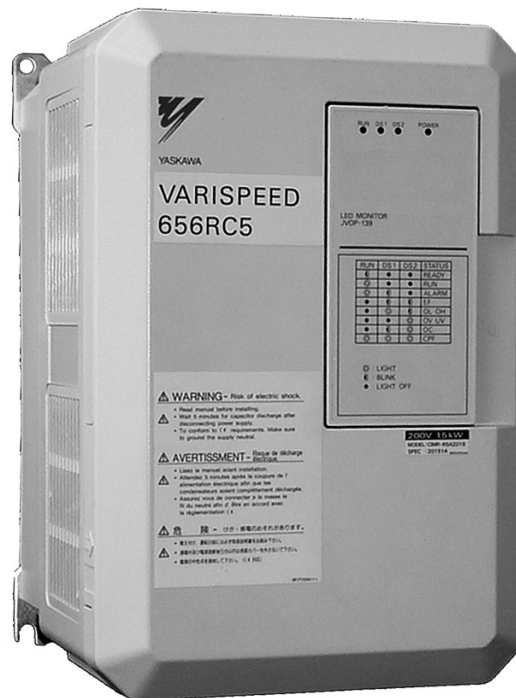




VARISPEED-656RC5

Instruction Manual

POWER REGENERATIVE UNIT (VS-656RC5)

MODEL: CIMR-R5U
200V CLASS 3.7 to 37kW
400V CLASS 3.7 to 75kW

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.



WARNING

YASKAWA manufactures component parts that can be used in a wide variety of industrial applications. The selection and application of YASKAWA products remain the responsibility of the equipment designer or end user. YASKAWA accepts no responsibility for the way its products are incorporated into the final system design.

Under no circumstances should any YASKAWA product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically and fail safely under all circumstances. All products designed to incorporate a component part manufactured by YASKAWA must be supplied to the end user with appropriate warnings and instructions as to that part's safe use and operation. Any warnings provided by YASKAWA must be promptly provided to the end user.

YASKAWA offers an express warranty only as to the quality of its products in conforming to standards and specifications published in YASKAWA's manual. **NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS OFFERED.** YASKAWA assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

PREFACE

YASKAWA's VS-656RC5 is a power regenerative unit which has both braking and regenerative functions. This instruction manual describes installation, maintenance, inspection, troubleshooting, and specifications of the VS-656RC5. Read this instruction manual thoroughly before operation.

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General Precautions

- Some drawings in this manual are shown with the protective covers and shields removed, in order to illustrate detail with more clarity. Make sure all covers and shields are replaced before operating this product.
- This manual may be modified when necessary to reflect improvements to the product, or changes in specifications.
Such modifications are denoted by a revised manual No.
- To order a copy of this manual, contact your YASKAWA representative.
- YASKAWA is not responsible for any modification of the product made by the user. Any modifications will void the warranty.

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NOTES FOR SAFE OPERATION

Read this instruction manual thoroughly before installation, operation, maintenance or inspection of the RC5. In this manual, NOTES FOR SAFE OPERATION are classified as “WARNING” or “CAUTION”.



Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.



Indicates a potentially hazardous situation which, may result in minor or moderate injury to personnel, and possible damage to equipment if not avoided. It may also be used to alert against unsafe practices.

Items described in  CAUTION may also result in a vital accident in some situations. In either case, follow these important notes.

The warning symbols for ISO and JIS standards are different, as shown below.

ISO	JIS
	

The ISO symbol is used in this manual. Both of these symbols appear on the warning labels on Yaskawa products. Please abide by these warning labels regardless of which symbol is used.



These are steps to be taken to ensure proper operation.

RECEIVING

CAUTION	
	(Ref. page)
Do not install or operate any power regenerative unit which is damaged or has missing parts. Failure to observe this caution may result in personal injury or equipment damage	11

(Ref. page)

- Do not install or operate any power regenerative unit which is damaged or has missing parts.
Failure to observe this caution may result in personal injury or equipment damage 11

INSTALLATION

CAUTION

(Ref. page)

- Lift the cabinet by the base. When moving the unit, never lift by the front cover or the front panel. Otherwise, the main unit may be dropped causing damage to the unit. 19
- Mount the power regenerative unit on nonflammable material (i.e., metal). Failure to observe this caution can result in a fire. 19
- When mounting units in an enclosure, install a fan or other cooling device to keep the intake air temperature below 113°F (45°C). Overheating may cause a fire or damage to the unit. 20

WIRING

WARNING

(Ref. page)

- Start wiring only after verifying that the power supply is turned OFF for at least one minute. Failure to observe this warning can result in electric shock or fire. 25
- Wiring should be performed only by qualified personnel. Failure to observe this warning can result in electric shock or fire. 25
- Make sure to ground the ground terminal  before connecting the other terminals. Failure to observe this warning can result in an electric shock or a fire. 25
- Make sure to ground the ground terminal  according to the local ground code. Failure to observe this warning can result in electric shock or fire. 25

 CAUTION

(Ref. page)

- Verify that the power regenerative unit rated voltage coincides with the AC power supply voltage.
Failure to observe this caution can result in personal injury or fire..... 25
- Do not perform a withstand voltage test of the power regenerative unit.
It may cause semi-conductor elements to be damaged. 25
- Connect the power coordination reactor and the power suppression reactor as described in this instruction manual.
Improper connection may cause a fire.. 25
- Verify that the rated voltage of the power regenerative unit coincides with the rated voltage of the power regenerative unit to be connected.
Failure to observe this caution can result in a fire..... 25
- Tighten terminal screws.
Failure to observe this caution can result in a fire..... 25

OPERATION

 WARNING	
	(Ref. page)
• Only turn ON the input power supply after replacing the front cover or the terminal cover. Do not remove the cover while the power is ON. Failure to observe this warning can result in electric shock. 35 • Never operate the digital operator or other switches when your hand is wet. Failure to observe this warning can result in electric shock. 35 • Never touch the terminals while power is ON, even if the power regenerative unit is at stop. Failure to observe this warning can result in electric shock. 35	
 CAUTION	
	(Ref. page)
• Never touch the heatsink or input reactor since the temperature is very high. Failure to observe this caution can result in harmful burns to the body. 35 • All the parameters of the power regenerative have been preset at the factory. Do not change the settings unnecessarily. The power regenerative unit may be damaged.35	

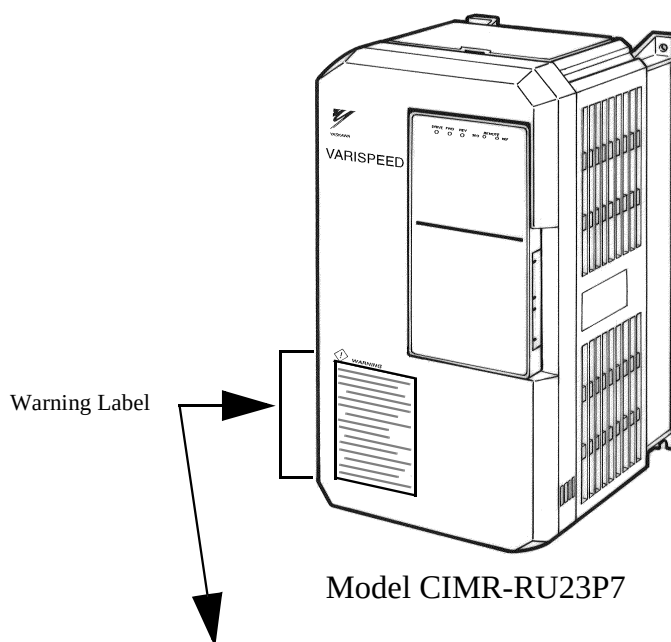
MAINTENANCE AND INSPECTION

 WARNING	
	(Ref. page)
• Never touch high-voltage terminals in the power regenerative unit Failure to observe this warning can result in an electrical shock. 42 Perform maintenance or inspection only after verifying that the CHARGE LED goes OFF, after the main circuit power supply is turned OFF. The capacitors are still charged and can be dangerous. 42 • Only authorized personnel should be permitted to perform maintenance, inspections or parts replacement. [Remove all metal objects (watches, bracelets, etc.) before operation.] (Use tools which are insulated against electrical shock.) Failure to observe this warning can result in an electrical shock. 42 • Never modify the product. Failure to observe this warning can result in an electric shock or personal injury and will void the warranty. 42	

 CAUTION	
	(Ref. page)
• The power regenerative unit employs semi-conductor elements. Do not touch the CMOS elements. They are easily damaged by static electricity. 42 • Do not connect or disconnect wires or connectors while power is applied to the circuit. Failure to observe this caution can result in personal injury. 42	

WARNING LABEL

A warning label is displayed on the front cover of the power regenerative unit, as shown below. Follow these instructions when handling the power regenerative unit.



	WARNING - Risk of electric shock.
	• Read manual before installing. • Wait 5 minutes for capacitor discharge after disconnecting power supply. • To conform to CE requirements, make sure to ground the supply neutral.
	AVERTISSEMENT - Risque de décharge électrique
	• Lisez le manuel avant installation. • Attendez 5 minutes après la coupure de l'alimentation électrique afin que les condensateurs soient complètement déchargés. • Assurez vous de connecter a la masse le fil du neutre afin d'être en accord avec la réglementation CE.
	危険 - けが・感電のおそれがあります。
	• 据え付け、運転の前には必ず取扱説明書をお読み下さい。 • 通電中及び電源遮断後5分以内は表面カバーを外さないでください。 • 電源の中性点を接地して下さい。(CE 対応)

1. RECEIVING

CAUTION

- Do not install or operate any power regenerative unit which is damaged or has missing parts.
Failure to observe this caution may result in personal injury or equipment damage.

