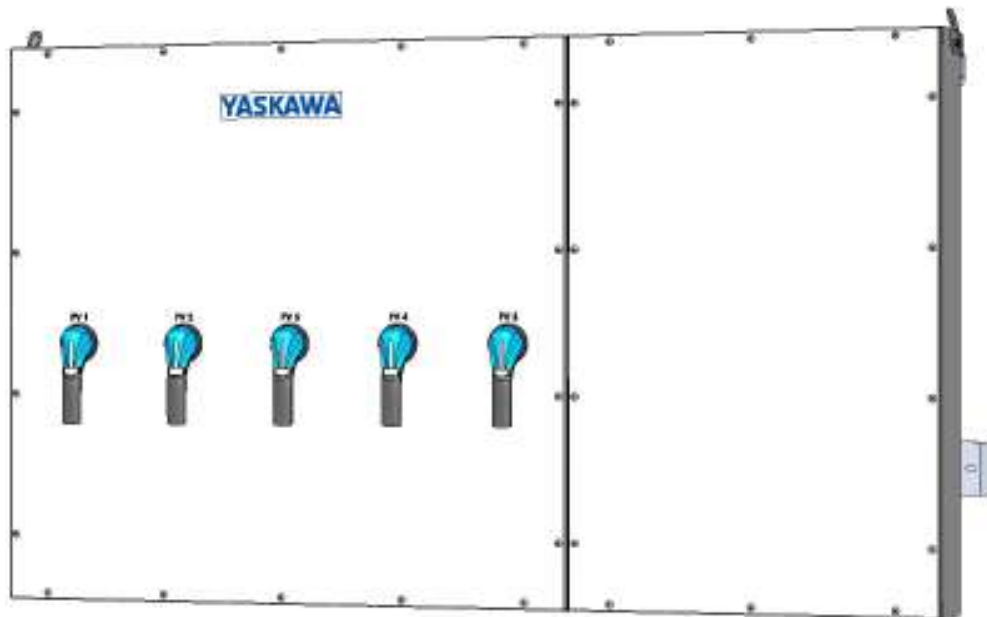


DCR-1500 RE-COMBINER

User's Manual



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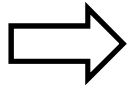
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1. IMPORTANT SAFETY INSTRUCTIONS



SAVE THESE INSTRUCTIONS

The SOLECTRIA DC Re-Combiners come in two models: DCR-1500-500 and DCR-1500-250. They are referred to here as the DCR 1500 Re-Combiners, and are exclusively compatible with the SOLECTRIA PVS-500 Energy Storage System. The DCR-1500 Re-Combiner is only sold as a component part of the PVS-500 DC-Coupled Energy Storage System and is not for use in any other application.



Populate the DC Re-Combiner with 2 - 5 PV Circuits.

Before using the DCR-1500 Re-Combiner, please read all instructions and caution markings in this manual and on the Re-Combiner, as well as all other instructions and warnings for associated equipment.

This manual contains important instructions that must be followed during installation and operation of the DCR-1500 Re-Combiner. To reduce the risk of electrical shock and to ensure the safe installation and operation of the Re-Combiner, the following safety symbols are used to indicate dangerous conditions and important safety instructions.



WARNING
Could Injure
Personnel or
Damage Equipment



Instructions
for Qualified
Personnel Only



Positive
Connection
Point Symbol



Negative
Connection
Point Symbol



Ground
Connection
Point Symbol



DC Electrical
Connection
Point Symbol



WARNING: Disconnect all PV modules or completely cover the surface of all PV modules with opaque (dark) material before wiring. PV arrays produce dc voltage when exposed to light and could create a hazardous condition. Always verify the absence of voltage before performing work on the Re-Combiner.



WARNING: Connecting PV output circuits to the input of the Re-Combiner and making the connection to the Dynapower DC/DC Converter (DPS-500 or DPS-250) and battery subsystem, must only be done after receiving approval from the utility company and AHJ, and should only be performed by qualified persons.



WARNING: The DCR-1500 Re-Combiner is designed and listed for use exclusively as a component in the SOLECTRIA PVS-500 DC-Coupled Energy Storage System; the DCR-1500 Re-Combiner must not be used in any other application.

2. PRODUCT OVERVIEW

The DCR-1500 Re-Combiner functions as the DC bus in the SOLECTRIA PVS-500 DC-Coupled Energy Storage System and is designed and listed exclusively for use in the SOLECTRIA PVS-500. Refer to the illustration in Figure 1.1 showing its general usage within the SOLECTRIA PVS-500.

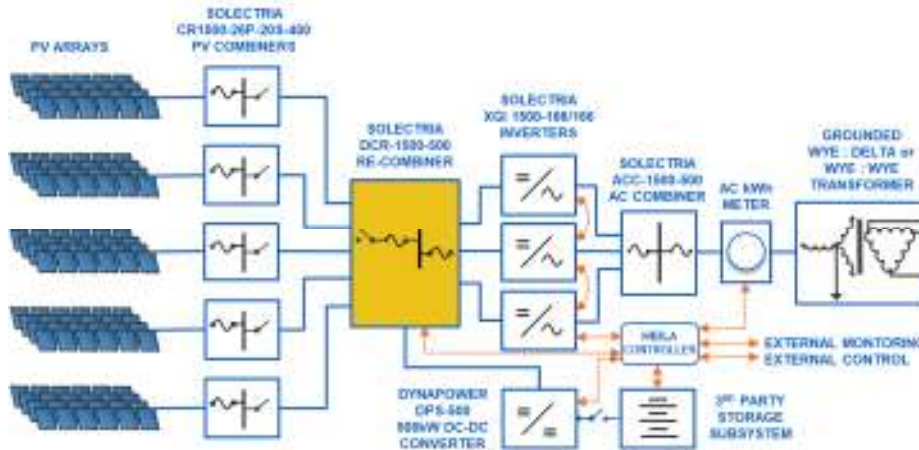


Figure 2.1 – Illustrated Usage of the DCR-1500 Re-Combiner in the SOLECTRIA PVS-500 Energy Storage System

The DCR-1500 Re-Combiner (see Fig 2.2) performs the following basic functions:

(1) PV Output Circuit Connections:

- Disconnect switches for 5 separate PV Output Circuits (originating in Solectria CR1500-400 PV Source Circuit Combiners located in the PV array field)
- Provisions on the disconnect switches for field-wired connections
- Overcurrent protection fuses
- Connection from all PV Output Circuits to the DC bus in the Re-Combiner

(2) Solectria XGI 1500 Inverter Connections:

- Connection from the main DC bus to overcurrent protection sized expressly for the three XGI 1500 inverters.
- Terminal blocks for the factory wiring connections from the Re-Combiner to the three XGI 1500 inverters.

