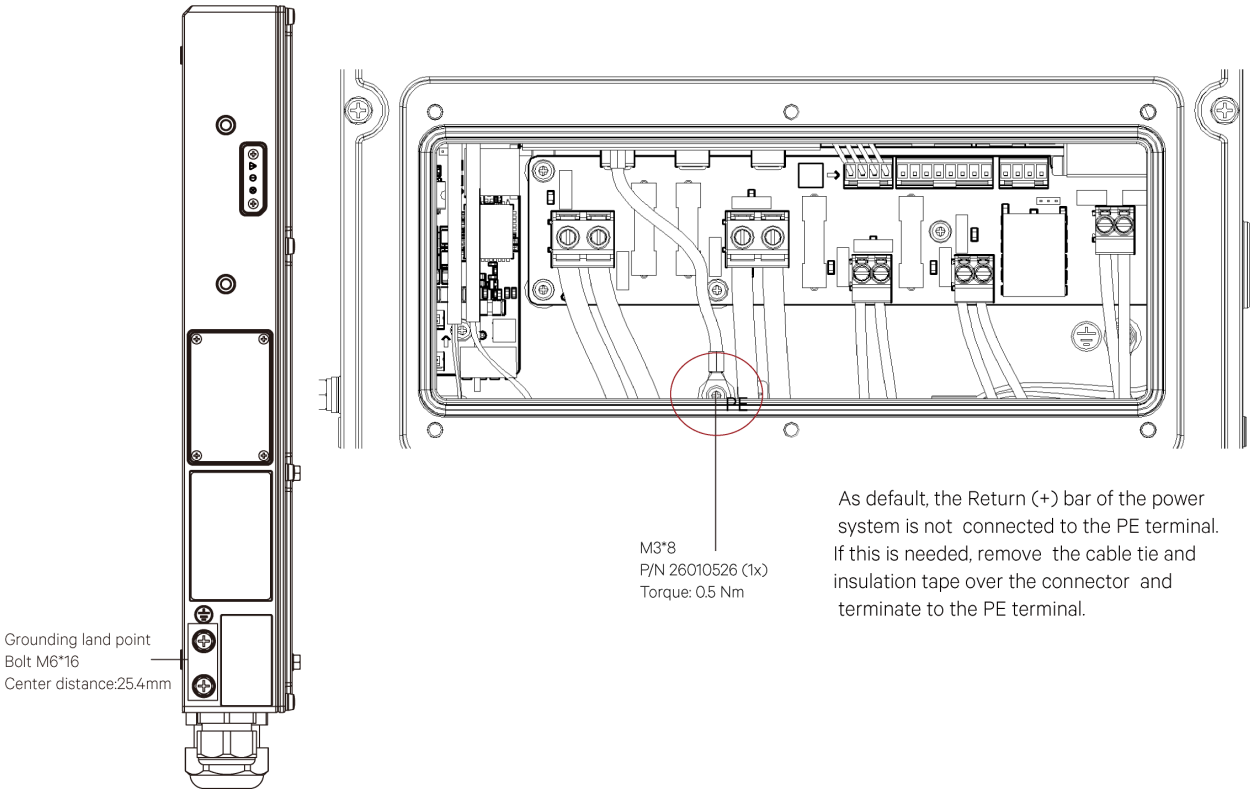
As default, the power system is not positive grounded. Connect the grounding wire as shown in Figure 3.2 to ground positive, if required.

3.4.3 Chassis Grounding

Two (2) M6*16 screws are located on the left side panel for a customer furnished frame ground lug. Screws are spaced on 25.4 mm centers. Refer to Figure 3.2 for location.

Connect the rectifier Chassis to the site grounding point with a two-hole lug. Lugs should be crimped per lug manufacturer's specifications.

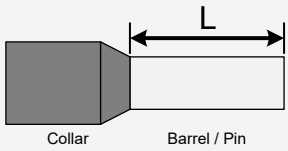
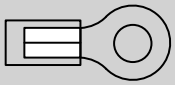
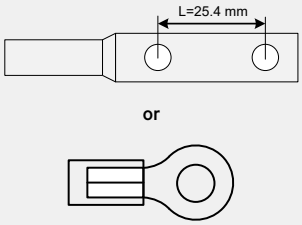
Figure 3.2 Rectifier Grounding Location



3.5 Terminal List

3.5.1 PG Version

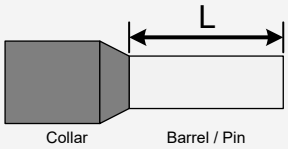
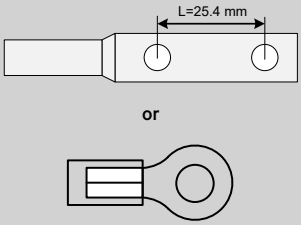
Table 3.1: PG Version Terminal List

Cable	Wire Size	Terminal Size	Illustration
1 kW DC Output	6 mm^2	L = 12 mm	
2 kW DC Output	10 mm^2	L = 12 mm	
AC Input – L & N	2.5 mm^2	L = 12 mm	
AC Input – PE	2.5 mm^2	Φ stud: M3	
PE	10 mm^2	L = 25.4 mm Φ screw: M6	

NOTE! *Terminals to be customer supplied.*

3.5.2 Quick Connect Version

Table 3.2: Quick Connect Version Terminal List

Cable	Wire Size	Dimension	Illustration
1 kW DC Output	6 mm^2	L = 12 mm	
2 kW DC Output	10 mm^2	L = 12 mm	
AC Input	2.5 mm^2	L = 12 mm	
PE	10 mm2	L = 25.4 mm Φ screw: M6	

NOTE! *Terminals to be customer supplied.*

3.6 Customer Wiring Selection

Refer to Table 1.4 on page 2 and Table 1.5 on page 3.

3.7 Digital Output (DO) Relay Functions

Refer to “Digital Output (DO) Dry Relay Contacts” on page 10.

3.8 Changing the Alarm Relay Configuration for the Digital Output (DO) Relay Functions

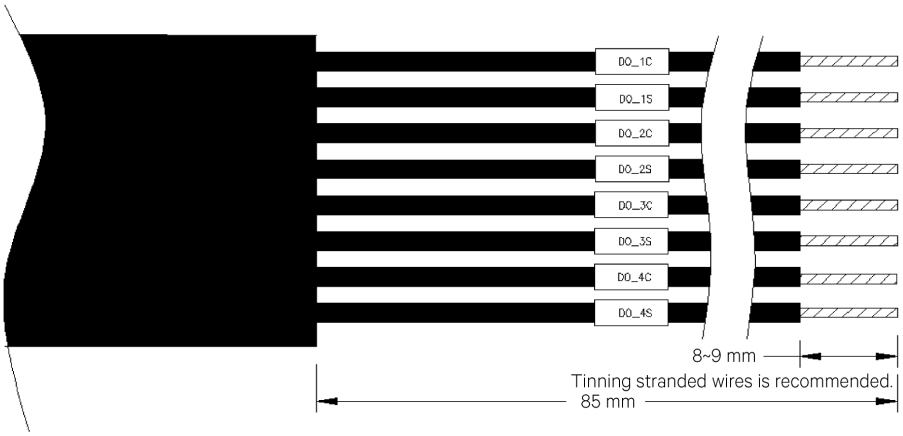
The alarm relay contact configurations can be changed. Refer to the following procedure.