1.1 Inspection Checkpoints

After unpacking the RC5, check the following:

- Verify that the part numbers match your purchase order or packing slip.
- Check the unit for physical damage that may have occurred during shipping.

If any part of RC5 is missing or damaged, call for service immediately.

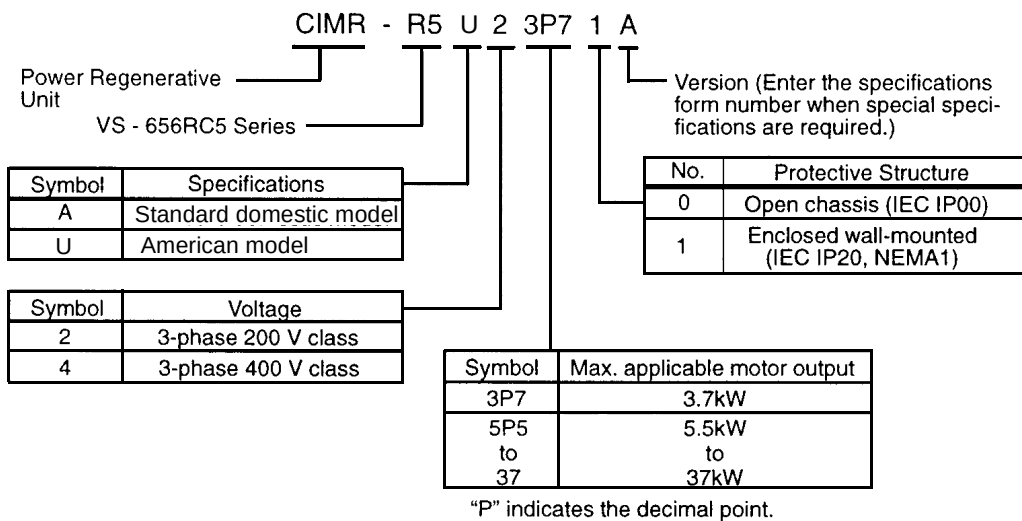
- ## Checking the Nameplate

Example of standard domestic model CIMR-R5U23P7

Nameplate Data

Power Regenerative Unit Model	MODEL	: CIMR- R5U23P7	
Input Spec.	INPUT	AC 3PH 200 - 220V 50Hz 200-230V 60Hz	10A 1min 25%ED
Output Spec.	OUTPUT	: DC 300 - 340V 13A 1min 25%ED	
Power Regenerative Unit Spec.	SPEC	: 23P71A	
Lot No.	LOT NO	:	MASS : 4.5 kg ← Mass
Serial No.	SER NO	:	
		 YASKAWA ELECTRIC CORPORATION	JAPAN MS

Model Designation



Protective Structure

- Open Chassis Type (IEC IP00)

Protected so that parts of the human body cannot reach electrically charged parts from the front when the Power regenerative unit is mounted in a control panel.

- Enclosed Wall-mounted Type (IEC IP20, NEMA 1)

The power regenerative unit is structured so that the power regenerative unit is shielded from the exterior, and can thus be mounted to the interior wall of a standard building (not necessarily enclosed in a control panel). The protective structure conforms to the standards of NEMA 1 in the USA.

2. SPECIFICATIONS



1. Use 1 to 1 with an inverter. Do not connect more than one inverter to one power regenerative unit.
2. Use the power regenerative unit whose capacity is equal to or exceeding the inverter capacity to be combined.
3. Do not use this unit with single-phase power. Use three-phase power.

2.1 Standard Specifications (200V Class)

Voltage Class		200V								
Model CIMR-R5U□		23P7	25P5	27P5	2011	2015	2018	2022	2030	2037
Rating	Rated Capacity (kW)	3.7	5.5	7.5	11	15	18.5	22	30	37
	Rated DC Current (A)	13	19	26	37	51	64	77	102	126
	Rated Current on Power Side (A)	10	15	20	30	40	50	60	80	100
	Regenerative Torque	100% for 1 minute, 25% ED, 80% continuous								
Input Power Supply	Voltage Frequency	200 to 220 VAC 50 Hz, 200 to 230 VAC 60 Hz								
	Allowable Voltage Fluctuation	+10 to -15% (Imbalance rate between phases: within 2%)								
	Allowable Frequency Fluctuation	±3Hz (No phase rotation)								
Control Characteristics	Control Method	120° current conduction								
	Input Power Factor	0.9 or more (Rated current)								
	Overload Capacity	30 seconds at approx. 150% of rated current								
Operation Input		External terminals								
Status Output	Fault	I C contact output								
	Running, READY Signal	Photocoupler output								
	Analog Output	Analog output: 1 point can be selected (current monitor)								
Protective Functions	Instantaneous Overcurrent	Stops at approx. 200% of the current on power side								
	Blown fuse	Stops by blown fuse								
	Overload	Stops after 30 seconds at 150% of rated current								
	Under voltage (DC Voltage)	Stops at approx. 190 VDC or less.								
	Under voltage (Power Side Voltage)	Stops at approx. 150 VAC or less.								
	Overload	Stops at approx. 400 VDC or more.								
	Fin Overheat	Protected by thermistor								
	Power Supply Open Phase	Stops at power supply open phase detection.								
	Power Frequency Error	Stops by fluctuation more than ±3Hz of rated input frequency.								
	Power Charge Indication	Indicated until main output voltage is approx. 50V or less.								

Voltage Class		200V								
Model CIMR-R5U□		23P7	25P5	27P5	2011	2015	2018	2022	2030	2037
Environmental Conditions	Location	Indoor (Protected from corrosive gases and dust)								
	Ambient Temperature	14°F (-10° C) to 104° F (40° C) (Enclosed wall-mounted type) 14° F (-10° C) to 113° F (45° C) (Open chassis type)								
	Humidity	90% RH or less (non-condensing)								
	Vibration	9.8 m/s ² (1G) at less than 20 Hz, up to 1.96 m/s ² (0.2G) at 20 to 50 Hz								

* Use a power regenerative unit with larger output capacity if the imbalance rate between phases exceeds 2%.

Imbalance rate between phases can be calculated using the following formula (Conforming to IEC1800-3).

$$\text{Imbalance rate between phases [\%]} = \frac{\text{Max voltage} - \text{Min. voltage}}{\text{Three-phase average voltage}} \times 67$$

2.2 Standard Specifications (400V Class)

Voltage Class		400V											
Model CIMR-R5U□		43P7	45P5	47P5	4011	4015	4018	4022	4030	4037	4045	4055	4075
Rating	Rated Capacity (kW)	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75
	Rated DC Current (A)	6	9	13	19	26	32	37	51	64	77	96	128
	Rated Current on Power Side (A)	5	7.5	10	15	20	25	30	40	50	60	75	100
	Regenerative Torque	100% for 1 minute, 25% ED, 80% continuous											
Input Power Supply	Voltage Frequency	380 to 460 VAC, 50/60 Hz											
	Allowable Voltage Fluctuation	+10 to -15% (Imbalance rate between phases: within 2%)											
	Allowable Frequency Fluctuation	±3Hz (No phase rotation)											
Control Characteristics	Control Method	120° current conduction											
	Input Power Factor	0.9 or more (Rated current)											
	Overload Capacity	30 seconds at approx. 150% of rated current											
Operation Input		External terminals											
Status Output	Fault	I C contact output											
	Running, READY Signal	Photocoupler output											
	Analog Output	Analog output: 1 point can be selected (current monitor)											
Protective Functions	Instantaneous Overcurrent	Stops at approx. 200% of the current on power side											
	Blown fuse	Stops by blown fuse											
	Overload	Stops after 30 seconds at 150% of rated current											
	Under voltage (DC Voltage)	Stops at approx. 190 VDC or less.											
	Under voltage (Power Side Voltage)	Stops at approx. 150 VAC or less.											
	Overload	Stops at approx. 400 VDC or more.											
	Fin Overheat	Protected by thermistor											
	Power Supply Open Phase	Stops at power supply open phase detection.											
	Power Frequency Error	Stops by fluctuation more than ±3Hz of rated input frequency.											
	Power Charge Indication	Indicated until main output voltage is approx. 50V or less.											

Voltage Class		400V											
Model CIMR-R5U□		43P7	45P5	47P5	4011	4015	4018	4022	4030	4037	4045	4055	4075
Environmental Conditions	Location	Indoor (Protected from corrosive gases and dust)											
	Ambient Temperature	14° F (-10°C) to 104° F (40° C) (Enclosed wall-mounted type) 14° F (-10° C) to 113° F (45° C) (Open chassis type)											
	Humidity	90% RH or less (non-condensing)											
	Vibration	9.8 m/s ² (1G) at less than 20 Hz, up to 1.96 m/s ² (0.2G) at 20 to 50 Hz											

Use a power regenerative unit with larger output capacity if the imbalance rate between phases exceeds 2%.