(3) Dynapower DC-DC Converter (DPS-500 or -250) Connections:

- Factory pre-made internal connections.
- Overcurrent protection and a connection to the main DC bus. Note that a dc switch is located between the Dynapower DC-DC Converter and the storage subsystem.

(4) IMI Functionality: the DC Re-Combiner contains

- Sensors and circuitry for the XGI 1500 inverters' Isolation Monitor Interruptor functionality
- Factory-wired communications cable from the IMI circuitry to each of the XGI 1500 inverters

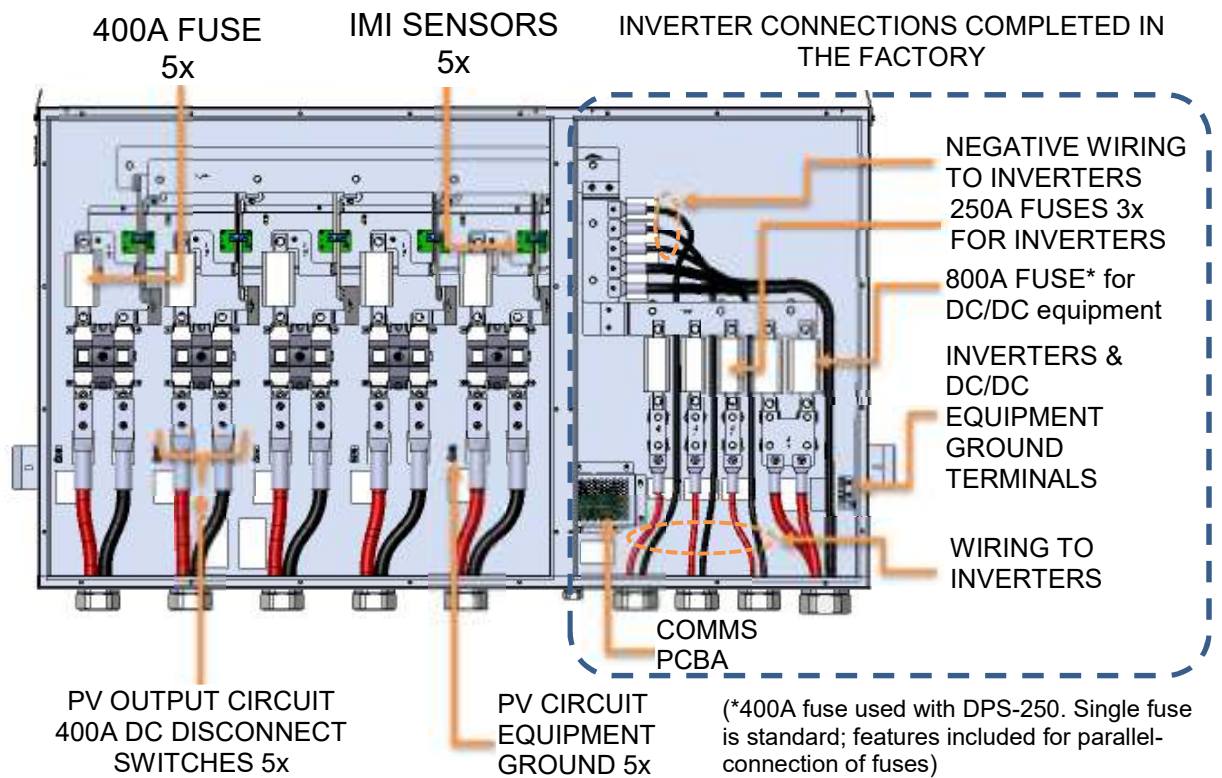
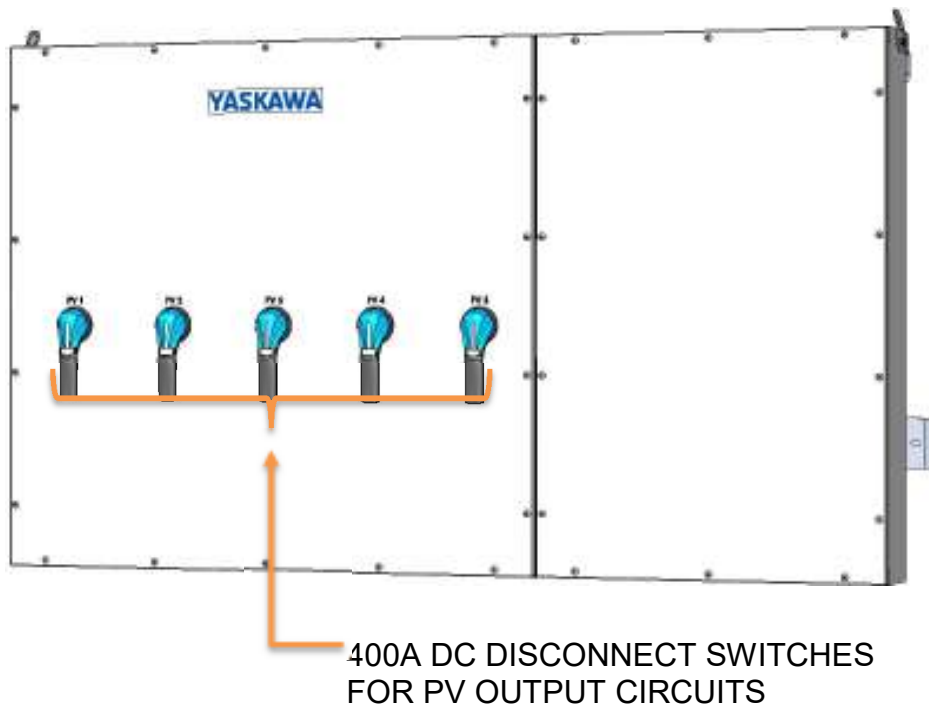