Procedure

1. Refer to “Opening / Closing the Front Access Panel” on page 39, and open the rectifier enclosure front access panel.
2. Locate jumpers JP1, JP2, JP3, and JP4. Set the jumpers per site requirements. See Table 1.10 on page 10 and Figure 1.6 on page 10.
3. Refer to “Opening / Closing the Front Access Panel” on page 39, and close the rectifier enclosure front access panel.

3.9 Wire Preparation

Figure 3.3 Strip insulation off the wires for RELAY OUTPUT and COMM as required (This is for PG Gland Wiring version only.)



8-Conductor Cable: 24 AWG to 26 AWG leads, 4 PR DO’s (Recommended Shielded Twisted Pair (STP) Cable)

Figure 3.4 Strip insulation off the wires for RECTIFIER AC INPUT as required for PG gland version (mm)

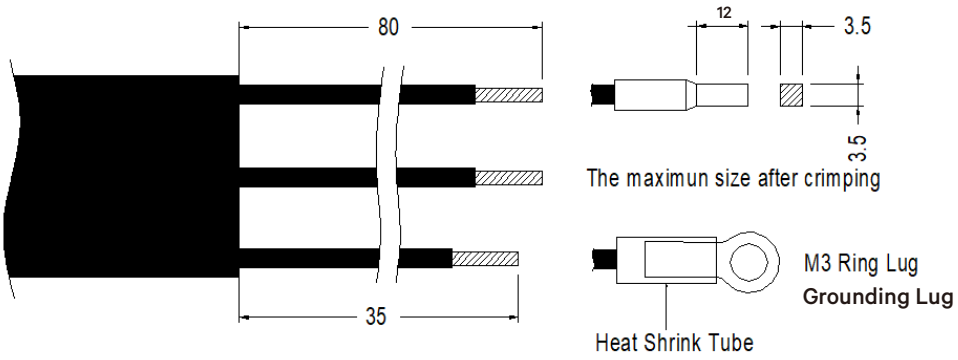
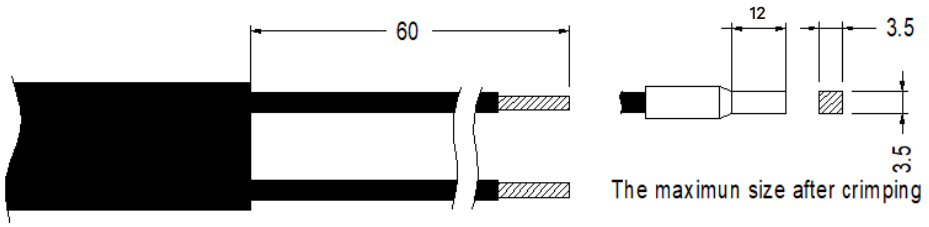
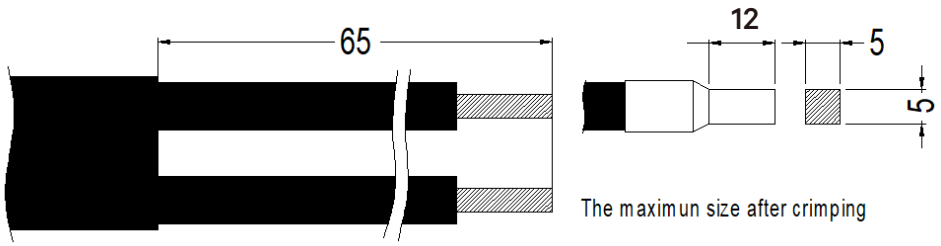


Figure 3.5 Strip insulation off the wires for DC OUTPUT as required (mm)



1KW DC Output



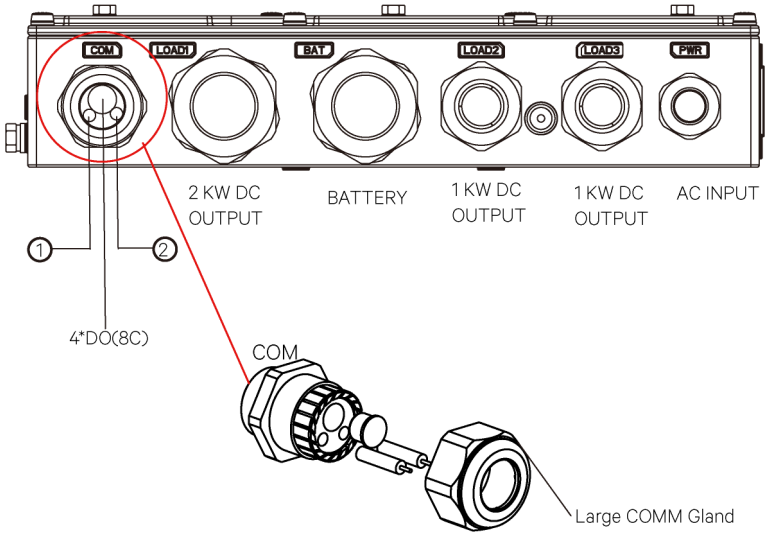
2KW DC Output

3.10 Customer Wiring Connection Procedure

3.10.1 Customer Wiring Connection Procedure for PG Terminal

After finishing pre-install of customer cables, remove the rectifier access panel and connect power cord and wire harnesses according to the following procedures. Refer to Figure 3.6 and the illustrations in the following procedure. Refer also to Table 3.3.

Figure 3.6 Customer Wiring Connection Interface



Note: 3 holes for COM have been factory installed "plugs", only one hole is used for DO.
① and ② will not be used and the plugs must remain in place.
Please don't remove them unless customer install a cable there.