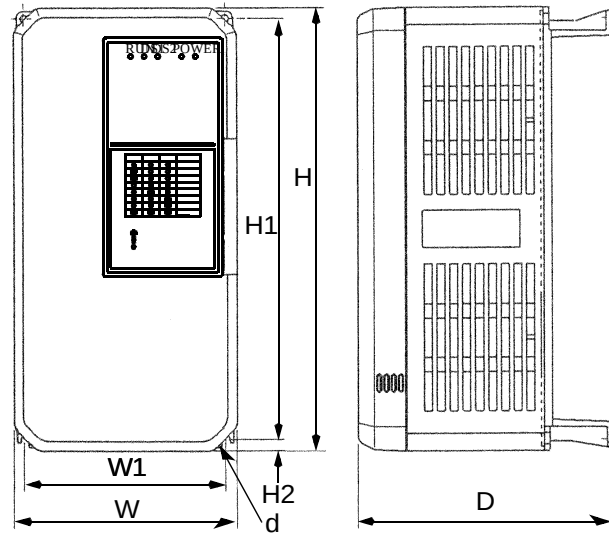
Imbalance rate between phases can be calculated using the following formula (Conforming to IEC1800-3).

$$\text{Imbalance rate between phases [\%]} = \frac{\text{Max voltage} - \text{Min. voltage}}{\text{Three-phase average voltage}} \times 67$$

2.3 Dimensions

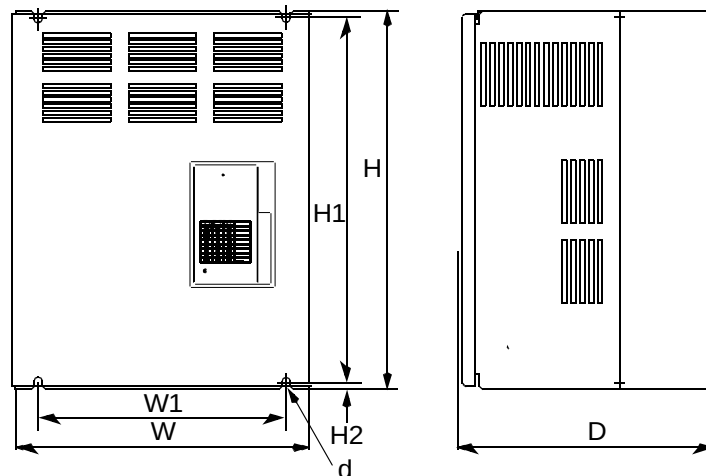
Models of 200V/400V 30 kW and Lower

The following figure shows a 200V 3.7kW model. Use open chassis type 200V/400V 30kW and lower with the top and bottom covers removed.



Models of 200V/400V 37 kW and Higher

The following figure shows a 200V/400V 3.7kW model.



Dimensions in inches (mm)/mass (kg)

Voltage	VS-656RC5U	Open Chassis Type (IPOO)							Enclosed Wall-Mounted (IP20)							Mounting Hole
		Dimensions in/mm			Mounting Dimensions in/mm			Approx. Mass (kg)	Dimensions in/mm			Mounting Dimensions in/mm			Approx. Mass (kg)	
		W	H	D	W1	H1	H2		W	H	D	W1	H1	H2		
200V Class	23P7															M5
	25P5	5.51 (140)	11.02 (280)	7.08 (180)	4.96 (126)	10.47 (266)	0.275 (7.0)	4.5	5.51 (140)	11.02 (280)	7.08 (180)	4.96 (126)	10.47 (266)	0.275 (7.0)	4.5	
	27P5															
	2011	7.87 (200)	11.81 (300)	8.07 (205)	7.32 (186)	11.22 (285)	0.314 (8.0)	5.5	7.87 (200)	11.81 (300)	8.07 (205)	7.32 (186)	11.22 (285)	0.314 (8.0)	5.5	M6
	2015							6							6	
	2018							10		14.96 (380)				0.295 (7.5)	10	M6
	2022	9.84 (250)	14.96 (380)	8.85 (225)	9.29 (236)	14.37 (365)	0.295 (7.5)		9.84 (250)		8.85 (225)	9.29 (236)	14.37 (365)			
	2030							11		15.74 (400)				1.08 (27.5)	11	
2037	12.79 (325)	17.71 (450)	11.22 (285)	10.82 (275)	17.12 (435)	0.295 (7.5)	23	12.99 (330)	24.01 (610)	11.22 (285)	10.82 (275)	17.12 (435)	3.44 (87.5)	27	M6	
400V Class	43P7							3.5							3.5	M5
	45P5	5.51 (140)	11.02 (280)	7.08 (180)	4.96 (126)	10.47 (266)	0.275 (7.0)	4	5.51 (140)	11.02 (280)	7.08 (180)	4.96 (126)	10.47 (266)	0.275 (7.0)	4	
	47P5															
	4011	7.87 (200)	11.81 (128)	8.07 (81)	7.32 (96)	11.22 (118)	0.314 (8.0)	6	7.87 (200)	11.81 (300)	8.07 (205)	7.32 (186)	11.22 (285)	0.314 (8.0)	6	M6
	4015															
	4018							10.5							10.5	M6
	4022	9.84 (250)	14.96 (380)	8.85 (225)	9.29 (236)	14.37 (365)	0.295 (7.5)		9.84 (250)	14.96 (380)	8.85 (225)	9.29 (236)	14.37 (365)	0.295 (7.5)		
	4030															
	4037	12.79 (325)	17.71 (450)	11.22 (285)	10.82 (275)	17.12 (435)	0.295 (7.5)	25	12.99 (330)	24.01 (610)	11.22 (285)	10.82 (275)	17.12 (435)	3.44 (87.5)	28	M6
	4045							26							29	
	4055	12.79 (325)	24.60 (625)	11.22 (285)	10.82 (275)	24.01 (610)	0.295 (7.5)	34	12.99 (330)	12.99 (330)	11.22 (285)	10.82 (275)	24.01 (610)	3.44 (87.5)	38	M6
	4075							36	12.99 (330)	33.46 (850)				6.00 (152.5)	40	

3. MOUNTING

CAUTION

- Lift the cabinet by the base. When moving the unit, never lift by the front cover or the front panel. Otherwise, the main unit may be dropped causing damage to the unit.
- Mount the power regenerative unit on nonflammable material (i.e., metal). Failure to observe this caution can result in a fire.
- When mounting units in an enclosure, install a fan or other cooling device to keep the intake air temperature below 113°F (45°C). Overheating may cause a fire or damage to the unit.

This chapter describes the configuration location and space when mounting the VS-656RC5.

3.1 Choosing a Location to Mount the Inverter

Install the power regenerative unit under the following conditions.

Type	Ambient Operating Temperature	Humidity
Enclosed wall-mounted	14 to 104° F -10 to +40° C	90% RH or less (no condensation)
Open chassis	14 to 113° F -10 to +45° C	90% RH or less (no condensation)

Protection covers are attached to the top and bottom of the power regenerative unit. Be sure to remove the protection covers before installing a 200 or 400V Class power regenerative unit with an output of 30 kW or less in a panel.

Be sure the power regenerative unit is protected from the following conditions:

- Extreme cold and heat. Use only within the ambient temperature range (for open chassis type): 14 to 131°F (-10 to +50°C)
- Rain, moisture.

-
- Oil sprays, splashes.
 - Salt spray.
 - Direct sunlight. (Avoid using outdoors).
 - Corrosive gases (e.g. sulfurized gas) or liquids.
 - Dust or metallic particles in the air.
 - Physical shock, vibration.
 - Electromagnetic noise. (Example: welding machines, power devices, etc.)
 - High humidity.
 - Radioactive materials.
 - Combustibles: thinner, solvents, etc.

- **Controlling the Ambient Temperature**

To enhance the reliability of operation, the power regenerative unit should be installed in an environment free from extreme temperature increases. If the power regenerative unit is installed in an enclosed environment, such as a box, use a cooling fan or air conditioner to maintain the internal air temperature below 113°F (45°C).

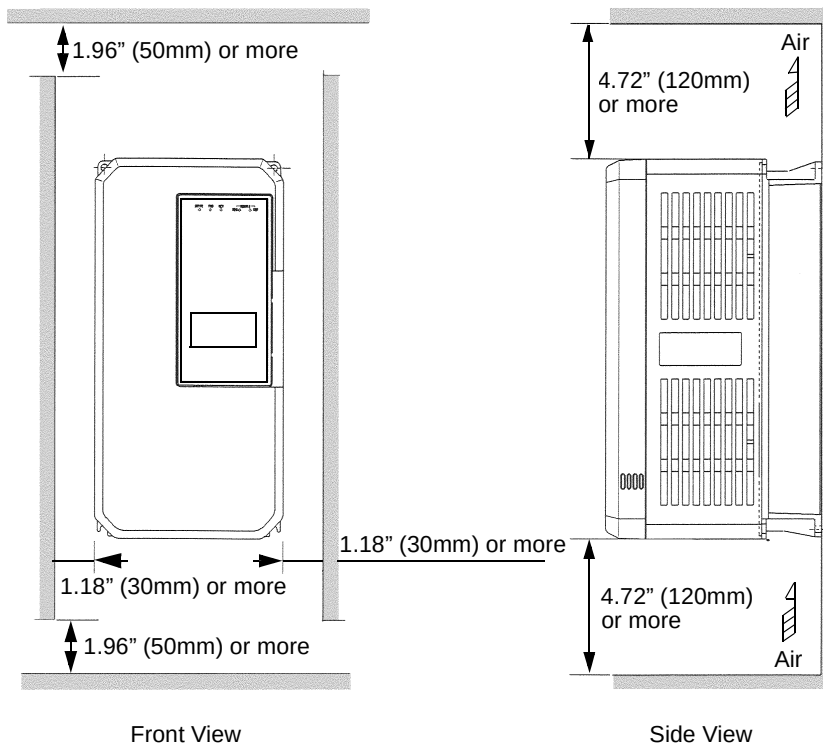
- **Protecting the Power Regenerative Unit from Foreign Matter**

Place a cover over the power regenerative unit during installation to shield it from metal powder produced by drilling.

