Rectifier Unit

Unidad Rectificadora

Unidade Retificadora

UR11

User's Manual
Manual del Usuario
Manual do Usuário

UR11

RECTIFIER UNIT MANUAL

Series: UR11

Language: English

Document: 10001149720 / 01

Models: 1140 A / 380...480 V

893 A / 500...600 V

811 A / 660...690 V

03/2015

Summary of Revisions

Version	Revision	Description
-	R00	First edition.
-	R01	Updating of the figures and general revision.

1 SAFETY INSTRUCTIONS

This manual provides information for the proper installation and operation of the Rectifier Unit UR11 developed to perform the rectification for the CFW-11M product line.

Only trained and qualified personnel should attempt to install, start-up, and troubleshoot this type of equipment.

1.1 SAFETY WARNINGS IN THE MANUAL

The following safety warnings are used in this manual:

DANGER!
The procedures recommended in this warning have the purpose of protecting the user against dead, serious injuries and considerable material damage.

ATTENTION!
The procedures recommended in this warning have the purpose of avoiding material damage.

NOTE!
The text supplies important information for the correct understanding and good operation of the product.

1.2 SAFETY WARNINGS IN THE PRODUCT

The following symbols are attached to the product and require special attention:

High voltages are present.

Components sensitive to electrostatic discharge.
Do not touch them.

Mandatory connection to the protective ground (PE).

Connection of the shield to the ground.

Hot surface.

1.3 PRELIMINARY RECOMMENDATIONS

DANGER!

Only trained personnel, with proper qualifications, and familiar with the UR11 and associated machinery shall plan and implement the installation, starting, operation, and maintenance of this equipment.
The personnel shall follow all the safety instructions described in this manual and/or defined by the local regulations.
Failure to comply with the safety instructions may result in death, serious injury, and equipment damage.

NOTE!

For the purpose of this manual, qualified personnel are those trained and able to:

1. Install, ground, power-up, and operate the UR11 according to this manual and to the current legal safety procedures.
2. Use the protection equipment according to the established regulations.
3. Provide first aid

DANGER!

Always disconnect the main power supply before touching any electrical device associated with the rectifier.
Several components may remain charged with high voltage and/or in movement (fans), even after the AC power supply has been disconnected or turned off.
When there is a capacitive load connected to the UR11 output (e.g. frequency inverters fed directly from the DC link), wait at least 10 minutes to guarantee the fully discharge of capacitors.
Always connect the equipment frame to the protection earth (PE) at the suitable connection point.

ATTENTION!

The electronic boards contain components sensitive to electrostatic discharges. Do not touch the components and terminals directly. If needed, touch first the grounded metal frame or wear an adequate ground strap.

Do not perform a withstand voltage test on any part of the rectifier unit!
If needed, please, consult WEG.

NOTE!

Rectifiers may cause interference in other electronic devices. Follow the recommendations listed in chapter 3 INSTALLATION AND CONNECTION on page 3-1, to minimize these effects.

NOTE!

Fully read this manual before installing or operating the rectifier unit UR11.

ATTENTION!

The operation of this equipment requires installation instructions and detailed operation provided in this manual.

2 GENERAL INSTRUCTIONS

2.1 ABOUT THE MANUAL

This manual presents how to install, operate, the main features and basic troubleshooting of the UR11 (rectifier unit) models.

For more information on other features, accessories and operating conditions, refer to the following mounting guide:

☑ RACK 2/RACK 3 mounting guide.

The mounting guide is available in the CD-ROM provided with the rectifier unit or it can be downloaded from WEG website at - www.weg.net.

2.2 TERMS AND DEFINITIONS USED IN THE MANUAL

Normal Duty Cycle (ND): inverter duty cycle that defines the maximum continuous operation current (I_{nom-ND}) and the overload current (110 % for 1 minute). It is selected according to the programming of the inverter connected to the rectifier output. This duty cycle shall be used for the operation of motors that are not subjected to high torque loads (with respect to the motor rated torque) during its operation, starting, acceleration, or deceleration.