Figure 2.2 - The DCR-1500 DC Re-Combiner Components

3. RATINGS AND SPECIFICATIONS

3.1 Specifications

DCR-1500-500, DCR-1500-250 SPECIFICATIONS			
PV OUTPUT CIRCUITS (<i>FIELD WIRED from PV Source Circuit Combiners</i>)			
Maximum Wire Size Compatibility	Cu: 1 or 2 cond, 500 kcmil; 1 cond, 750 kcmil Al: 1 or 2 cond, 500 kcmil; 1 cond, 750 kcmil EGC: 14 AWG – 2 AWG		
Overcurrent Protection	400A Fuse, positive polarity only		
Maximum Voltage	1500 VDC		
Maximum Current (Maximum Current per circuit depends on the number of PV Output Circuits connected)		DCR-500	DCR-250
	Combined	1,093 A	609.1 A
	Indiv Ckt (5)	219 A	122 A
	Indiv Ckt (4)	273 A	152 A
	Indiv Ckt (3)	273 A	203 A
	Indiv Ckt (2)	305 A	305 A
Positions	5 PV Output Circuit Positions (switch & fuse)		
DC Disconnect Switch	Integrated 400A, 2-pole, 1500 VDC		
XGI 1500 INVERTERS (<i>FACTORY PRE-WIRED and tested</i>)			
Wire Size	Conductors: 4/0 AWG Cu EGC: 4 AWG Cu		
Overcurrent Protection	250A fuse; positive polarity only		
Maximum Voltage	1500 VDC		
DC-DC CONVERTER (<i>FIELD-WIRED</i>)			
Maximum Wire Size Compatibility	Note: 2 conductors per pole (+ & -) Cu: 2 cond, 500 kcmil Al: 2 cond, 500 kcmil EGC: 1/0 AWG Cu, or 3/0 AWG Alum		
Overcurrent Protection	DPS-500: 800A DPS-250: 400A Positive polarity only		
DC-DC Converter: DC Disconnect Switch	Located on the DC-DC Converter		
MECHANICAL, ENVIRONMENTAL, SAFETY			
Ambient Temperature Range	-40°F to 140°F (-40C to +60C)		
Safety Certification & Listing / Certification Agency	Intertek, UL1741		
Standard Warranty	5 Years standard; 10 Year optional		
Enclosure Dimensions	Height:	43.3 in. (1100 mm)	
	Width:	74.8 in. (1900 mm)	
	Depth:	6.65 in. (169 mm)	
Enclosure Rating, Material, Weight	Type 3R, Polyester Powder-Coated Aluminum 192 lbs (87 kg)		

3.2 Temperature De-Rating

The DC Recombiner, DCR-1500-500, has a combined current rating of 1,093 Amps. This rated combined current is subject to temperature de-rating as in Figure 3.1 below.

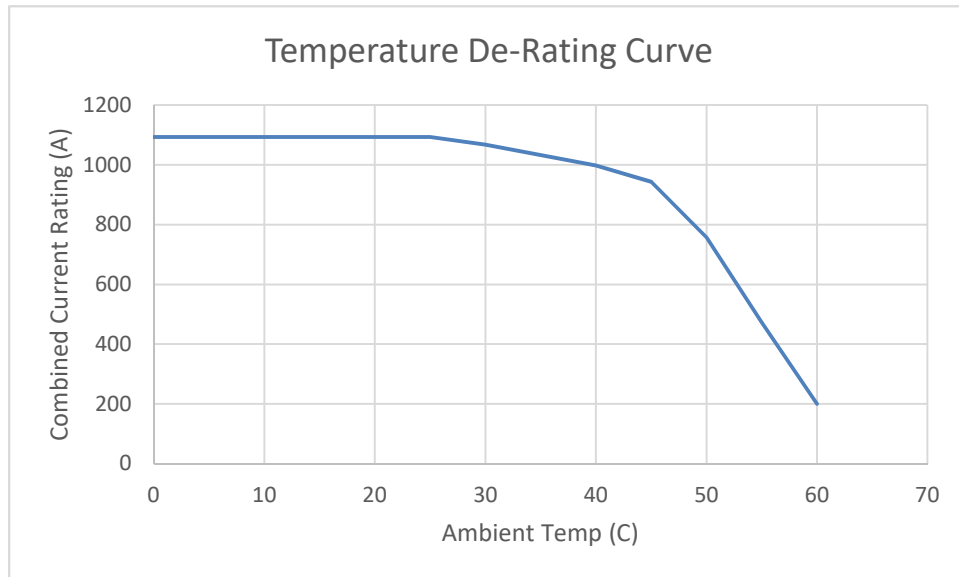


Fig. 3.1 DCR-1500-500 Temperature De-Rating Curve

Safe Design and Operation Guidelines



To maintain safe operation of the DC Re-Combiner, users should follow these guidelines.

- ✓ Design the PV subarrays to be identical: same PV modules, same number of modules in a source circuit, and the same number of source circuits in parallel.
- ✓ Populate the DC Re-Combiner with 2 - 5 PV Circuits.
- ✓ When shutting down the PV Array for any reason, turn off all five PV subarrays at the Re-Combiner. DO NOT disconnect a single subarray at any time.