Table 3.3: Designation for Customer Wiring Connection

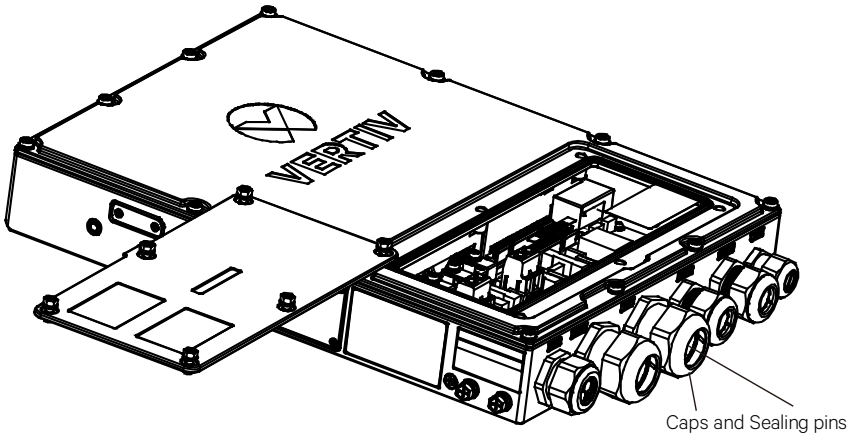
Designation	Cable Gland Connector	Acceptable Cable Outer Diameter Range (mm)	Connect to
COM	M25 Cable Gland	< 11	4 x DO
		< 5.6	/
		< 5.6	/
LOAD1	PG29 Cable Gland	13~20	2KW DC Output1+ and Output1-
BAT	PG29 Cable Gland	13~20	2KW BAT Input Output2+ and Output2-
LOAD2	PG21 Cable Gland	9~16	1KW DC Output3+ and Output3-
LOAD3	PG21 Cable Gland	9~16	1KW DC Output4+ and Output4-
PWR	PG13.5 Cable Gland	6~12	AC Input L+N+PE

Procedure

1. Refer to "Opening / Closing the Front Access Panel" on page 39, and open the rectifier enclosure front access panel. Tighten the hardware indicated in the procedure to secure the access cover in the open position.
2. Remove the cable gland caps and sealing pins from the connectors to be used. Refer to Figure 3.7.

DANGER! If the connector will not be used, DO NOT remove the caps and sealing pins as they are necessary to ensure IP65 compliance.

Figure 3.7 Remove the Cable Gland Caps and Sealing Pin from Cable Gland Connectors to be Used

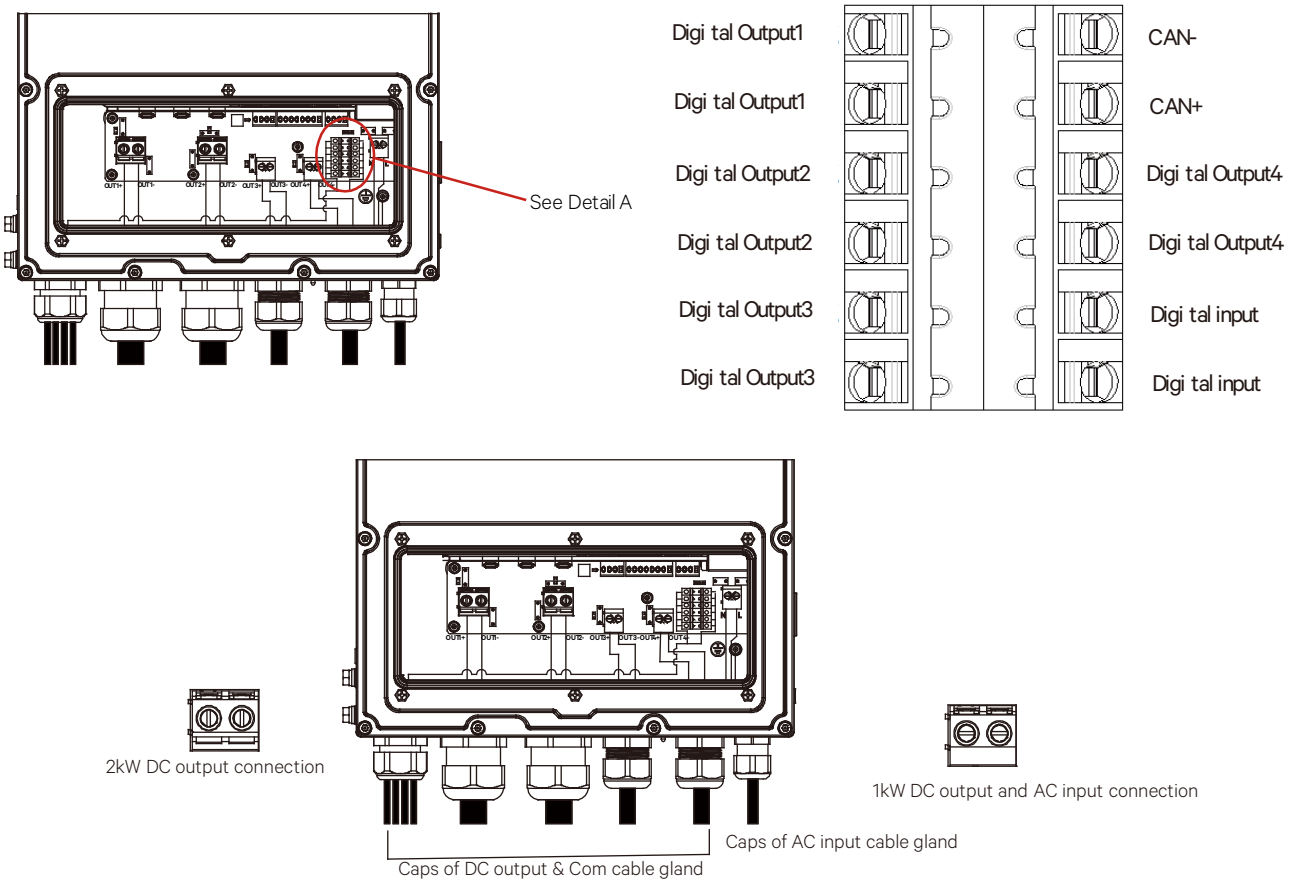


3. Feed the cables through the cable glands.
4. Slide appropriate cable into the designation position of the terminal block. Refer to Figure 3.8.

NOTE! *All cables shall always have the outer sheath firmly fixed to places where appropriate to stop the wires pulling out of the terminals/connectors, and avoid sheath degrades.*

5. Tighten the screw of the terminal block as required.
6. Tighten the caps of cable gland connectors as required.

Figure 3.8 Customer Wiring Connection



7. Refer to “Opening / Closing the Front Access Panel” on page 39, and close the rectifier enclosure front access panel. Torque the screws to 2.5 Nm.

3.10.2 Customer Wiring Connection Procedure for Quick Connect Terminal

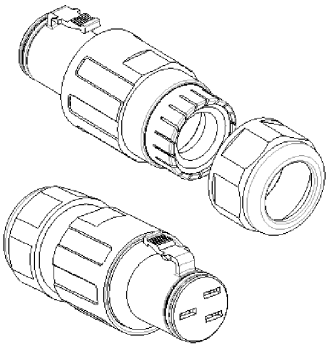
Refer to the illustrations in the following procedures. Refer also to Table 3.4.