I_{nom-ND}: inverter rated current for use with the normal duty (ND) cycle.
Overload: 1.1 x I_{nom-ND} / 1 minute.

Heavy Duty Cycle (HD): inverter duty cycle that defines the maximum continuous operation current (I_{nom-HD}) and the overload current (150 % for 1 minute). It is selected according to the programming of the inverter connected to the rectifier output. This duty cycle shall be used for the operation of motors that are subjected to high torque (with respect to the motor rated torque) during its operation, starting, acceleration, or deceleration.

I_{nom-HD}: inverter rated current for use with the heavy duty (HD) cycle.
Overload: 1.5 x I_{nom-HD} / 1 minute.

Current Unbalance (%):

$$\text{unbalance at rectifier unit X - phase Y} = \left| \frac{I_{YX} - I_{YAVG}}{I_{YAVG}} \right| \times 100$$

$$I_{YAVG} = \frac{I_{Y1} + I_{Y2} + \ldots + I_{YN}}{N}$$

Where:
N = number of power units.
I_{YN} = Y phase current (R, S or T) of the rectifier unit N.
I_{YAVG} = Y phase average current.

Rectifier: input circuit of inverters that transforms the AC input voltage in DC voltage. It is composed of power diodes.

Pre-charge Circuit: transitional stage of the UR11 operation, which starts when the power is applied to the input phases and ends with the complete charging of the DC link capacitors of the inverter connected to its output. This step is controlled by the UR11, which performs the loading of DC link capacitors through a voltage ramp with limited current, avoiding high current spikes on the inverter startup.

DC Link: inverter intermediate circuit with DC voltage and current, obtained from the rectification of the AC supply voltage via UR11, or from an external source; it supplies the output IGBTs inverter bridge.

Inverter Circuit: circuit to modify the DC voltage of the DC Link.

Diode: basic component of the input rectifier bridge. It works like an electronic key (controlled by the voltage polarity of the anode and cathode terminals), in the following modes: conduction (closed switch, terminals directly polarized) and blocked (open switch,terminals reversely polarized).

Thyristor (SCR): Silicon-Controlled Rectifier; basic component of the input rectifier. It works like a diode but it needs a voltage pulse in the gate terminal to be able to get into the conduction mode, besides the proper polarization of the anode and cathode terminals, which allows the control of the starting conduction angle.

IGBT: Insulated Gate Bipolar Transistor; basic component of the output inverter bridge. The IGBT works as an electronic switch in the saturated (closed switch) and cut-off (open switch) modes.

Braking IGBT: operates as a switch for the activation of the braking resistor. It is commanded by the DC Link level, through the output inverter.

R, S e T Arm: it is a set of one diode and one thyristor of the R, S and T phases of the rectifier input.

Power Modules U, V, and W: set of two IGBTs of the inverter output phases U, V, and W.

Bridge 1 (and bridge 2): it is a set of three thyristors and three diodes, making a semi-controlled rectifier unit.

6 Pulses Rectifier: three-phase rectifier configuration, where each power diode operates for 120° and commutates every 60°, performing six commutations in one cycle of the power supply.

12 Pulses Rectifier: six-phase rectifier configuration, regularly available through a phase shifting transformer with two secondaries connected in delta and star, where each power diode operates for 120° and commutates every 30°, performing twelve commutations in one cycle of the power supply.

PTC: resistor which resistance value in ohms increases proportionally to the temperature increase; used as a temperature sensor in electrical motors.

NTC: resistor which resistance value in ohms decreases proportionally to the temperature increase; used as a temperature sensor in power modules.

PE: Protective Earth.

RFI Filter: Radio-Frequency Interference Filter for interference reduction in the Radio-Frequency range.

PWM: Pulse Width Modulation; pulsed voltage that feeds the motor.