4. MECHANICAL DETAILS

The DCR-1500 Re-Combiner comes pre-integrated as a component in the Solectria PVS-500 DC-Coupled Storage System. See Figures 4.1 – 4.3. The PVS-500 comprises an engineered rack that holds the DCR-1500 Re-Combiner, three XGI 1500 inverters, the AC Panel, and a Plant Master Controller (not shown). Except for the required field-wiring connections, the components on the rack are pre-wired and tested in the factory.

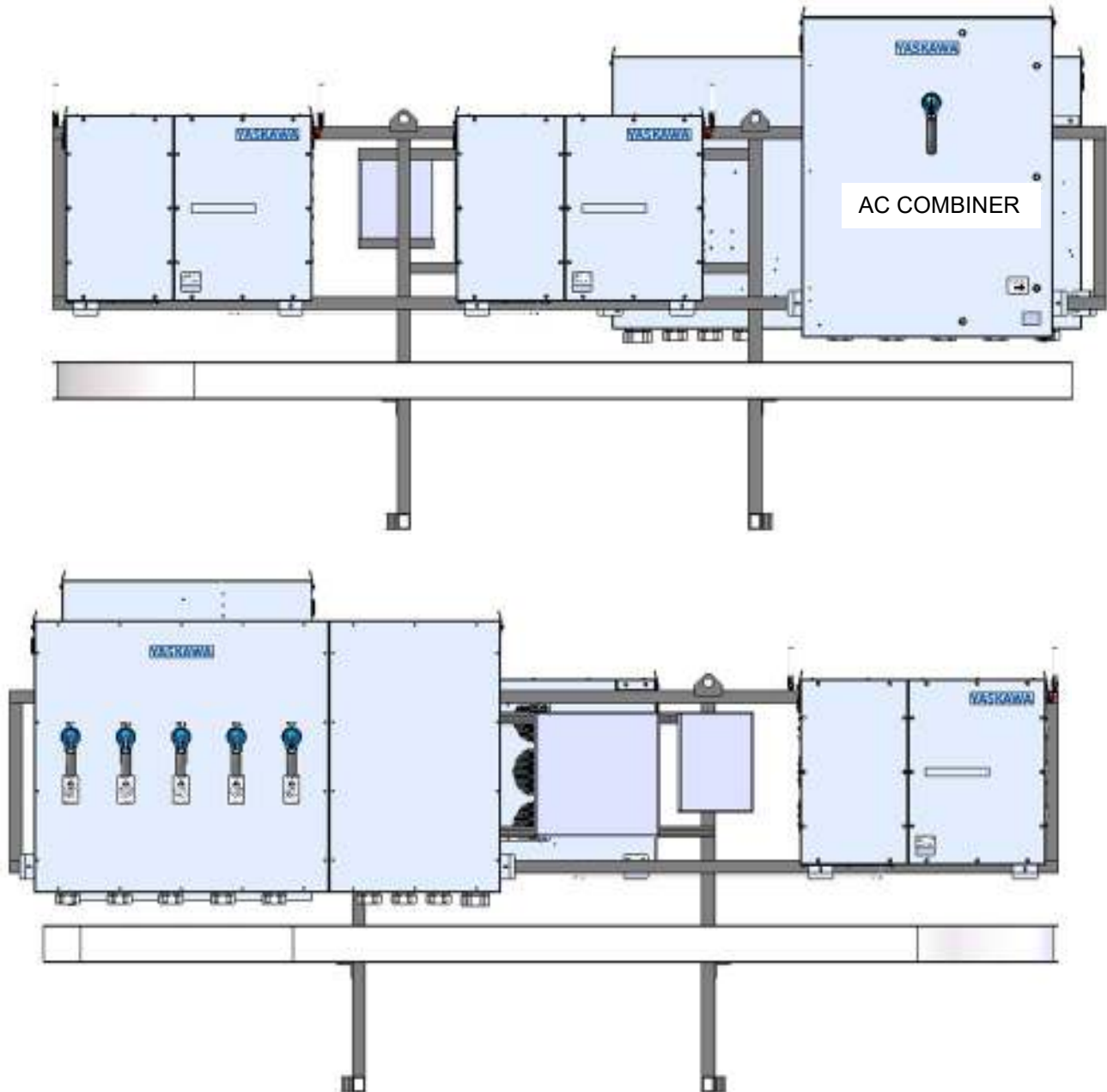


Fig. 4.1 Front and Back of the PVS-500 Rack-Mounted Equipment: AC Combiner, DC Re-Combiner, Controller and Power Supply, and three XGI 1500 Inverters (factory wiring not shown)