Always remove the cover from the power regenerative unit after completing installation. Otherwise, ventilation will be reduced, causing the power regenerative unit to overheat.

3.2 Mounting Dimensions

Install the VS-656RC5 vertically and allow sufficient clearances for effective cooling as shown in the figure below.



NOTE

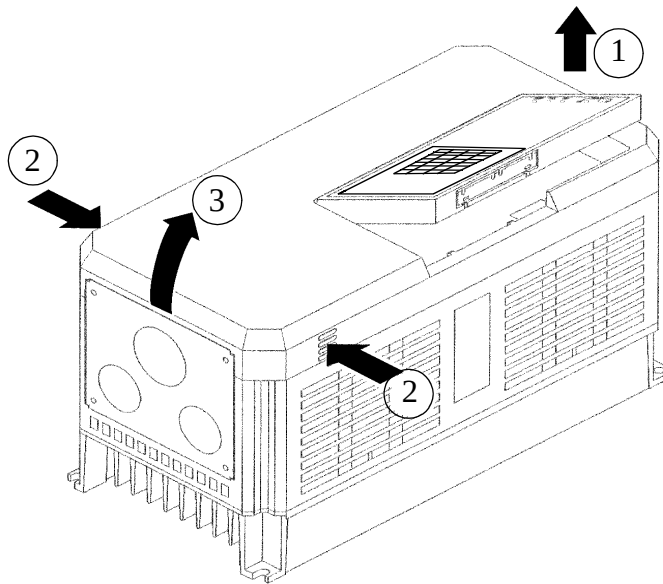
- (1) The clearances required at top/bottom and both sides are common in open chassis type (IPOO) and enclosed wall-mounted type (NEMA 1).
- (2) Remove the top and bottom covers to use the open chassis type of 200V/400V 30 kW or less.
- (3) When installing the models of 200V/400V 37kW or more, equipped with eyebolts, extra spacing will be required on either side. For detailed dimensions, contact your YASKAWA representative.

3.3 Mounting/Removing Components

Removing and Replacing the Front Cover

- **Removing front cover**

To remove the front cover, first move the LED monitor in the direction shown by arrow ①. Then press the right and left sides in the direction shown by arrows ②, and lift cover to direction ③.

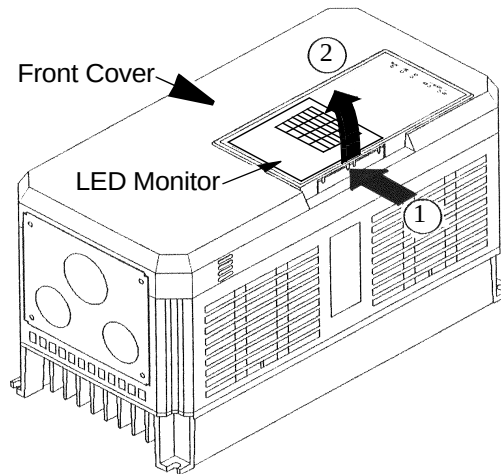


NOTE

Do not replace the front cover with the LED monitor connected. The LED monitor will not be connected to the power regenerative unit. Replace the front cover first and then install the LED monitor on the cover.

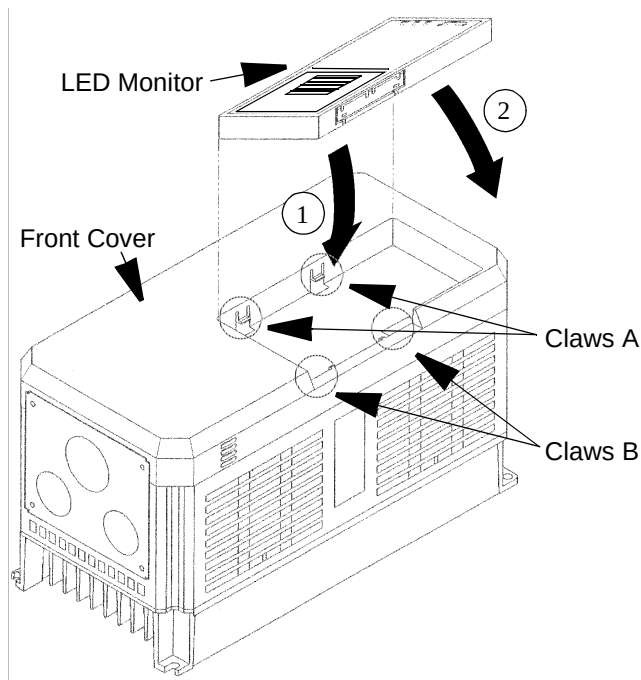
- **Removing the LED monitor**

Push the LED monitor lever in the direction shown by arrow ① and lift the LED monitor in the direction shown by arrow ② to remove the LED monitor from the front cover.



- **Replacing the LED Monitor**

Engage the LED monitor on claws A in the direction shown by arrow ① and then on claws B in the direction shown by arrow ② to lock the LED monitor.





Never fit the LED monitor in any other direction or by any other method.
The LED monitor will not be connected to the inverter.

4. WIRING

WARNING

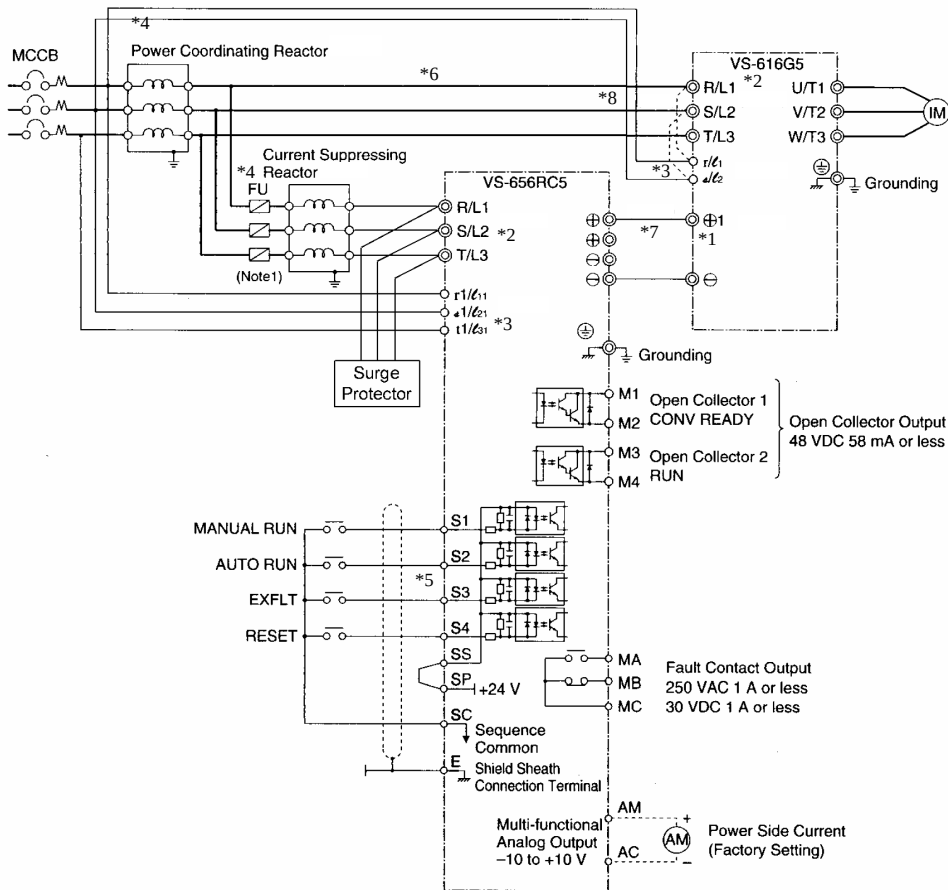
- Start wiring only after verifying that the power supply is turned OFF.
Failure to observe this warning can result in an electric shock or fire.
- Wiring should be performed only by qualified personnel.
Failure to observe this warning can result in an electric shock or fire.
- Make sure to ground the ground terminal  before connecting any other terminals.
Failure to observe this warning can result in an electric shock or fire.

CAUTION

- Verify that the power regenerative unit rated voltage coincides with the AC power supply voltage.
Failure to observe this caution can result in personal injury or a fire.
- Do not perform a withstand voltage test of the power regenerative unit.
It may cause semi-conductor elements to be damaged.
- Connect the power coordination reactor and the power suppression reactor as described in this instruction manual.
Improper connection may cause a fire.
- Verify that the rated voltage of the power regenerative unit coincides with the rated voltage of the power regenerative unit to be connected.
Improper connection may cause a fire.
- Tighten terminal screws.
Failure to observe this caution can result in a fire.

4.1 Connection Diagram

The Figure below shows a typical connection diagram of VS-656RC5 with a VS-616G5.