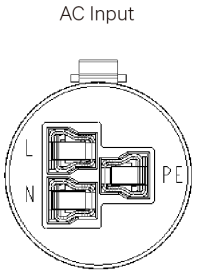
Table 3.4: Designation for Customer Wiring Connection

Designation	Connector	Acceptable Cable Outer Diameter Range (mm)	Connect to
COM 1	DB15 COM Quick Connector	8.5-10	4 x DO
COM 2	DB9 COM Quick Connector	<5.5	CAN extension
LOAD1	2KW DC Quick Connector	11 - 17	2KW BAT Input Output2+&Output2-
LOAD2	1KW DC Quick Connector	11 - 17	1KW DC Output3+&Output3-
LOAD3	1KW DC Quick Connector	11 - 17	1KW DC Output4+&Output4-
PWR	AC Quick Connector	10 - 16	AC Input L+N+PE

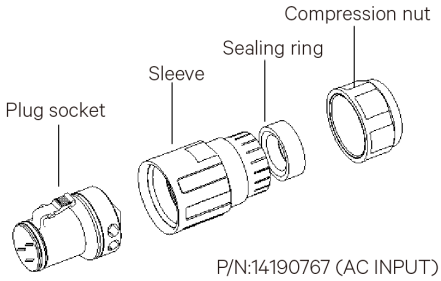
Power Input Interface

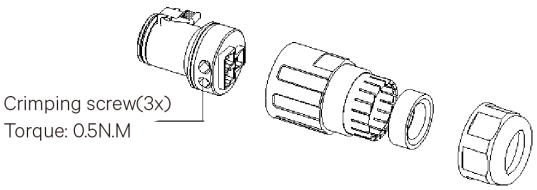
Figure 3.9 AC Power 3-Terminal Input Interface



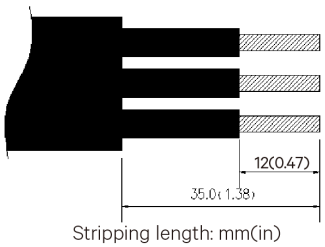


1.Cable type： Outdoor 3-conductor cable,300V,105℃.
2.Adapter wire diameter of the connector crimping terminal：
4mm²~6mm²
3.Sealing ring is adapted to the outer diameter of the cable：
ø10~ ø16mm

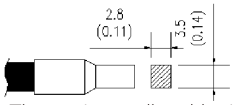




Wiring steps：
1)Strip the cable insulation 10±0.5mm and use tubular terminals for crimping.
2)Remove the sleeve and compression nut from the plug connector.
3)Insert the cable into the corresponding terminal of the plug and tighten the crimping screw. (torque=0.5 N·m)
4)Insert the sleeve and compression nut and tighten.
(Sleeve tightening torque=5 N·m) (Tail compression nut lock torque=5 N·m)
5)Insert the plug into the corresponding socket



Stripping length: mm(in)

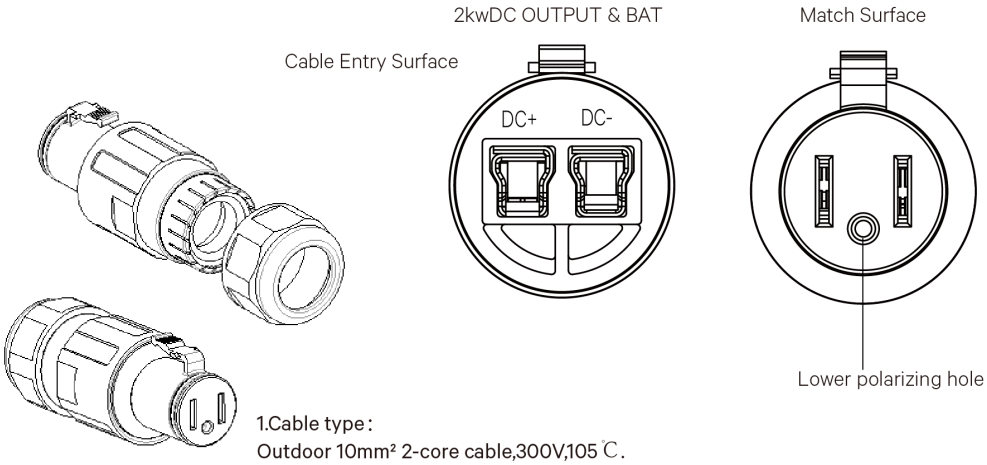


The maximum allowable size of the tubular terminal after crimping:mm(in)

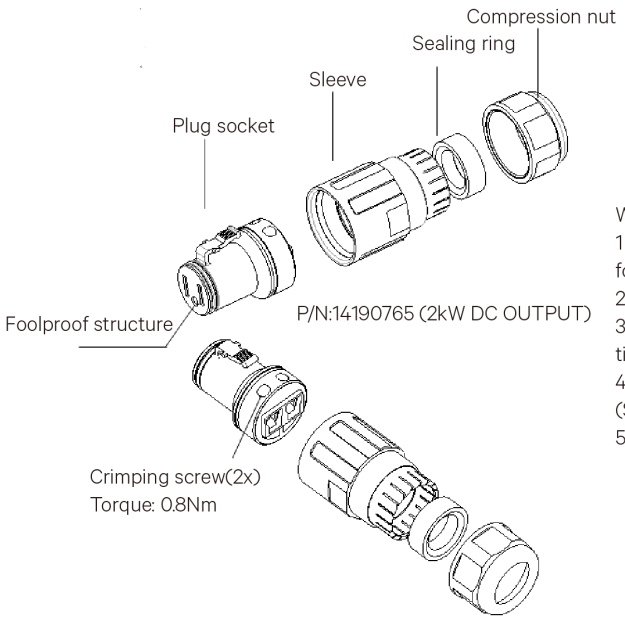
Load Output Interface 1

NOTE! *If the connector is not be used, then the sealing pins and cap must not be removed!*

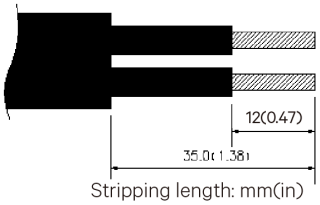
Figure 3.10 Load Output Interface 1



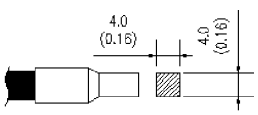
1.Cable type：
Outdoor 10mm² 2-core cable,300V,105℃.
2.Adapter wire diameter of the connector crimping terminal
6mm²~10mm²
3.Tail accessories are adapted to the outer diameter of the cable：
ø11~ ø17mm



Wiring steps：
1）Strip the cable insulation 10±0.5mm， and use tubular terminals for crimping.
2）Remove the sleeve and compression nut from the plug connector.
3）Insert the cable into the corresponding terminal of the plug and tighten the crimping screw.（torque=0.8 Nm）
4）Insert the sleeve and compression nut and tighten.
(Sleeve tightening torque =5 Nm)（Tail compression nut lock torque =5 Nm）
5）Insert the plug into the corresponding socket



Stripping length: mm(in)