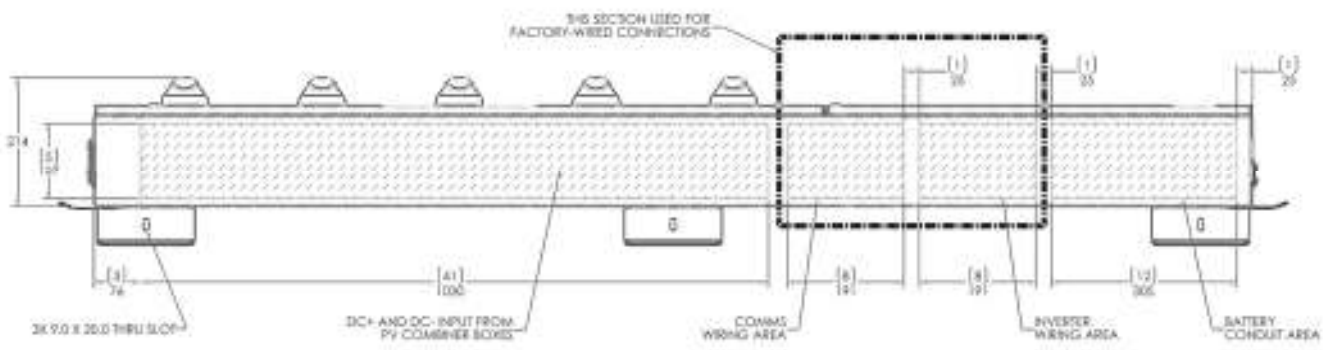
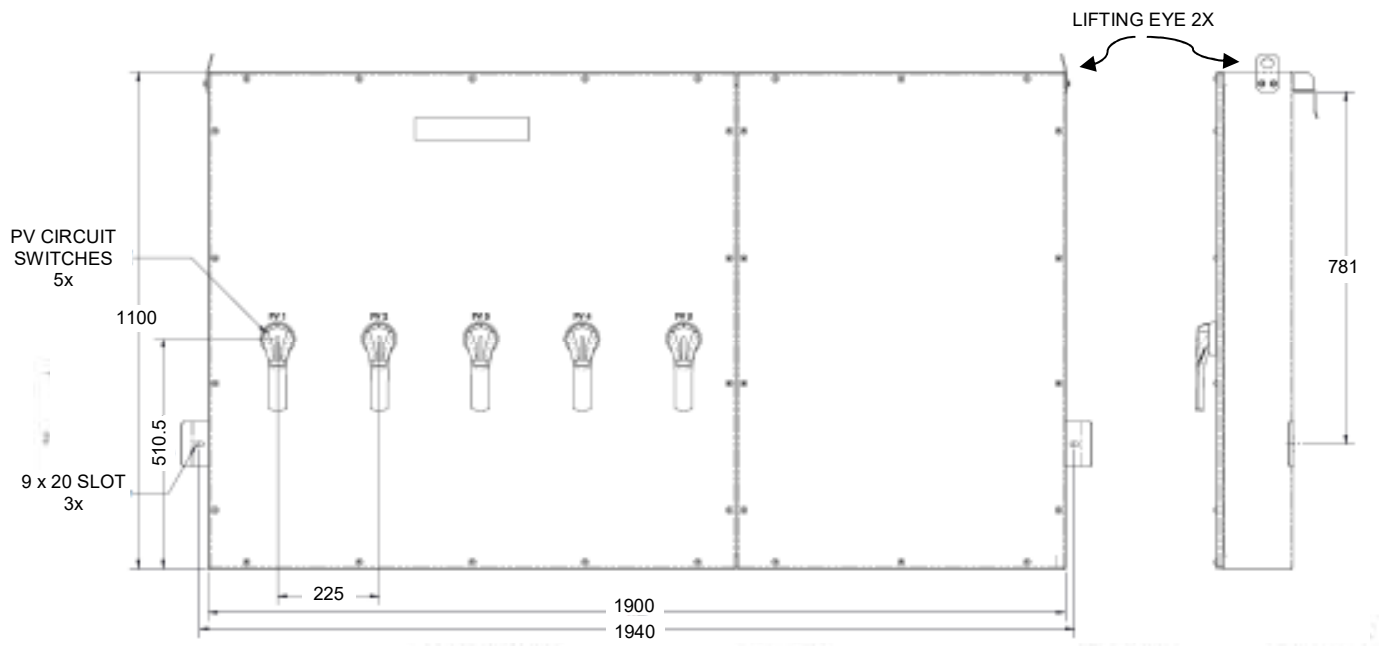


Fig. 4.2 Re-Combiner Dimensions (mm), Front, Side and Bottom Views

5. INSTALLATION and WIRING



Do not attempt to make connections to the Re-Combiner if not qualified for electrical work.

Completing the installation of the Re-Combiner (see Figure 5.1) requires: (1) field wiring from the (up-to-five) PV Output Circuits, originating in CR1500-400 PV Source Circuit Combiners in the PV array field, to the terminals in the Re-Combiner and (2) field wiring from the terminals in the DCR to the terminals in the Dynapower DC/DC Converter. In addition, the Re-Combiner has two factory pre-wired connections: DC power from the Re-Combiner to the DC input of the XGI 1500 inverters, and the communications wiring harness that also connects the Re-Combiner to the XGI 1500 inverters. Figure 5.1 shows the maximum wire compatibility for the field-wired connections, and the as-delivered factory-wired conductor specifications.