Switching Frequency: frequency of the IGBTs switching in the inverter bridge, normally expressed in kHz.

Heatsink: metal device designed to dissipate the heat generated by the power semiconductors.

Amp, A: ampères.

°C: celsius degree.

AC: alternated current.

DC: direct current.

CFM: Cubic Feet per Minute; unit of flow.

cm: centimeter.

hp: horse power = 746 Watts; unit of power, used to indicate the mechanical power of electrical motors.

Hz: hertz.

l/s: liters per second.

kg: kilogram = 1000 grams.

kHz: kilohertz = 1000 Hertz.

m: meter.

mA: miliampère = 0.001 Ampère.

min: minute.

ms: millisecond = 0.001 seconds.

N.m.: newton meter; unit of torque.

rms: "root mean square"; effective value.

rpm: revolutions per minute; unit of speed.

s: second.

V: volts.

Ω: ohms.

2.3 ABOUT THE UR11

The rectifier unit UR11 provides DC voltage to feed the CFW-11M inverters. The UR11 can also be used to provide power to other devices that require DC link voltage. The main feature of this product is the two built-in complete semi-controlled rectifier bridges, which have the advantages presented next:

- ☑ DC link pre-charge control, provided by the control of the thyristors firing angle through a microcontroller: the pre-charge provides a linear voltage ramp, avoiding high currents and eliminating the pre-charge circuit of the panels.

- ☑ The independent control of each rectifier unit of the UR11, together with the two triphasic chokes with 3 % voltage drop, allows the use of this product in applications where 12-pulse rectifier configuration is required by simply connecting the power cables properly (for details, see chapter 3 INSTALLATION AND CONNECTION on page 3-1).

The UR11 product line with its modular structure (book type) is very similar to the CFW-11M power units (UP11), which makes it very appropriate for the assembly in panels with the CFW-11M inverter line. Each rectifier unit is able to provide power to two UP11 power units. In order to feed more than two UP11 it is just necessary to add more rectifier units in parallel proportionally.

Figure 2.1 on page 2-4 presents an example of diagram for a 6 pulse rectifier operation and Figure 2.2 on page 2-5 presents an example of diagram for a 12 pulse rectifier operation.

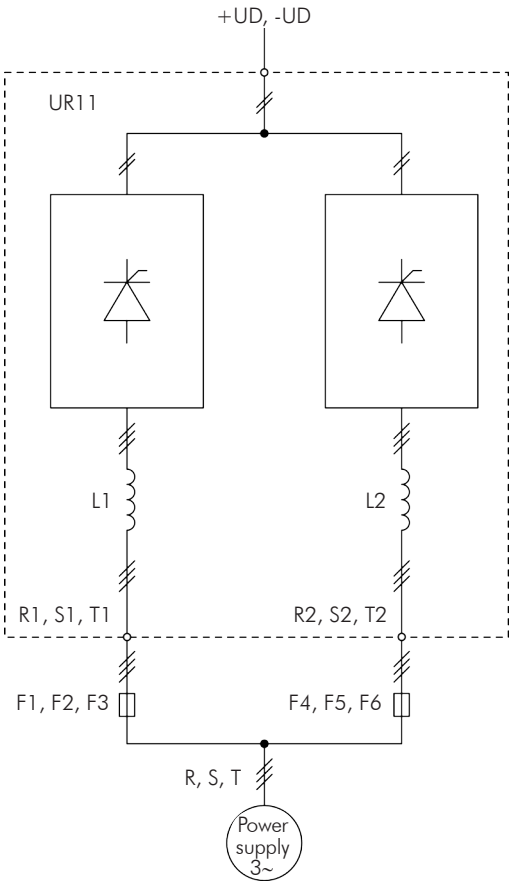


Figure 2.1 - *Example of diagram of a 6 pulse configuration with one rectifier unit*