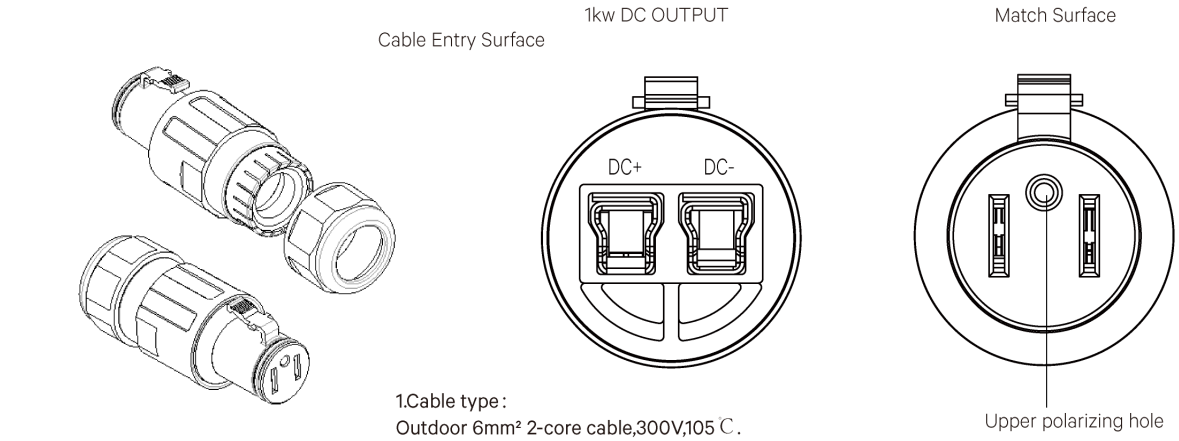


The maximum allowable size of the tubular terminal after crimping:mm(in)

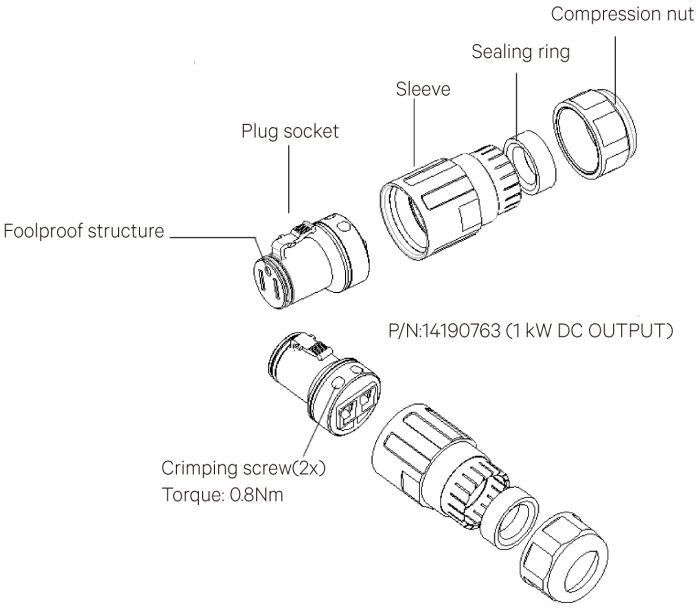
Load Output Interface 2 / Load Output Interface 3

NOTE! *If the connector is not be used, then the sealing pins and cap must not be removed!*

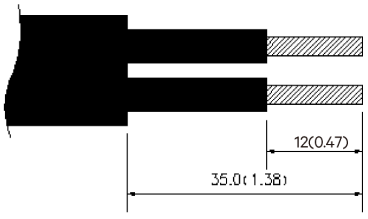
Figure 3.11 Load Output Interface 2 / Load Output Interface 3



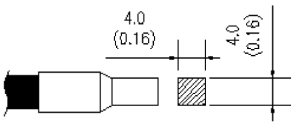
1.Cable type：
Outdoor 6mm² 2-core cable,300V,105℃.
2.Adapter wire diameter of the connector crimping terminal
6mm²~10mm²
3.Tail accessories are adapted to the outer diameter of the cable：
ø11~ ø17mm



Wiring steps：
1）Strip the cable insulation 10±0.5mm，and use tubular terminals for crimping.
2）Remove the sleeve and compression nut from the plug connector.
3）Insert the cable into the corresponding terminal of the plug and tighten the crimping screw.（torque=0.8 Nm）
4）Insert the sleeve and compression nut and tighten.
(Sleeve tightening torque =5 Nm)（Tail compression nut lock torque =5 Nm）
5）Insert the plug into the corresponding socket



Stripping length: mm(in)

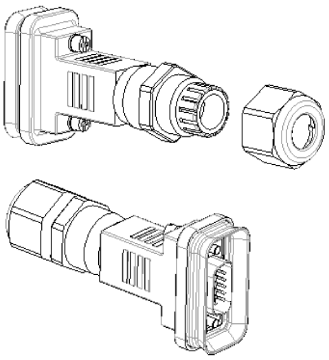


The maximum allowable size of the tubular terminal after crimping:mm(in)

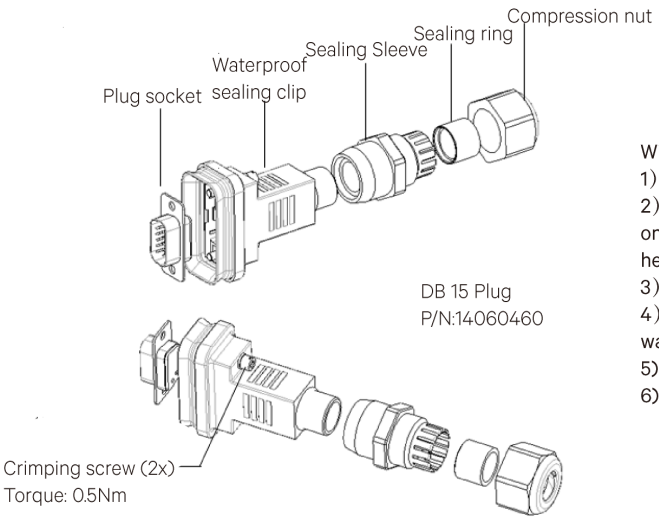
CAN and Alarm Interface

DB15 Wiring Instruction

Figure 3.12 DB15 Wiring

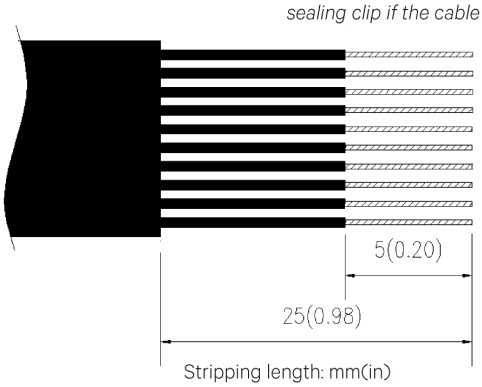


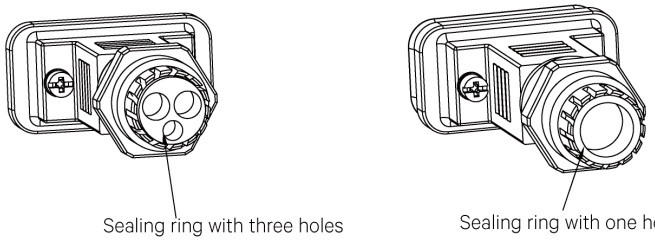
Cable Type：
Outoor rated or other equivalent specifications.
Adapt to the outer diameter of the cable：
No more than 8mm.