- *1 Connect to the terminal $\oplus 1$ for 200V class 0.4 to 22 kW, and 400 V class 0.4 to 45 kW VS-616G5 inverters. Use terminal $\oplus 3$ for 200V class 30 to 37 kW, and 400V class 55 to 75 kW VS-616G5 inverters.
- *2 Connect VS-616G5 AC power supply terminals R/L1, S/L2, and T/L3 to the secondary side of the power coordination reactor. Connect VS-656RC5 AC power supply terminals R/L1, S/L2, and T/L3 to the secondary side of the power suppression reactor.
- *3 Connect terminals r/l 1, s/l 2 of VS-616G5, and terminals r1/l 11, s1/l 21, and t1/l 31 of VS-656RC5 to the primary side of the power coordination reactor.
- *4 Make sure to use the specified reactor, fuse and fuse holder.
- *5 The circuit for the sequence input terminal of VS656RC5 is the same as terminal S1.
- *6 The wiring distance between the power coordination reactor and VS-616G5/VS-656RC5 should be 10 m or less.
- *7 DC bus wiring ($\oplus 1 \oplus \ominus \ominus$) between VS-616G5 and VS-656RC5 should be 5 m or less.
- *8 Remove the wiring of terminals r/l 1 and s/l 2 (they were connected at the factory.)

4.2 Wire and Terminal Screw Sizes

1. Wiring Main Circuit Terminals

Select wires to be used for wiring from the following tables.

200V Class Wire Size

Circuit	VS-656RC5 CIMR-R5U	Terminal Symbol	Terminal Screw	Wire Size* mm ²	Wire Type
Main	23P7	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M4	2 to 5.5	Power Cable 600V vinyl-sheathed wire or equivalent
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31			
		⊕			
	25P5	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M4	3.5 to 5.5	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31		2 to 5.5	
		⊕		3.5 to 5.5	
	27P5	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M4	5.5	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31		2 to 5.5	
		⊕		3.5 to 5.5	
	2011	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M5	8	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31		2 to 5.	
		⊕		5.5 to 8	
	2015	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M5	8	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31		2 to 5.5	
		⊕		5.5 to 8	
	2018	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M8	22	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31	M4	2 to 5.5	
		⊕	M6	8	
	2022	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M8	22	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31	M4	2 to 5.5	
		⊕	M6	8	
	2030	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M8	30 to 38	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31	M4	2 to 5.5	
		⊕	M6	14	
	2037	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M8	50 to 60	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31	M4	2 to 5.5	
		⊕	M6	14	
Control	Common to all models	S1, S2, S3, S4, SS, SP, SC, M1, M2, M3, M4, MA, MB, MC, AM, AC	—	twisted wire 0.5 to 1.25 single 0.5 to 1.25	Shielded twisted-pair wires
		E(G)	M3.5	0.5 to 2	

* Cable size is selected assuming external wiring of single 3-core cables at an ambient temperature of 86° F (30° C).

400V Class Wire Size

Circuit	VS-656RC5 CIMR-R5U	Terminal Symbol	Terminal Screw	Wire Size* mm ²	Wire Type
Main Control	43P7	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M4	2 to 5.5	Power Cable 600V vinyl-sheathed wire or equivalent
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31			
		⊕			
	45P5	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M4	2 to 5.5	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31			
		⊕			
	47P5	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M4	2 to 5.5	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31			
		⊕			
	4011	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M5	3.5 to 5.5	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31		2 to 5.5	
		⊕			
	4015	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M5	5.5	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31		2 to 5.5	
		⊕		5.5	
	4018	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M8	8 to 14	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31	M4	2 to 5.5	
		⊕	M6	8	
	4022	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M8	8 to 14	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31	M4	2 to 5.5	
		⊕	M6	8	
	4030	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M8	14	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31	M4	2 to 5.5	
		⊕	M6	8	
	4037	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M8	14 to 22	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31	M4	2 to 5.5	
		⊕	M6	8	
	4045	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M8	22 to 38	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31	M4	2 to 5.5	
		⊕	M6	8	
	4055	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M8	38 to 60	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31	M4	2 to 5.5	
		⊕	M6	14	
	4075	R/L1,S/L2,T/L3,⊕,⊕,⊖,⊖	M8	50 to 60	
		r 1 / ℓ 11, s1 / ℓ 21, t1 / ℓ 31	M4	2 to 5.5	
		⊕	M6	14	
Control	Common to all models	S1, S2, S3, S4, SS, SP, SC, M1, M2, M3, M4, MA, MB, MC, AM, AC	—	twisted wire 0.5 to 1.25 single 0.5 to 1.25	Shielded twisted-pair wires
		E(G)	M3.5	0.5 to 2	

* Cable size is selected assuming external wiring of single 3-core cables at an ambient temperature of 86° F (30° C).

4.3 Connecting Main and Control Circuits

Main Circuit Input Fuse

Connect a fuse at the primary side of the power suppression reactor. Recommended fuses are shown in the following table.

200V and 400V Class Input Fuses and Fuse Holders - Manufactured by Fuji Electric Co. Inc.

Input AC Fuse and Fuse Holders

VS-656RC5		Input Fuse				Fuse Holder		
Model CIMR-R5U	Rated Input Current (Amps) 25%ED	Rating	FUJI P/N	YEA P/N	Qty.	FUJI P/N	YEA P/N	Qty.
23P7	10	250V ac, 20A	CR2LS-20/UL	FU000799	3	CM-1A	FU002014	1
25P5	15	250V ac, 30A	CR2LS-30/UL	FU000791	3	CM-1A	FU002014	1
27P5	20	250V ac, 30A	CR2LS-30/UL	FU000791	3	CM-1A	FU002014	1
2011	30	250V ac, 50A	CR2LS-50/UL	FU000797	3	CM-1A	FU002014	1
2015	40	250V ac, 75A	CR2LS-50/UL	FU000792	3	CM-1A	FU002014	1
2018	50	250V ac, 100A	CR2LS-100/UL	FU002085	3	CM-1A	FU002014	1
2022	60	250V ac, 100A	CR2LS-100/UL	FU002085	3	CM-1A	FU002014	1
2030	80	250V ac, 150A	CR2LS-150/UL	FU002086	3	CM-2A	FU002090	1
2037	100	250V ac, 150A	CR2LS-150/UL	FU002086	3	CM-2A	FU002090	1
43P7	5	600V ac, 20A	CR6L-20/UL	FU002087	3	CMS-4	FU002091	3
45P5	7.5	600V ac, 20A	CR6L-20/UL	FU002087	3	CMS-4	FU002091	3
47P5	10	600V ac, 20A	CR6L-20/UL	FU002087	3	CMS-4	FU002091	3
4011	15	600V ac, 30A	CR6L-30/UL	FU002088	3	CMS-4	FU002091	3
4015	20	600V ac, 30A	CR6L-30/UL	FU002088	3	CMS-4	FU002091	3
4018	25	500V ac, 50A	CR6L-50/UL	FU000935	3	CMS-4	FU002091	3
4022	30	500V ac, 50A	CR6L-50/UL	FU000935	3	CMS-4	FU002091	3
4030	40	500V ac, 75A	CR6L-75/UL	FU002089	3	CMS-5	FU002092	3
4037	50	500V ac, 75A	CR6L-75/UL	FU002089	3	CMS-5	FU002092	3
4045	60	500V ac, 100A	CR6L-100/UL	FU000927	3	CMS-5	FU002092	3
4055	75	500V ac, 150A	CR6L-150/UL	FU000928	3	CMS-5	FU002092	3
4075	100	500V ac, 150A	CR6L-150/UL	FU000928	3	CMS-5	FU002092	3

An input 3-phase reactor corresponding to each model is necessary when operating VS-656RC5. This input AC reactor is effective against saturated current and excessive heat.

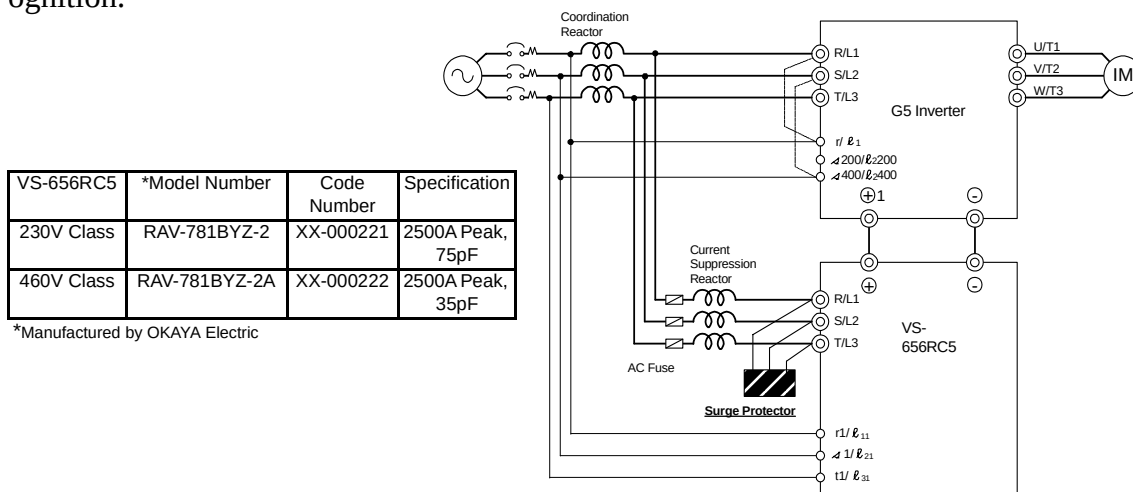
The table below shows the code numbers of the AC reactor for each model. Check the table and use a specified AC reactor.