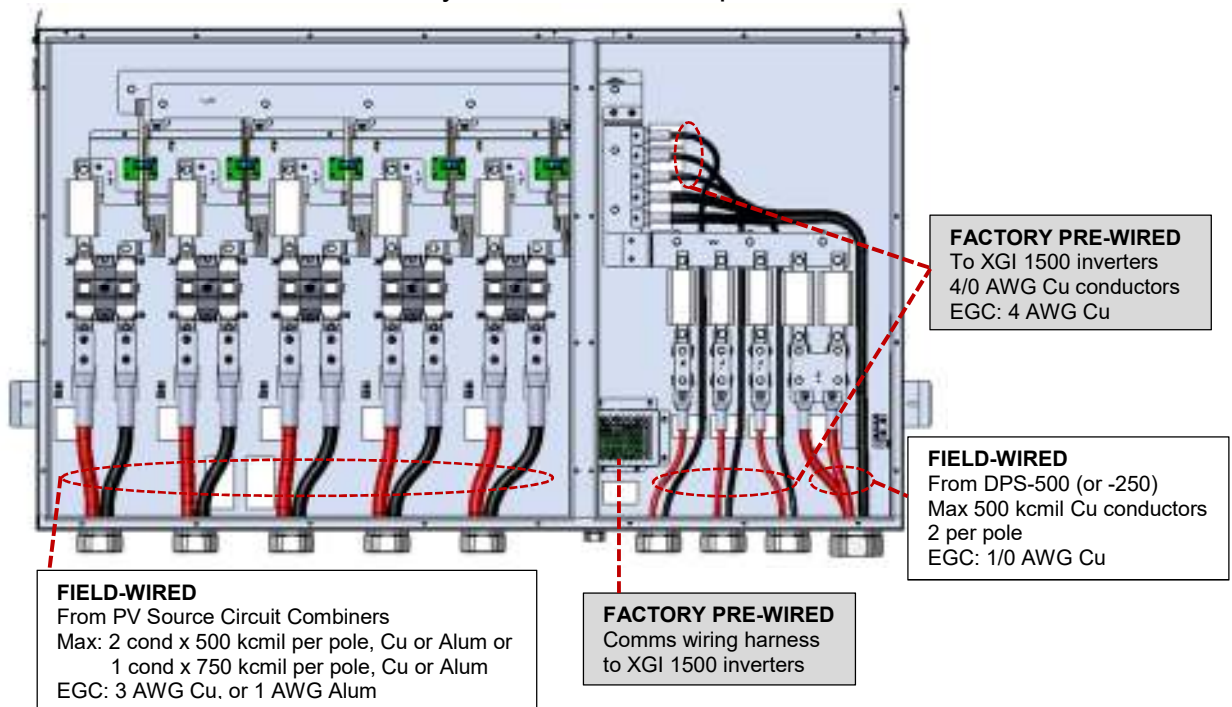


Figure 5.1 – Specs for Field Wiring to the DCR-1500 Re-Combiner

STEP 1: Disconnect all Equipment Before Wiring to the Re-Combiner

BEFORE removing the Re-Combiner's covers:



- ✓ Open all five DC switches on the Re-Combiner, and
- ✓ Open the DC switch between the Dynapower DC/DC Converter and the Battery Subsystem, to disconnect the batteries from the system.

STEP 2: De-Energize the PV Conductors



PV arrays can create hazardous DC voltages. Do not attempt to connect the PV circuits to the Re-Combiner until all PV conductors are confirmed to be de-energized.

1. Use a multi-meter to check for DC voltage and confirm that the PV Output Circuit conductors, coming from the CR1500-26-20S-400 PV Source Circuit Combiners in the array field, are de-energized.
2. If DC voltage is present, locate the PV Source Circuit Combiners and open all DC disconnect switches, then re-measure.
3. DO NOT PROCEED until the conductors are confirmed to be de-energized.

STEP 3: Prepare the Enclosure for Conduits

1. Remove the left-side cover from the Re-Combiner; save all fasteners for later re-installation.
2. Note the target area for conduit connections for the PV circuits on the bottom face of the Re-Combiner, as shown in Figure 5.2.
3. Add the necessary holes for the conduits for PV Output Circuit entries. The Re-Combiner accepts up to 5 separate PV Output Circuits.
4. Be sure to remove any metal shavings and debris from the inside of the Re-Combiner.

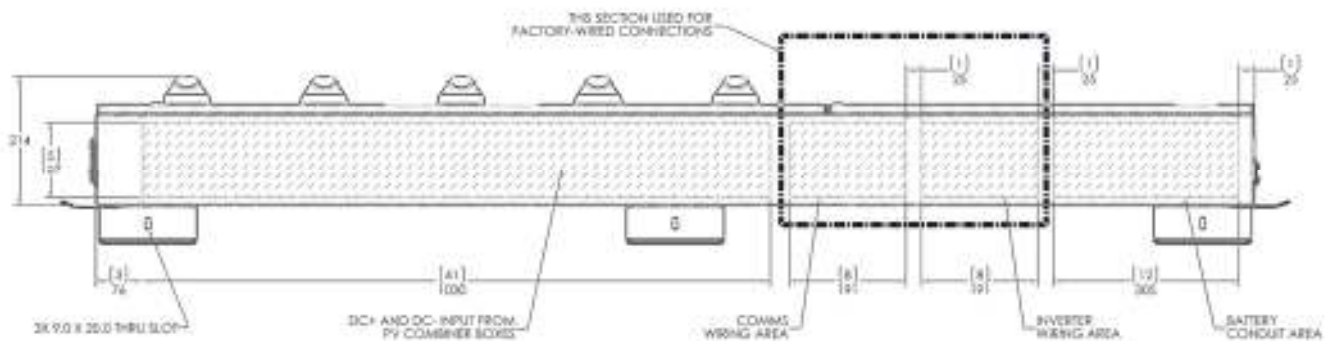


Figure 5.2 – Bottom face of the Re-Combiner, showing the area for conduit connections for the PV circuits, and the area with the factory-wired Communications Cable, and DC +/- to the XGI 1500 Inverters. All dimensions in millimeters.

SPECIAL INSTRUCTIONS

PRECAUTIONS FOR ALUMINUM WIRE AND CONDUIT SEALING

Aluminum Conductors



Aluminum oxidizes quickly when exposed to the atmosphere. An oxidized layer is a poor conductor that could lead to thermal issues, production loss, or damage to the Re-Combiner.

When using aluminum conductors, follow these steps to prepare the conductors.

1. Prepare one wire at a time.
2. Remove the appropriate insulation from the wire.
3. Using a wire brush, remove the oxidized outer layer from the aluminum conductors.
4. Immediately apply a neutral dielectric grease, such as Ideal NOALOX® anti-oxidant compound, and connect the aluminum cable to the terminal.
5. If the connection is not made within 30 seconds of applying the compound, repeat this process, as an oxidized layer may have formed on the conductor.

Conduit Connections



Conduits connected to an outdoor enclosure can introduce water vapor into the enclosure and lead to the formation of condensation inside. Failure to follow these guidelines can result in water intrusion into the unit through the conduit connections and may void the warranty.

Follow these instructions and best practices when securing conduits to the Re-Combiner.

1. Use UL514B certified water-tight conduit fittings and proper installation methods to provide a water-tight connection that will maintain the Type 3R rating of the enclosure.
2. Use an appropriately-rated sealant and seal the conduits fully to prevent the exchange of air between the conduit and the enclosure. Sealing the conduit will help prevent condensation in the enclosure.