Wiring steps:
1）Strip the cable insulation 5±0.5mm
2）Solder the wire to the plug pin, and apply a heat shrink tube on the joint.(Drain wire shall be soldered on the plug socket, with a heat shrink tube covered.)
3）Remove the waterproof sealing clip and nut.
4）Pass the cable through the connector housing, waterproof sealing clip, sealing ring and nut.
5）Lock the sealing sleeve (Torque =5Nm)
6）Compression nut （Torque =5Nm)

Note: Do not untighten the Sealing Sleeve from the waterproof sealing clip if the cable is assembled.



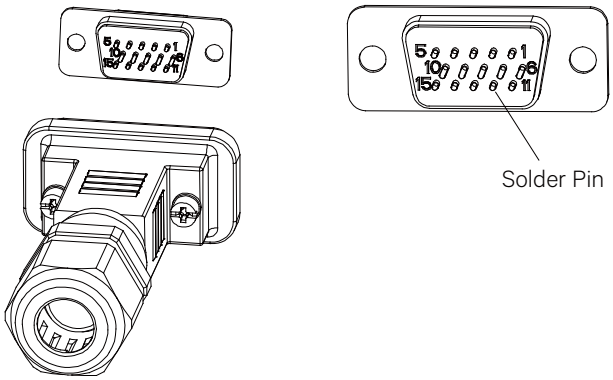


Note: Select sealing rings with three or one hole as cable need.

Table 3.5 DB15 Pin Definition

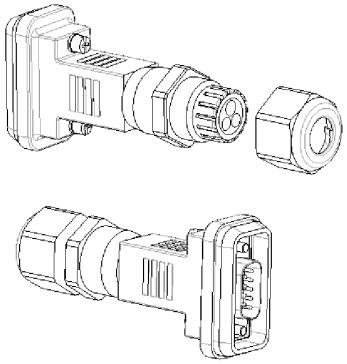
Pin	Signal Name
1	DO1_C
2	DO1_S
3	DO2_C
4	DO2_S
5	DO3_C
6	RS485_1A
7	RS485_1B
8	DO4_C
9	DO4_S
10	DO3_S
11	/
12	/
13	/
14	/
15	/

Figure 3.13 DB15 Plug Solder Pin Diagram

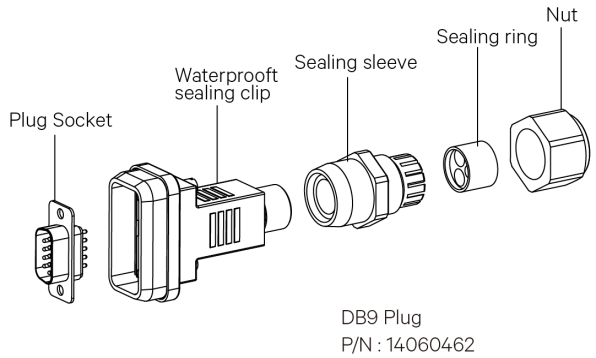


DB9 Wring Instruction

Figure 3.14 DB9 Wiring

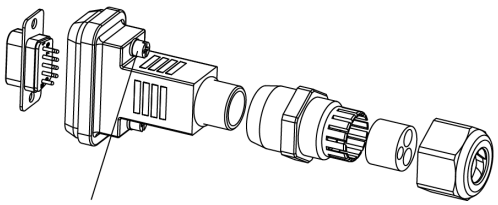


Cable Type：
Output rated or other equivalent specifications.
Adapt to the outer diameter of the cable：
1. The two small cable holes do not exceed 4.0mm.
2.A large wire hole does not exceed 4.5mm



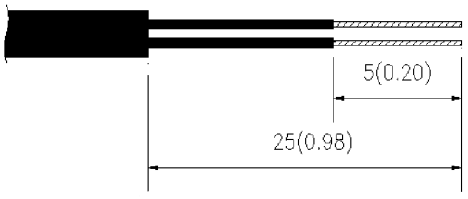
DB9 Plug
P/N : 14060462

Wiring steps:
1） Strip the cable insulation 5±0.5mm
2） Solder the wire to the plug pin, and apply a heat shrink tube on the joint.(Drain wire shall be soldered on the plug socket, with a heat shrink tube covered.).
3） Remove the waterproof sealing clip and nut.
4） Pass the cable through the connector housing, waterproof sealing clip, sealing ring and nut.
5） Lock the sealing sleeve (Torque =5Nm)
6） Lock nut （Torque =5Nm)

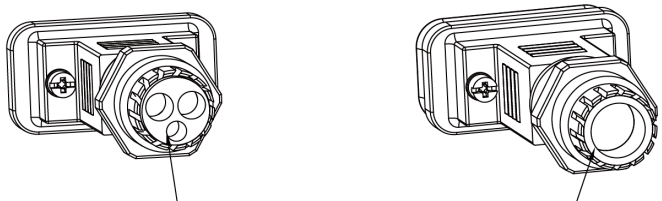


Lock nut (2X)
Torque:0.5 Nm

Note: Do not untighten the Sealing Sleeve from the waterproof sealing clip if the cable is assembled.



Stripping length: mm(in)



Sealing ring with three holes　　Sealing ring with one hole

Note: Select sealing rings with three or one hole as cable need.

Figure 3.15 DB9 Connector IP65 Compliance

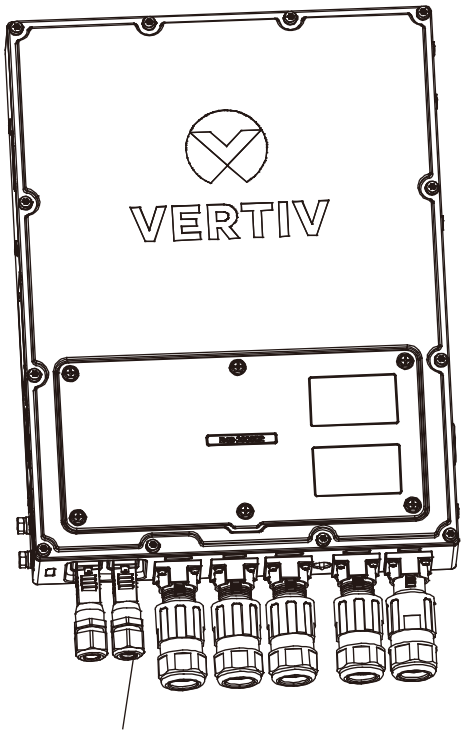
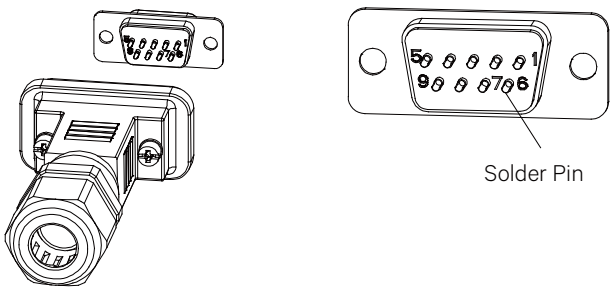