AC Reactor

VS-656RC5		Power Coordination Reactor			Power Suppression Reactor		
Model CIMR-R5U		Rated Current (Arms)	Inductance. (mH)	Code No.	Rated Current (Arms)	Inductance. (mH)	Code No.
200V Class	23P7	20	0.53	X002491	15	0.31	X010121
	25P5	30	0.35	X002492	15	0.31	X010121
	27P5	40	0.265	X002493	20	0.15	X010122
	2011	60	0.18	X002495	40	0.1	X010123
	2015	80	0.13	X002497	40	0.1	X010123
	2018	90	0.12	X002498	50	0.06	X010124
	2022	120	0.09	X002555	60	0.05	X010125
	2030	160	0.07	X002556	80	0.04	X010126
	2037	200	0.05	X002557	100	0.03	X010127
400V Class	43P7	10	2.2	X002500	7.5	1.2	X010128
	45P5	15	1.42	X002501	7.5	1.2	X010128
	47P5	20	1.06	X002502	10	0.6	X010129
	4011	30	0.7	X002503	15	0.4	X010130
	4015	40	0.53	X002504	25	0.3	X010131
	4018	50	0.42	X002505	25	0.3	X010131
	4022	60	0.36	X002506	30	0.2	X010132
	4030	80	0.26	X002508	40	0.15	X010133
	4037	90	0.24	X002509	50	0.12	X010134
	4045	120	0.18	X002566	60	0.1	X010135
	4055	150	0.15	X002567	75	0.08	X010136
	4075	200	0.11	X002568	100	0.06	X010137

Voltage Suppression MOV Installation

The following voltage surge suppression MOV is required for compliance with UL recognition.

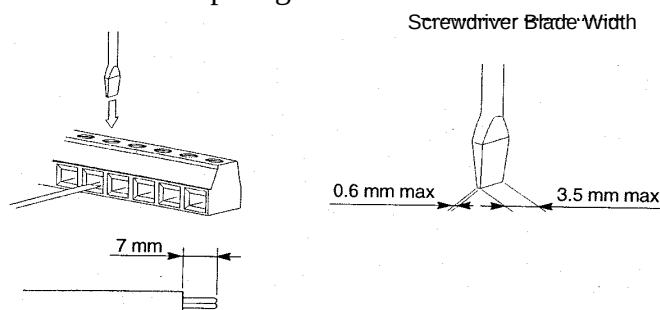


Wiring Precautions

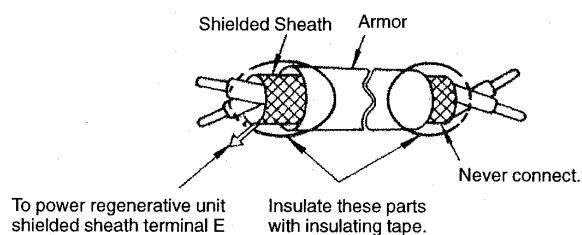
The external interconnection wiring must be performed with the following procedures. After completing VS-656RC5 interconnections, be sure to check that the connections are correct. Never use control circuit buzzer check.

Precautions on Control Circuit Wiring

1. Separate control circuit wires from main circuit wires and other power cables to prevent erroneous operation caused by noise interference.
2. Separate the wiring of control circuit terminals from other control terminals or main circuit wirings.
3. Wiring distance should be less than 50 m.
4. Insert the wire into the lower part of the terminal block and connect it tightly with a screwdriver. Wire sheath strip length must be 7 mm.



5. Use twisted shielded or twisted-pair shielded wire for the control circuit line and connect the shielded sheath to inverter terminal E.

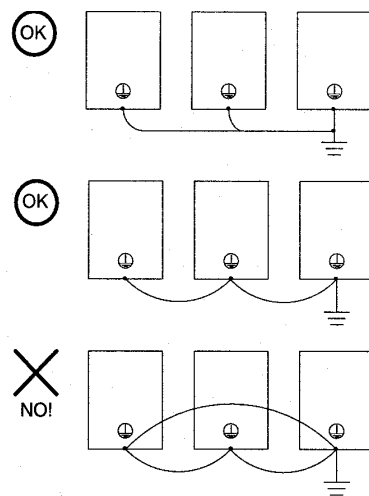


Ground Wiring

1. Always ground the ground terminal ⊕.
2. Do not share the ground wire with other devices, such as welding machines or power tools. Separate the grounding cables from the wirings for power tools.
3. Always use a ground wire that complies with technical standards on electrical equipment and minimize the length on the ground wire.

Leakage current flows through the power regenerative unit. Therefore, if the distance between the ground electrode and the ground terminal is too long, potential on the ground terminal of the power regenerative unit will become unstable.

4. When using more than one power regenerative unit, be careful not to loop the ground wire.



Closed-Loop Connector Size

Closed Loop Connectors sizes (JIS C 2805) (For 200V/400 classes)

Wire Size mm ²	Terminal Screw	Closed Loop Connectors
0.5	M3.5 M4	1.25 to 3.5 1.25 to 4
0.75		
1.25		
2	M4	2 to 4
	M5	2 to 5
3.5	M4	3.5 to 4
	M5	3.5 to 5
5.5	M4	5.5 to 4
	M5	5.5 to 5
8	M5	8 to 5
	M6	8 to 6
14	M6	14 to 6
22	M8	22 to 8
30/38	M8	38 to 8
30/38	M10	38 to 10
50/60		60 to 10
80		80 to 10
100		100 to 10
100	M12	100 to 12
150		150 to 12
200		200 to 12



Determine the wire size for the main circuit so that the line voltage drop is within 2% of the rated voltage. Line voltage drop is calculated as follows:
(If there is a possibility of excessive voltage drop, use a larger wire suitable to the required length.)

Line voltage drop (V) = $\sqrt{3} \times \text{wire resistance } (\Omega/\text{km}) \times \text{wire length (m)} \times \text{current (A)} \times 10^{-3}$

4.4 External Terminals

Main Circuit Terminal Functions

Terminal Symbol		Description
R/L1 S/L2 T/L3	Power Regenerative Unit Main Circuit Input	Main circuit AC power supply terminal for the power regenerative unit.
⊕, ⊖		Connect to the Inverter's DC power supply voltage input terminals. • Two terminals are provided for both ⊕ and ⊖.
r1/l 11 s 1/l 21 t1/l 31	Power Supply Voltage Detection	Detects the phase sequence and the voltage level. • Connect to the power side of the power coordination reactor.
	Power input for FAN and MC	Supplies power for the cooling fan and inrush prevention MC of the power regenerative unit.

Control Circuit Terminal Functions

Type	No.*	Signal Input	Function	Signal Level
Sequence Input	S1	MANUAL RUN	Run when Closed, stops when OPEN	24 VDC 8 mA Photo coupler isolation
	S2	AUTO RUN	Auto run (regenerative operation) when CLOSED	
	S3	EXFLT	External fault when CLOSED	
	S4	RESET	Fault reset when CLOSED	
	SC	Sequence Common		
	SS	Photo coupler internal common		
	SP	Sequence +24V Power Supply		
	M1-M2	CONV READY	Closed when power regenerative unit is READY	48 VDC 80 mA or less
	M3-M4	RUN	CLOSE during run	
	MA-MC MB-MC	FAULT Output (Transfer Contact)	Outputs when a fault is detected. Terminal MA-MC: Closed during fault detection Terminal MB-MC: Open during fault detection	250 VAC 1 A or less 30 VDC 1 A or less
	AM	Input Current	5V: 100% of rated input current	- 10V to +10 VDC 2 mA or less
	AC	Analog ground		

* Indicates the terminal number of the control card.

5. OPERATION



WARNING

- Replace the front cover and the terminal cover before turning on the power supply. Do not remove the cover while power is on.
Failure to observe this warning can result in an electric shock.
- Never operate the digital operator or other switches when your hand is wet.
Failure to observe this warning can result in an electric shock.
- Never touch the terminals while the power is on, even if the power regenerative unit is stopped.
Failure to observe this warning can result in an electric shock.



CAUTION

- Never touch the heatsink or input reactor since the temperature is very high.
Failure to observe this caution can result in harmful burns to the body.
- All the parameters of the power regenerative unit have been preset at the factory. Do not change the settings unnecessarily.
The power regenerative unit may be damaged.

5.1 Checkpoints Before Turning on Power Supply

Check the following before turning ON the power supply.

1. Check that the power supply is in the correct voltage.
200V class: 200 to 230 VAC, 50/60 Hz
400V class: 380 to 460 VAC, 50/60 Hz
2. Make sure that the power regenerative unit and the Inverter are connected correctly.
Check that the phase sequence is correct.
3. Make sure that the phase sequence of the main circuit terminals (R/L1, S/L2, T/L3) and the power supply voltage detection terminals (r/l 11, s1/l 21, t1/l 31) are correct.
4. Make sure that the power regenerative unit and the control device are wired correctly.
5. Set the run command of the power regenerative unit and the inverter to OFF.

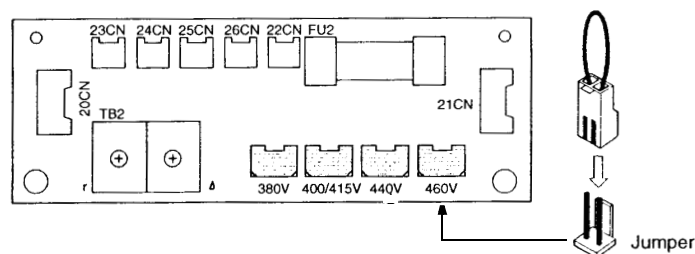
5.2 Setting the Power Supply Voltage Jumper

(400V Class Inverters of 18.5 kW or Higher)

Set the power supply voltage jumper for 400V class power regenerative unit of 37 kW or higher. Insert the jumper into the voltage connector nearest to the actual power supply voltage.

The jumper is factory-set to 460V when shipped. If the power supply voltage is not 460V, use the following procedure to change the setting.