STEP 4: PV Output Circuit Wiring Terminations in the Re-Combiner

The PV Output Circuit conductors terminate on tabs extending from the DC switch. The tabs are factory-supplied with dual studs to maintain conductor alignment. Figure 5.3 illustrates the terminations and the sections below identify the relevant specifications. Note that users must supply the Crimp Lug and Fasteners as defined.

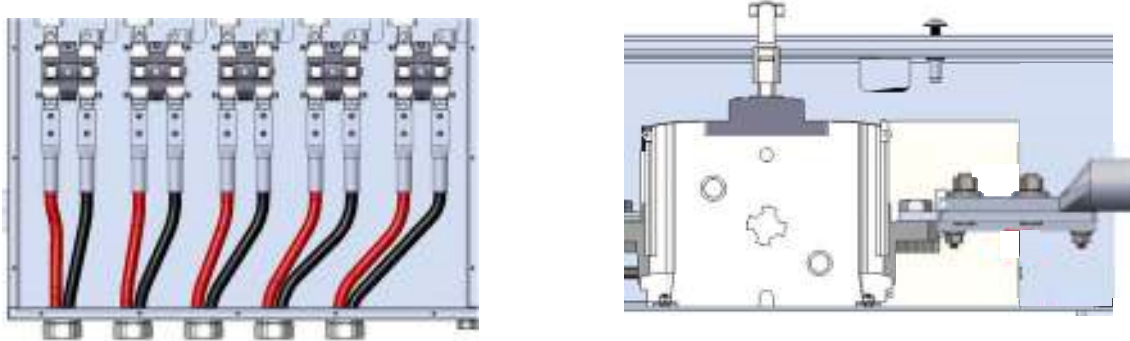
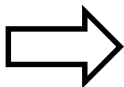


Figure 5.3 – PV Output Circuit Conductors Terminations



Positive polarity conductors (red wires in Fig 5.3) connect to a fuse. Confirm polarity and fuse connection for positive conductors.

Lugs

Compression lugs are NOT provided with the DCR Re-Combiner. The lugs must conform to the specifications given in the table below:

Lug Type	Plating & Material	Max. Tongue Width	Hole Size	Temp Rating
Two-Hole	Tin Plated Cu	1.95 in	for M8 stud	90C
Max distance from hole center to end of lug			14 mm	

Conductors

Max Allowable Conductor Size	Cu or Alum, 90C temp rating 1 or 2 cond at 500 kcmil 1 cond at 750 kcmil
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Conductor Termination

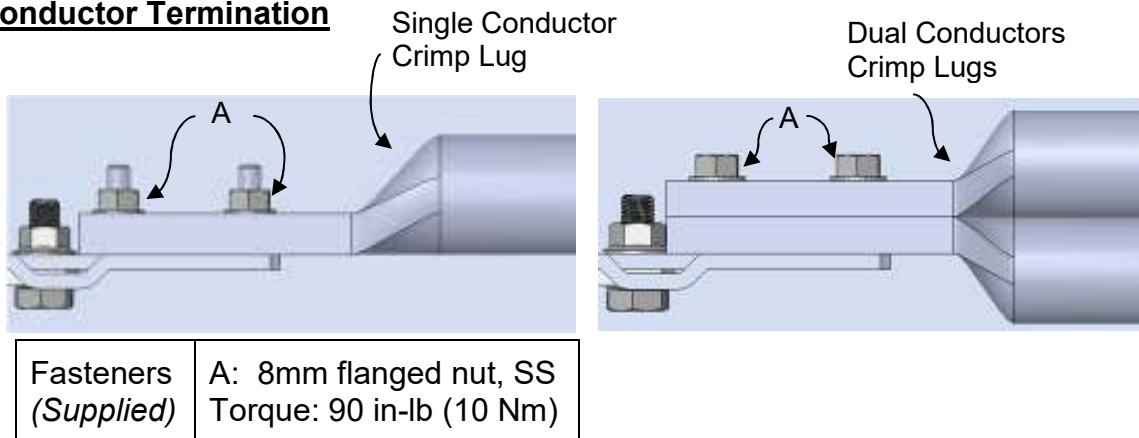
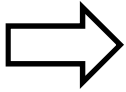


Fig. 5.4 – Single and Dual Conductor Terminations

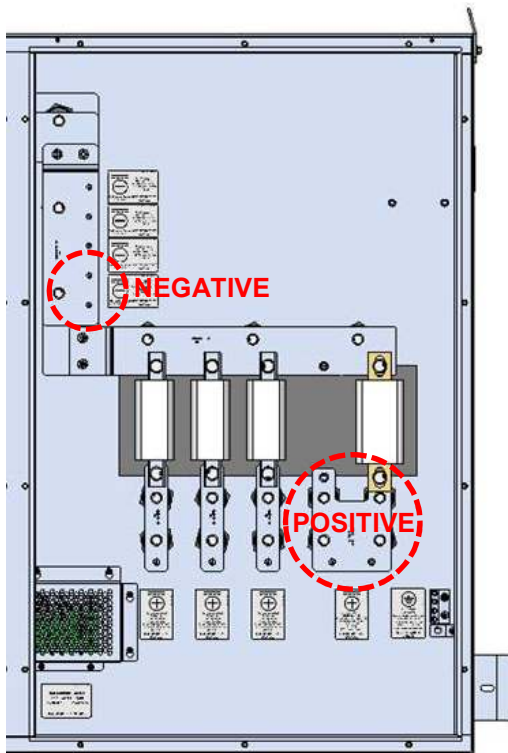
STEP 5: DynaPower DC/DC Converter Conductor Termination

The Re-Combiner provides terminals for the conductors to the Dynapower DC/DC Converter. The user is responsible to route, secure and properly terminate these conductors to the Dynapower DC/DC Converter.



See the DynaPower DC/DC Converter Installation User Manual for making connections to that unit.