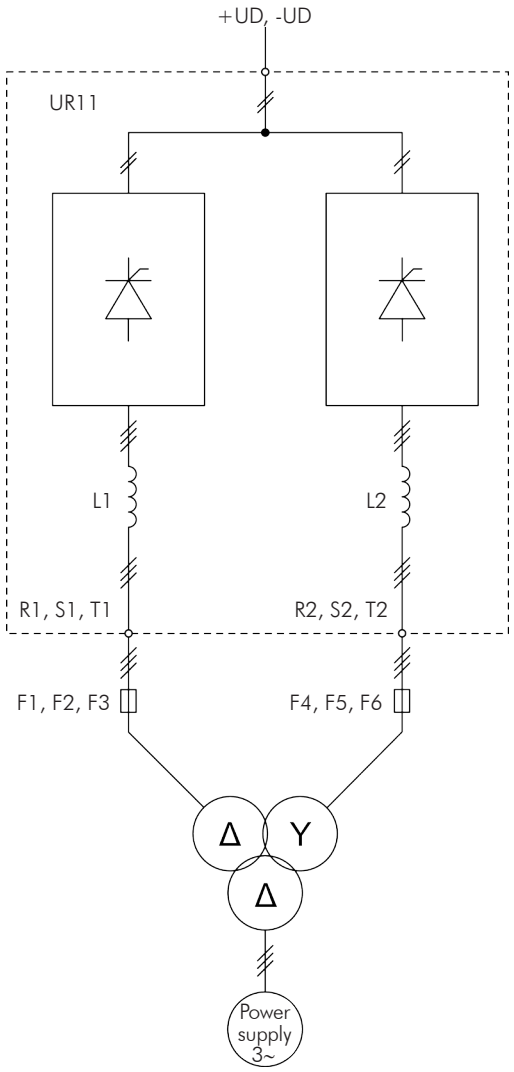


Figure 2.2 - *Example of diagram of a 12 pulse configuration with one rectifier unit*

The UR11 can be provided together with the complete panel (AFW-11M) or as a stand-alone product to be assembled in a panel. For the complete panel, all the components are provided in the panel.

NOTE!
Several additional items are needed for the complete panel assembly, such as: output inverters, AC fuses, DC link fuses for the output power units protection, circuit breaker or disconnect switch at the input and in case of 12 pulse configuration is also necessary to provide a phase shifting transformer.

The UR11 has an interface board feed by a +24 Vcc external power supply. This board presents three output relays for alarm and fault indication, five LEDs for fault visualization, as well as the rectifier bridges status. There are also two DIP switches for the voltage settings of the UR11 power supply, according to the model (refer to item 3.4.6.4 Control Connections on page 3-18 for more information). This board is also responsible for the heatsink temperature monitoring.

Figure 2.3 on page 2-6 shows a simplified block diagram of the UR11.