Table 3.6: DB9 Pin Definition

Pin	Signal Name
1	RS485_2A
2	RS485_2B
3	/
4	/
5	/
6	CAN+
7	CAN-
8	/
9	DI

Figure 3.16 DB9 Plug Solder Pin Diagram



4 Initially Starting and Checking Rectifier Operation

4.1 Initially Starting the Rectifier

Procedure

1. Verify all customer side DC load output connections are properly terminated, carefully paying attention to +/- DC polarity at the output. Customer must verify DC polarity output to load before energizing rectifier.
2. Apply AC input power to the rectifier by closing the external AC disconnect or protective device. The rectifier starts automatically.

4.2 Checking Rectifier Status

Procedure

1. Observe the status of the rectifier's local indicators (visible from the outside through a window located on the left side of the rectifier). If operating normally, the status of these is as shown in Table 4.1. See Figure 5.1 for location.

Table 4.1 Status and Alarm Indicators

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

5 Operation

5.1 Rectifier Local Indicators

There are three (3) indicators located inside the rectifier enclosure (visible from the outside through a window located on the left side of the rectifier). 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: Rectifier Local Indicator Locations

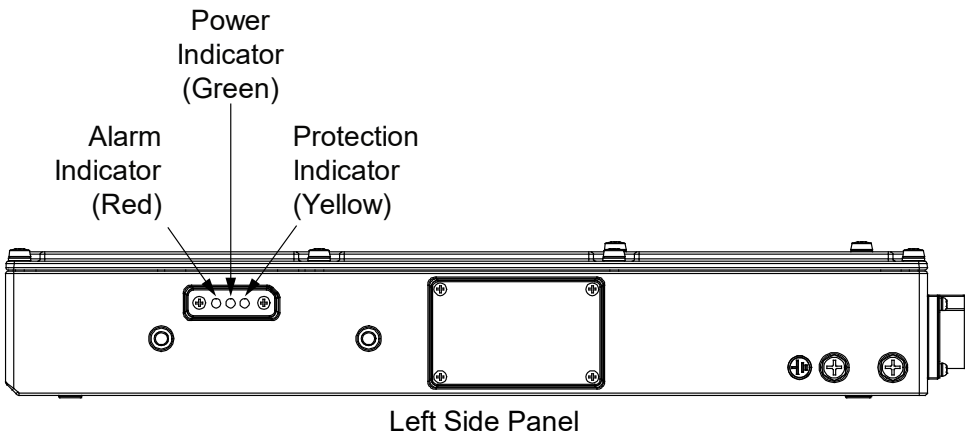


Table 5.1: Rectifier Indicators

Indicator	Normal State	Alarm State	Alarm Cause
Power (Green)	On	Off	No input voltage. Internal input fuse open.
Protection (Yellow)	Off	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 Opening / Closing the Front Access Panel

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

Refer to the following procedures to open and close the rectifier enclosure front access panel.

5.2.1 Opening the Front Access Panel

Procedure

1. Rotate the access panel clockwise 180° around the hardware of the top left corner. Refer to Figure 5.2 and Figure 5.3. Tighten the hardware circled in Figure 5.3 to secure the access cover in the open position.

Figure 5.2 Remove the Access Panel with Phillips Screwdriver

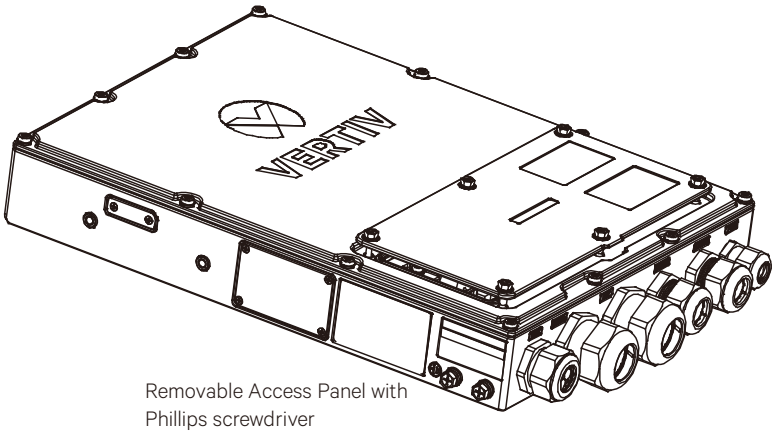
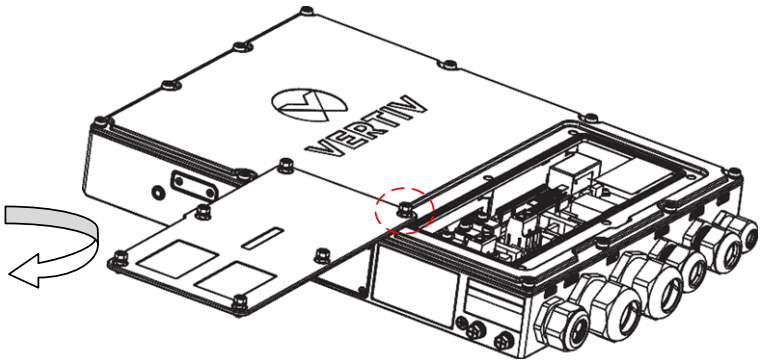