Conductors



Max Input / Output Current	DPS-500: 500 A DPS-250: 312.5A
DC Re-Combiner No. of Terminals	2 per pole (2 pos, 2 neg)
Terminals	Negative: 2 x 8mm Stud 40mm wide plate Positive: 2 x 10mm Stud 35mm wide plate
Max Conductor Recommendation	350kcmil, 90C rated 2 per Pole

Fig. 5.5 – DynaPower DC/DC Converter Conductor Terminations inside the Re-Combiner

STEP 6: Equipment Ground Wiring

Terminals are provided in the Re-Combiner for all Equipment Grounding Conductors (EGCs) associated with the PV Source Circuits, DynaPower DC/DC Converter and XGI 1500 inverters. NOTE: the Re-Combiner comes from the factory with the XGI 1500 inverters and Dynapower DC/DC Converter Equipment Ground Conductors pre-wired to ground lugs. Torque each EGC for the PV Source Circuits per the specifications below.

PV Equipment Ground Lugs (5x)

14 AWG – 2 AWG Torque to 20 in-lb, Slotted Screw Cu or Al Conductors

Final Steps



Verify the proper polarity of each conductor. Polarity reversal can lead to dangerous conditions capable of harming personnel and equipment.



Check the Re-Combiner for tools and debris; ensure that the unit is clean and orderly.

1. Verify that all connections meet the requirements of this User's Manual.
2. Secure the Re-Combiner cover, ensuring that all fasteners are in place.
3. Consult the startup and commissioning procedures for the PVS-500 before energizing.

6. OPERATING INSTRUCTIONS

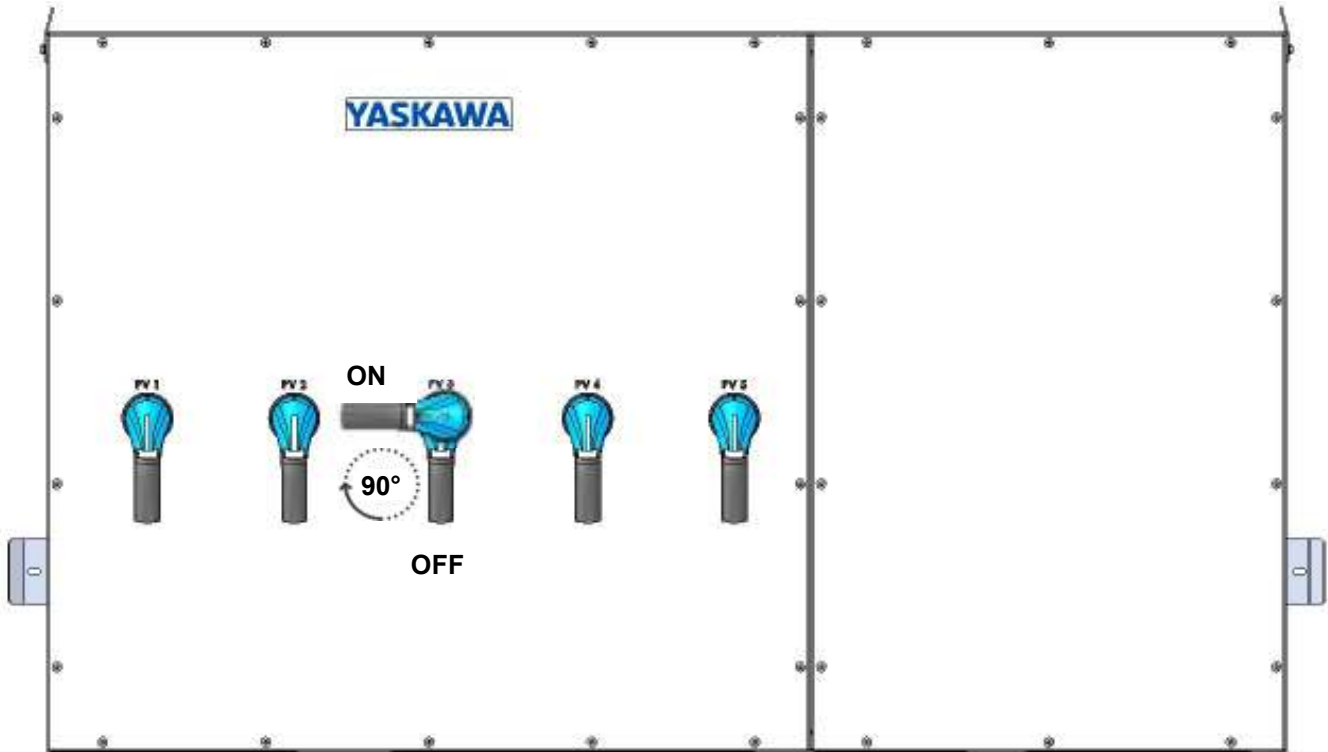


Fig. 6.1 – Re-Combiner Switches On/Off Positions

The Re-Combiner contains five user-operable disconnect switches for the PV Output Circuit inputs (see Fig. 6.1). When the disconnect switch handle is in the OFF position, the circuit is open between the PV Output Circuit and the DC bus in the Re-Combiner. Conversely, when the disconnect switch is in the ON position, the circuit is closed between the PV Output Circuit and the DC Bus in the Re-Combiner.

The disconnect switch is rated for 400A, is fully load-break rated and can be safely operated under normal operating conditions when installation is per this User's Manual and all warnings and ratings are observed.

⇒ All Disconnect Switches must be OFF before working on the Re-Combiner.

⇒ See also the User's Manual for the **PVS-500 Energy Storage System**.

7. WARRANTY & RMA INSTRUCTIONS

For warranty information, please visit: <http://solectria.com/support/documentation/warranty-information/grid-tied-inverter-warranty-letter/>

8. APPENDICES

Appendix A – Contact Information

Yaskawa Solectria Solar
360 Merrimack Street
Building 9, Suite 221
Lawrence, MA 01843 USA
Tel: 978.683.9700
Fax: 978.683.9702

Sales/General Info: inverters@solectria.com
Customer Support: 978-683-9700 x2
Website: www.solectria.com

Appendix B - UL1741 Authorization to Mark