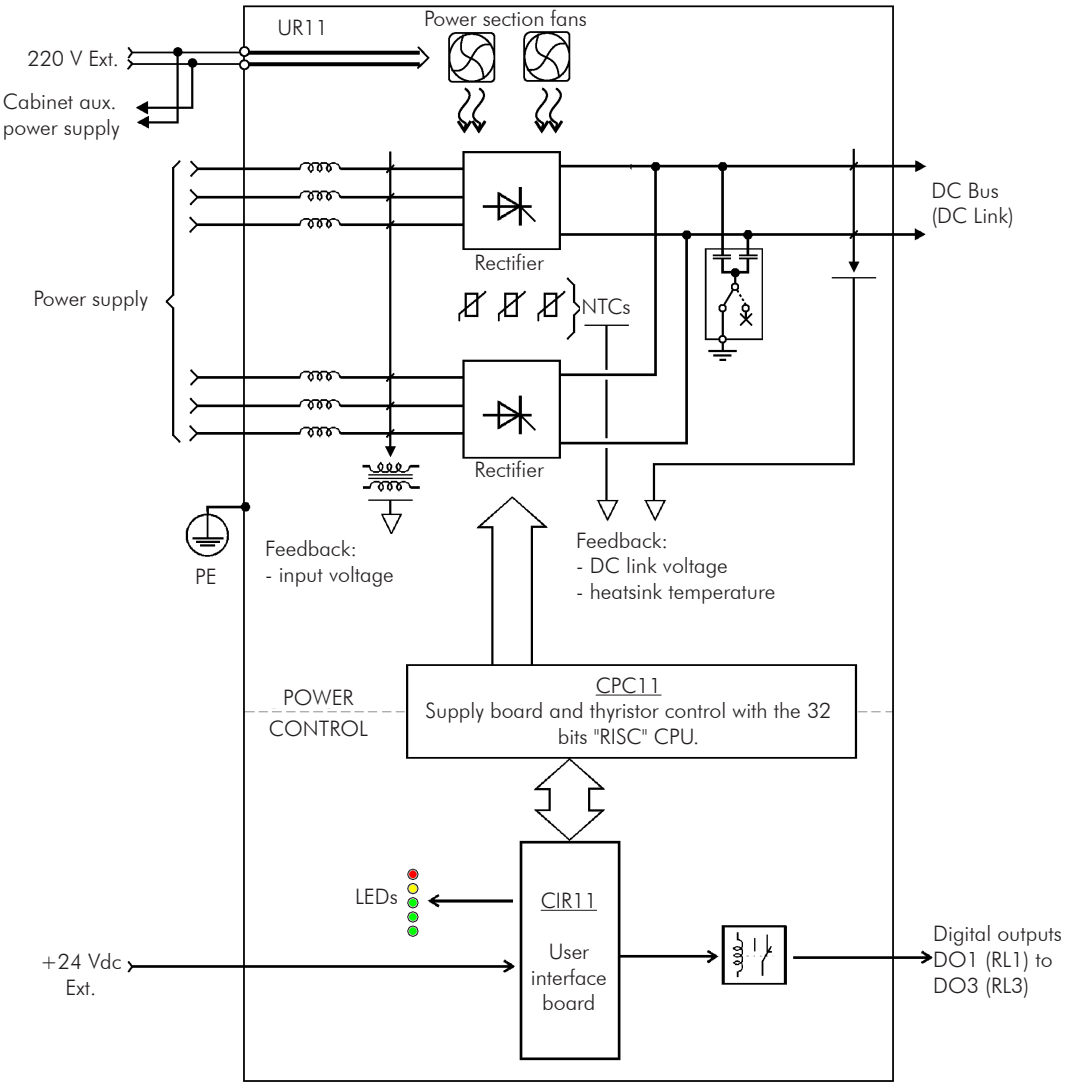


Figure 2.3 - *Block diagram for the UR11*

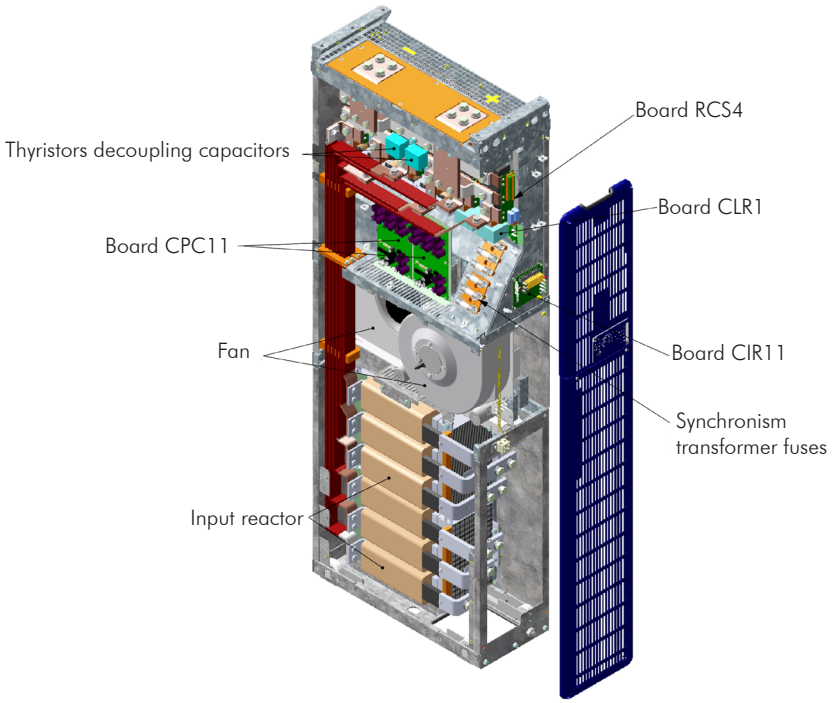


Figure 2.4 - *UR11 main components*