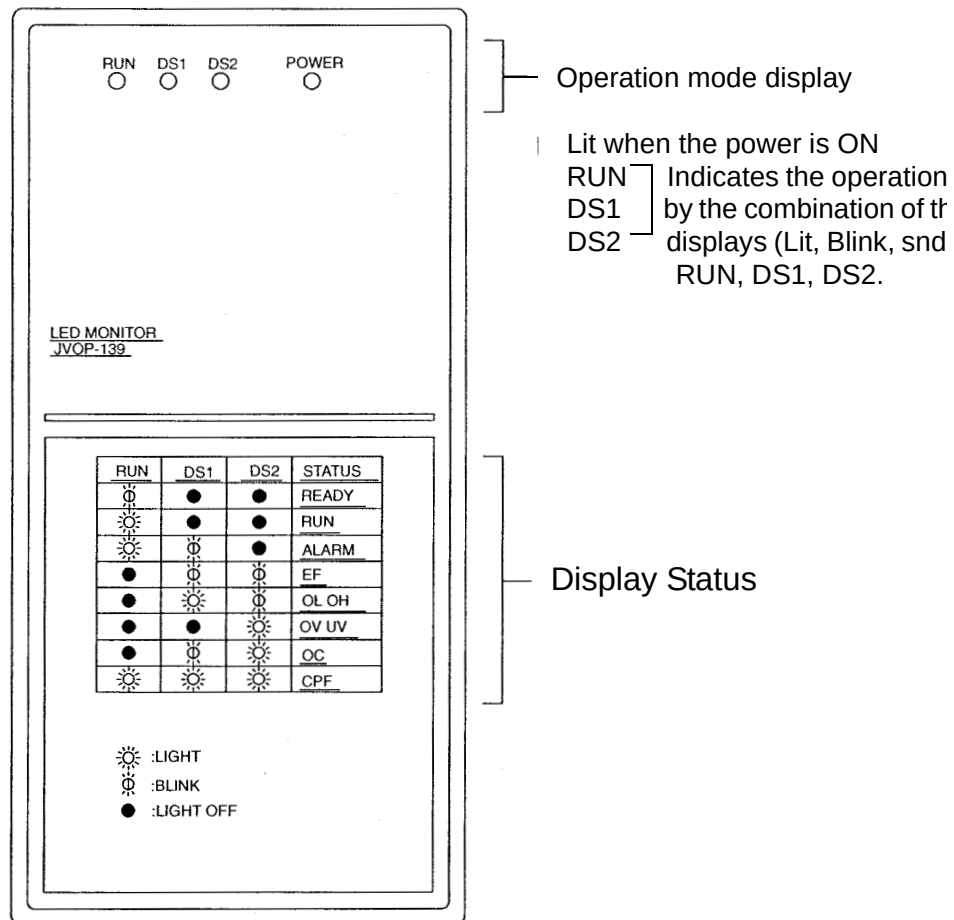
1. Turn OFF the power supply switch and wait for at least five minutes before removing the front panel and setting the jumper.
2. Remove the front cover.
3. Insert the jumper at the position for the voltage supplied to the power regenerative unit (see figure below).
4. Replace the front cover.



5.3 Confirming Display Status

LED Monitor Display

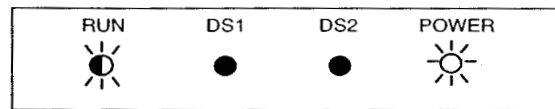
The figure below shows the LED monitor display of the VS656RC5.



LED Display when power is ON

The following shows the LED display pattern during normal operation.

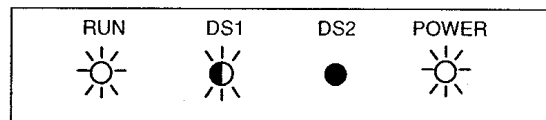
[At normal operation]



Indicates READY

The LED display pattern is different when an alarm (minor fault) occurs. below shows an example of LED display when a minor fault occurs. Refer to Chapter 6 and take appropriate countermeasures.

Alarm (monitor fault)

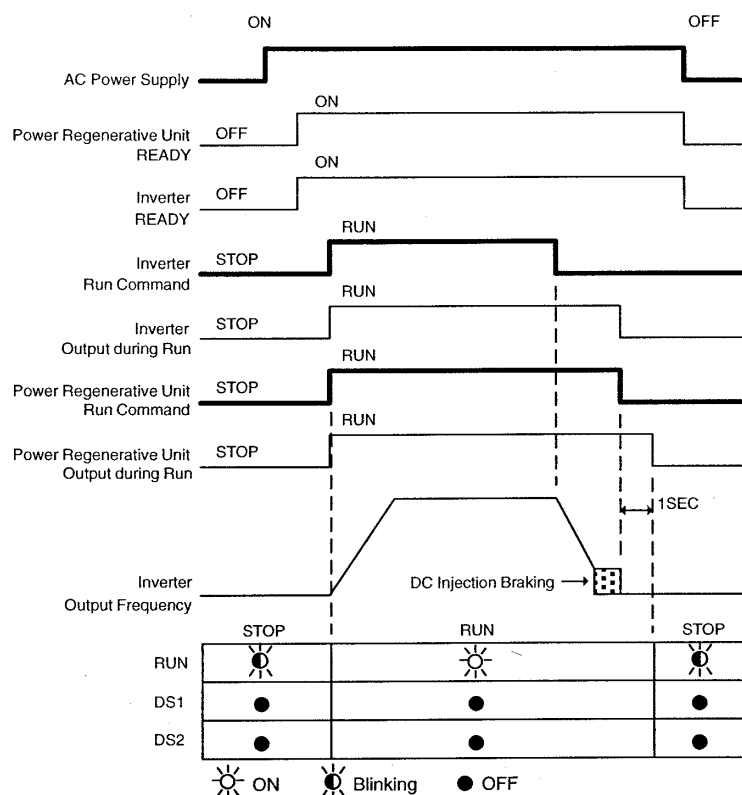


Indicates a minor fault

 : ON  : Blinking  : OFF

5.4 Power ON/OFF Sequence

Refer to figure below when building a power ON/OFF sequence for the VS-656RC5.



Check the following when using the power regenerative unit.

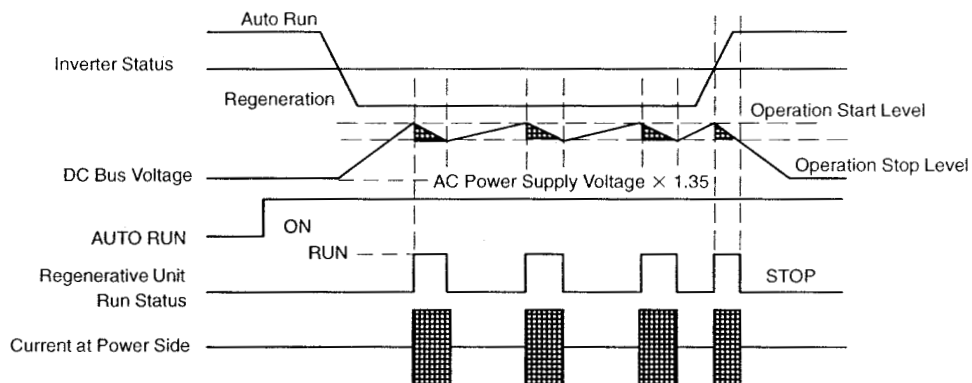
1. Run commands of the inverter and the power regenerative unit should be turned ON after confirming that they are READY.
2. Run commands of the inverter and the power regenerative unit should be turned ON at the same time.
3. Never turn the run command of the power regenerative unit OFF while the inverter output during run is ON.
4. Run output of the power regenerative unit turns OFF one second after the run command is turned OFF.
5. Turn the power OFF after the run output of the power regenerative unit is OFF.

5.5 Run Command Selection

This section explains the two run command modes of the power regenerative unit. Select the mode according to the application.

Auto Run

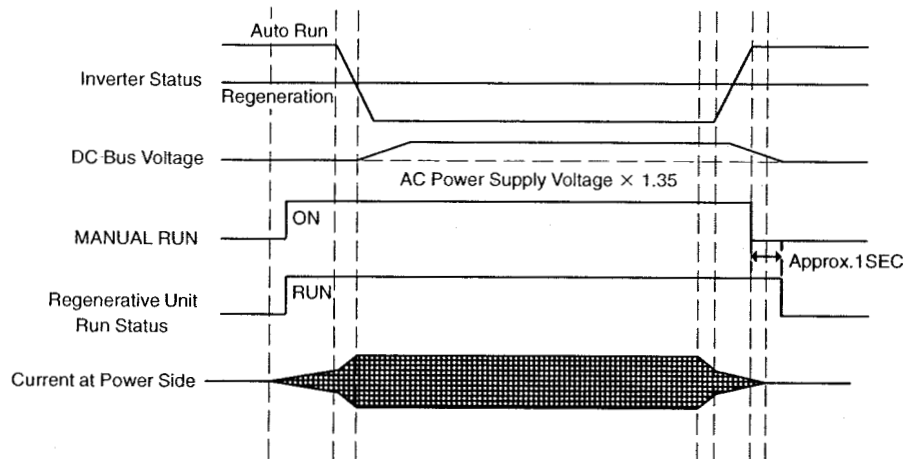
Auto run is the mode in which the power regenerative unit detects any increase/decrease of the bus voltage and performs an auto run/stop if the terminal S2-SC is “closed.”



If the motor vibrates excessively when in AUTO RUN mode, change the mode to MANUAL RUN.