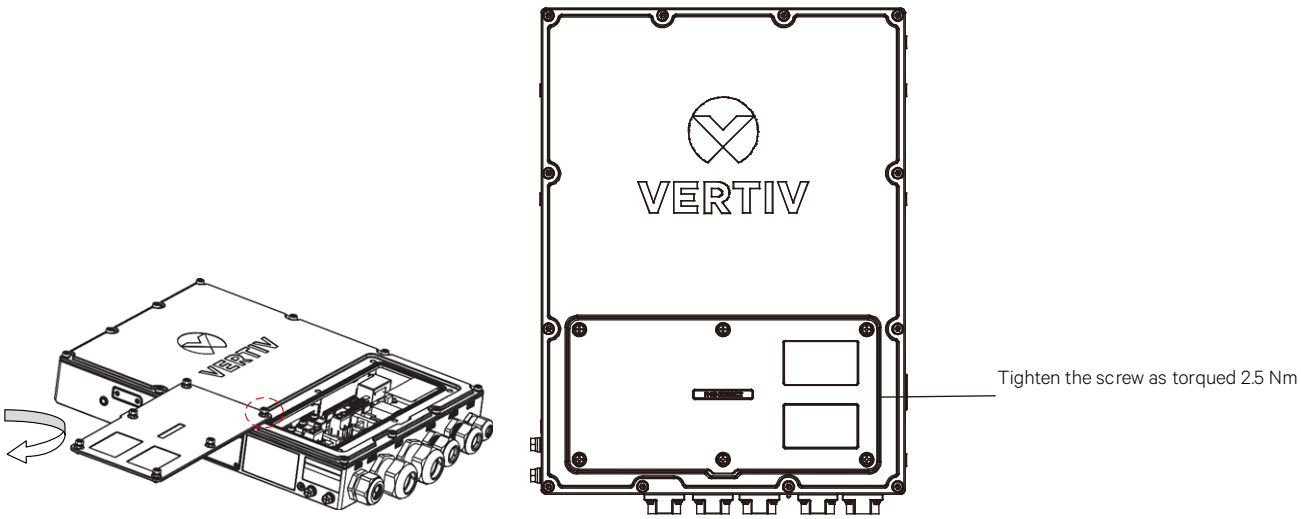
Figure 5.3 Rotate the Panel Clockwise 180°Around the Hardware of the Top Left Corner, Tighten the Hardware Circled Below to Secure Open



5.2.2 Closing the Front Access Panel

1. Close the access cover and torque the screws to 2.5 Nm. See Figure 5.4.

Figure 5.4 Close the Access Cover



6 Troubleshooting and Repair

6.1 General

This system is designed for ease in troubleshooting and repair. The rectifier contains various indicators as described below and in “Rectifier Local Indicators” on page 39. These are designed to isolate a failure to a specific fault. Once a failure fault has been identified, refer to “Replacement Information” on page 41 and “Replacement Procedures” on page 42.

6.2 Alarm Conditions Identified by the Rectifier

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

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.

6.3 Replacement Information

6.3.1 General

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

6.3.2 Rectifier Fuses

Replace rectifier fuses with the same type and rating. Refer to Table 6.2 for fuse part numbers.

Table 6.2 Fuse Part Numbers

Fuse	Rating	Part Number
Load (1) 2 kW	63A	10026717
Load (2) 1 kW	30A	10026704
Load (3) 1 kW	30A	10026704
Battery	63A	10026717

6.4 Replacement Procedures

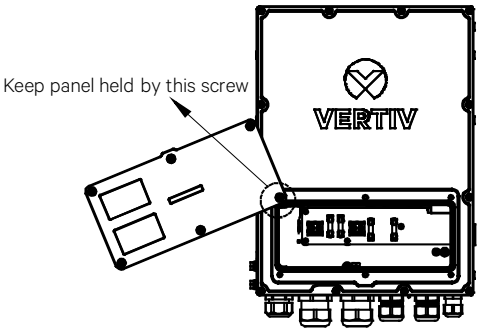
DANGER! Adhere to the “Important Safety Instructions” starting on page vi.

6.4.1 Replacing a DC Load Fuse or Battery Fuse

Procedure

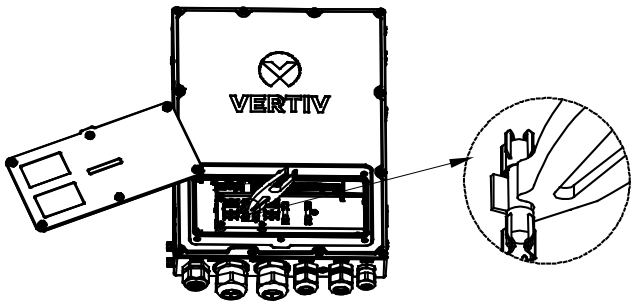
1. Remove AC input power from the rectifier.
2. Refer to “Opening / Closing the Front Access Panel” on page 39, and open the rectifier enclosure front access panel.
3. Refer to Figure 6.1 and replace the appropriate fuse.
4. Refer to “Opening / Closing the Front Access Panel” on page 39, and close the rectifier enclosure front access panel.
5. Apply AC input power to the rectifier by closing the external AC disconnect or protective device. The rectifier starts automatically.

Figure 6.1 Replacing Fuses



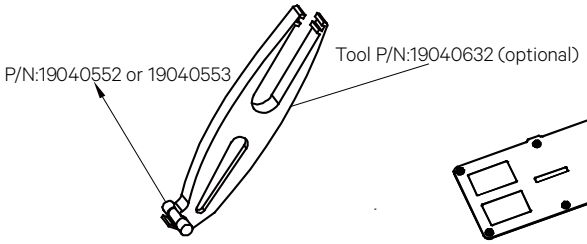
1

Open the service access panel:
Loose screws and keep service access panel held by the upper left screw, please refer to picture 1.



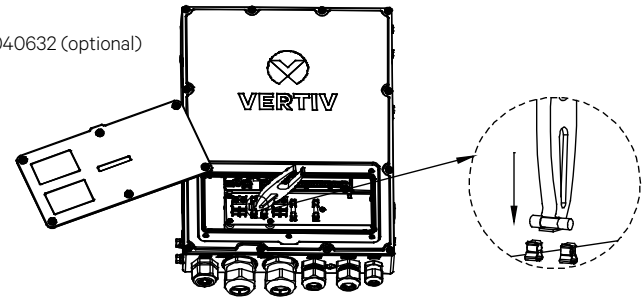
2

Using the fuse puller tool to hook the fuse that need to be replaced by the tool slot, then pull it straight out of the fuseholder, please refer to picture 2.



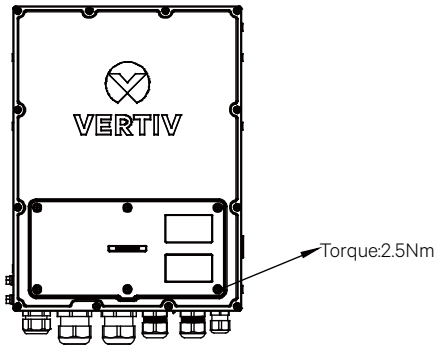
3

Insert new fuse into tool slot, please refer to picture3.
Note that the new fuse must be the same type and rating as before.



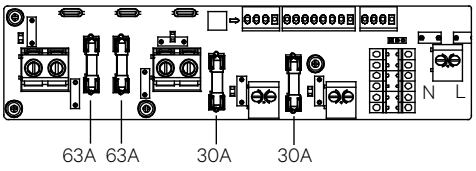
4

Push the new fuse into fuseholder vertically by the tool, please refer to picture 4.



5

Close service access panel and fasten all screws with torque wrench (Torque:2.5N.m).
please refer to picture 5.



Fuse Rating

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