Manual Run

Manual run is the mode in which the power regenerative unit starts running when the terminal S1-SC is “closed,” and stops one second after S1-SC is “open”.



Build a sequence so that the run commands of the power regenerative unit and the inverter are turned ON at the same time.

6. MAINTENANCE AND INSPECTION

WARNING

- Never touch high-voltage terminals in the power regenerative unit.
Failure to observe this warning can result in an electric shock.
- Perform maintenance or inspection only after verifying that the CHARGE LED goes OFF, after the main circuit power supply is turned OFF.
The capacitors are still charged and can be dangerous.
- Only authorized personnel should be permitted to perform maintenance, inspections or parts replacement.
[Remove all metal objects (watches, bracelets, etc.) before operation.]
(Use tools which are insulated against electric shock.)
Failure to observe this warning can result in an electric shock.
- Never modify the product.
Failure to observe this warning can result in an electric shock or personal injury and will invalidate the warranty.

CAUTION

- The power regenerative unit employs semi-conductor elements. Do not touch the CMOS elements.
They are easily damaged by static electricity.
- Do not connect or disconnect wires or connectors while power is applied to the circuit.
Failure to observe this caution can result in personal injury.

6.1 Daily Inspection

Check the following items with the system in operation.

1. There should be no abnormal heat generation.
2. The ambient temperature should not be too high.
3. The cooling fan on the power regenerative unit should be operating normally.

6.2 Periodical Inspection

Check the following items during periodic maintenance.

Always turn OFF the power supply before beginning inspection. Confirm that the LED indicators on the front cover have all turned OFF, and then wait at least five minutes have elapsed before beginning the inspection. Be sure not to touch terminals right after the power has been turned OFF. Doing so can result in an electric shock.

Location to Check	Check For	Solution
External terminal, unit mounting screws, etc.	Connection hardware is properly seated and securely tightened.	Properly seat and tighten hardware.
Cooling fins	Built up dust, dirt, and debris.	Blow with dry compressed air: 39.2 X 10 ⁴ to 58.8 X 10 ⁴ Pa, 57 to 85 psi (4 to 6kg / cm ²) pressure.
Printed circuit board	Accumulation of conductive material or oil mist.	Blow with dry compressed air: 39.2 X 10 ⁴ to 58.8 X 10 ⁴ Pa, 57 to 85 psi (4 to 6kg / cm ²) pressure. If dust or oil cannot be removed, replace the inverter unit.
Power elements and smoothing capacitor	Abnormal odor or discoloration.	Replace the inverter unit.
Cooling fan	Abnormal noise or vibration. Cumulative operation time exceeding 20,000 hours.	Replace the cooling fan.
Power elements	Accumulation of conductive material or oil mist.	Blow with dry compressed air: 39.2 X 10 ⁴ to 58.8 X 10 ⁴ Pa, 57 to 85 psi (4 to 6kg / cm ²) pressure. If dust or oil cannot be removed, replace the inverter unit.
Smoothing capacitor	Irregularities such as discoloration or odor.	Replace the capacitor or power regenerative unit.

6.3 Part Replacement

The power regenerative unit consists of many parts, and they must be operating properly in order to make full use of the Inverter functions.

Among the electronic components, there are some that require maintenance depending on their usage conditions. In order to keep the power regenerative unit operating normally over a long period of time, it is necessary to perform period inspections and replace parts according to their service life.

Periodic inspection standards vary depending on the installation environment and usage conditions. The power regenerative unit's maintenance periods are noted below. Keep them as a reference.

Part Replacement Guidelines

Part	Standard Replacement Period	Replacement Method
Cooling fan	2 to 3 years	Replace with new part.
Smoothing capacitor	5 years	Replace with new part. (Determine need by inspection).
Breaker relays	—	Determine need by inspection.
Fuses	10 years	Replace with new part.
Electrolytic capacitors on PCBs	5 years	Replace with new board. (Determine need by inspection).

- Note: Usage conditions are as follows:
- Ambient temperature: Yearly average of 30°C.
 - Load factor: 80% max.
 - Operating rate: 12 hours max. per day.

7. FAULT DIAGNOSIS AND CORRECTIVE ACTION

When the power regenerative unit detects a fault, the fault code is displayed on the LED monitor, the fault contact output operates.

1. When a fault has occurred, refer to the following table to identify and correct the cause of the fault.
2. Before restarting the power regenerative unit, reset the fault by either turning the run signal OFF then turn the fault reset signal ON, or turn the main circuit power supply OFF.

 : ON

 : Blinking

 : OFF

Fault Display and Contents

LED				Meaning	Trouble Causes	Causes and Corrective Actions
RUN	DS1	DS2	Meaning			
			EF	External Fault	An external fault was input from the contact input terminal.	Check the following: • Reset the fault from the contact input terminal. • Correct the cause of the external fault.
			OL	Power Regenerative Unit Input Overload Power regenerative unit input exceeded the overload capacity.	The load is too heavy.	Check the size of the load.
			OH	Heatsink Overheating The temperature of the power regenerative unit's cooling fins exceeded the factory setting.	The ambient temperature is too high.	Install a cooling unit.
					There is a heat source nearby.	Remove the heat source.
					The power regenerative unit's cooling fan has stopped.	Replace the cooling fan. (Contact our sales representative.)

LED				Meaning	Trouble Causes	Causes and Corrective Actions
RUN	DS1	DS2	Meaning			
●	●	☀	UV	Main Circuit Under voltage The main circuit DC voltage is below the under voltage detection level. 200V class: Approx. 190 VDC or less 400V class: Approx. 380 VDC or less	• An open-phase occurred with the input power supply. • A momentary power loss occurred. • The wiring terminals for the input power supply are loose. • The voltage fluctuations in the input power supply are too large.	Reset the fault after correcting its cause.
				Control Power Fault The control power supply voltage dropped.	—	• Try turning the power supply off and on. • Replace the power regenerative unit if the fault continues to occur.
				Inrush Prevention Circuit Fault A fault occurred in the inrush prevention circuit.	—	• Try turning the power supply off and on. • Replace the power regenerative unit if the fault continues to occur.

LED				Meaning	Trouble Causes	Causes and Corrective Actions
RUN	DS1	DS2	Meaning			
●	●	☀	UV	Input Under voltage Input under voltage was detected during operation. 200V class: Approx. 150 VDC or less 400V class: Approx. 300 VDC or less Power Supply Frequency Fault Power supply frequency exceeded the power supply frequency limit (factory setting).	- There is a fault to the equipment at the power side. - There is a fault to the power supply.	- Check the wiring of the equipment at the power side. - Adjust the power supply voltage.
				Power Supply Phase Rotation Fault Phase rotation of the input side changed after the control power supply was turned ON.	The voltage detection circuit at the power side is faulty.	- Replace the control card. - Replace the power board.
			OV	Main Circuit Over voltage The main circuit DC voltage exceeded under voltage detection level. 200V class: Approx. 400VDC or above 400V class: Approx. 800VDC or above	The regenerative energy from the motor is too large.	Adjust the regenerative load.
					The power supply voltage is too high. - The wiring between the voltage detection circuit at the power side (r1, ^d1,t1) and the main circuit (R,S,T) is not correct. - The wiring distance between the power regenerative unit and the AC reactor is too long.	Decrease the voltage so it is within specifications. Check the wiring.

LED				Meaning	Trouble Causes	Causes and Corrective Actions
RUN	DS1	DS2	Meaning			
			OC	Overcurrent The input current of the power regenerative unit exceeded the overcurrent detection level. (200% of rated current)	• A short-circuit occurred at the power regenerative output. • Power supply drop. • The wiring between the voltage detection circuit at the power side (r1, ⁴1,tl) and the main circuit (R,S,T) is not correct. • Imbalance of power supply voltage phases.	• Improve the power supply • Check the wiring • Reset the fault after correcting its cause.
			CPF	Baseblock Circuit Error EEPROM Error CPU Internal A/D Converter error	— The control circuit is damaged.	Try turning the power supply off and on. Replace the control card.

7.1 Minor Fault Detection

An alarm is displayed on the LED monitor when the power regenerative unit detects a minor fault. The power regenerative unit automatically returns to the original status once the cause of the minor fault has been removed.

Take appropriate countermeasures according to the table below.

 : ON

 : Blinking

 : OFF

LED				LED Display	Trouble Causes	Causes and Corrective Actions
RUN	DS1	DS2	Meaning			
			ALARM	UV Main Circuit Under voltage The following conditions occurred during stop. - The main circuit DC voltage was below the under voltage detection level. - The surge current limiting contactor opened. - The control power supply is below the under voltage detection level. - Frequency detection exceeded the allowable level. - Voltage phase rotation at the input side changed.	Refer to the UV section of the Fault Detection.	Refer to the UV section of the Fault Detection.
				OV Main Circuit Over voltage The main circuit DC voltage exceeded the over voltage detection level during stop. 200V class: Approx. 400 VDC or above 400V class: Approx. 800VDC or above	The power supply voltage is too high.	Decrease the voltage so it is within specifications.
				OH Heatsink Overheating The temperature of the power regenerative unit heatsink exceeded 90% of the allowable level.	The ambient temperature is too high.	Install a cooling unit.
					There is a heat source nearby.	Remove the heat source.
				OL Power Regenerative Unit Input Overload The amount of the load exceeded 80% of the overload capacity.	The load is too heavy.	Reduce the load
				EF External Fault (Operation continues by the setting of the digital operator.)	An external fault was input from the contact input terminal	- Reset the external fault from the contact input terminal. - Correct the cause of the external fault.



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