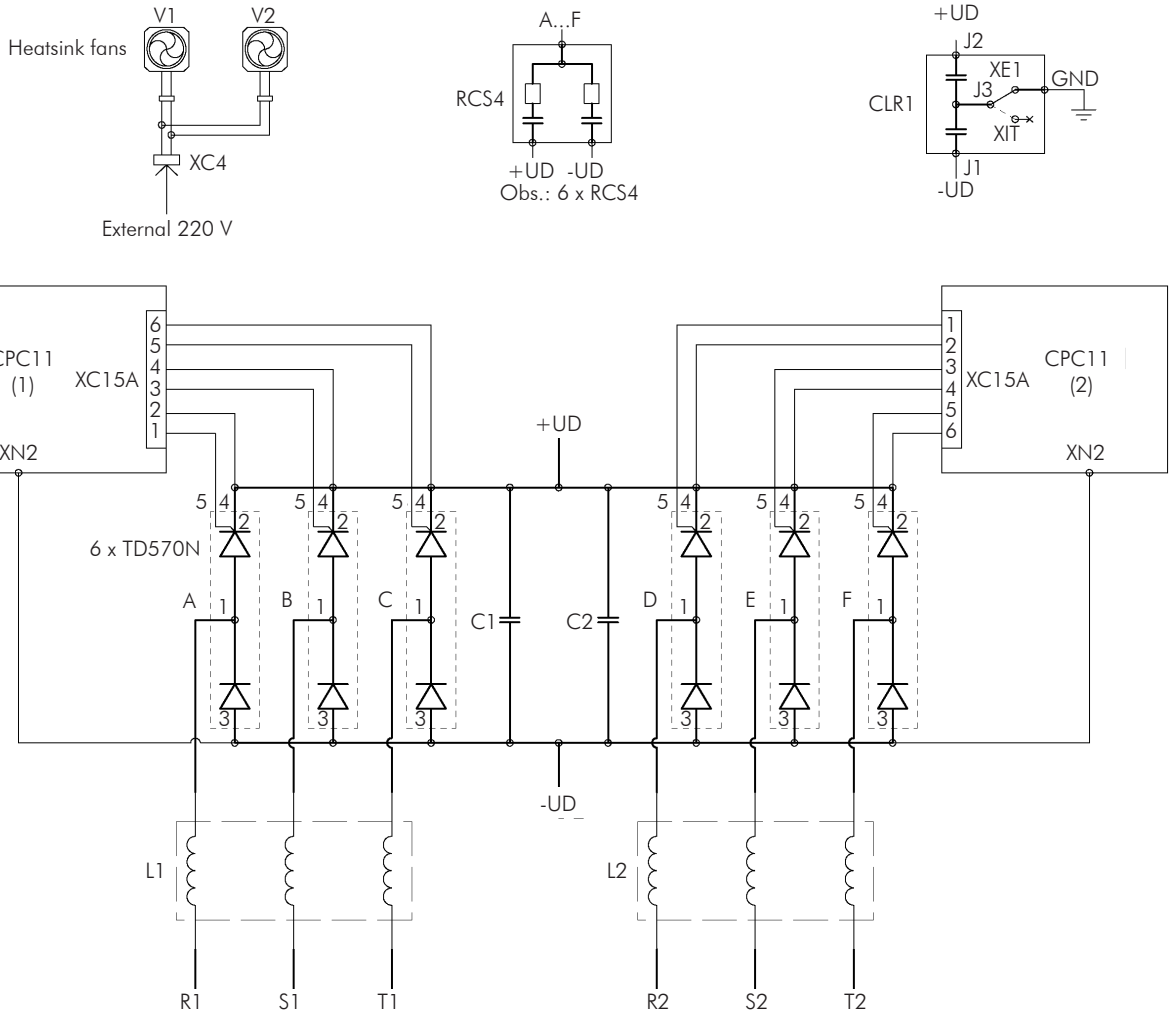


Figure 2.5 - *UR11 general internal diagram: power connections*

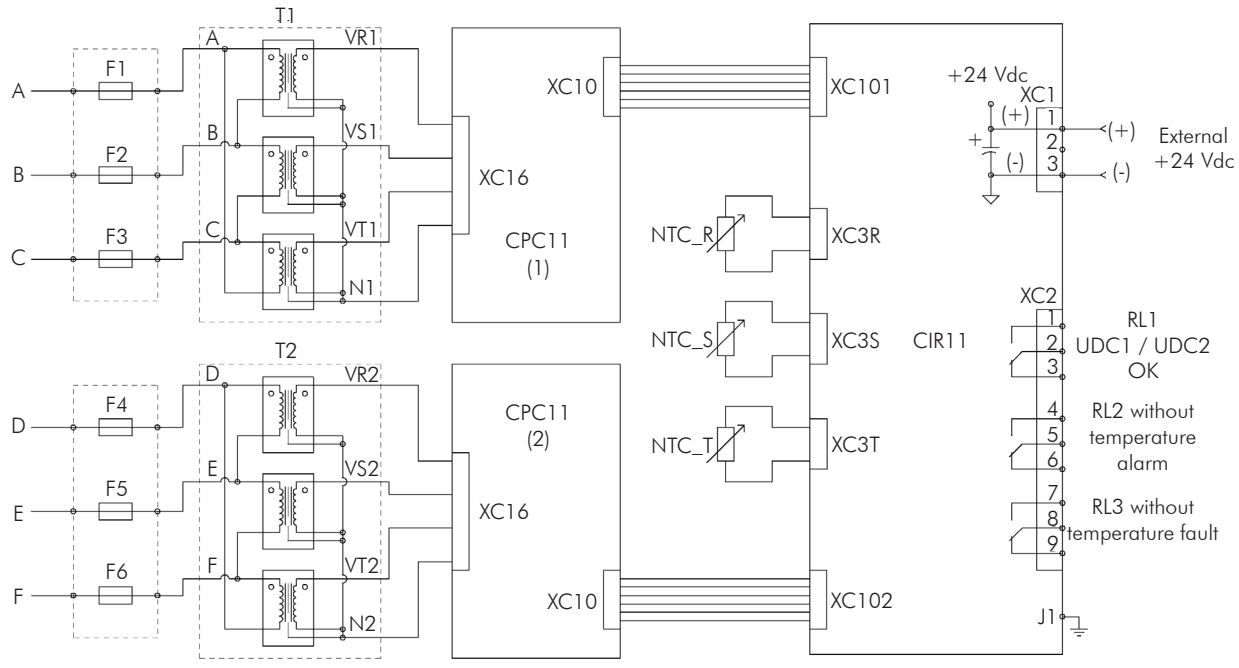


Figure 2.6 - *UR11 general internal diagram: control connections*

2.4 IDENTIFICATION LABEL FOR THE UR11

There are two identification labels, one located at the front cover and another inside the UR11 enclosure, close to the fans.

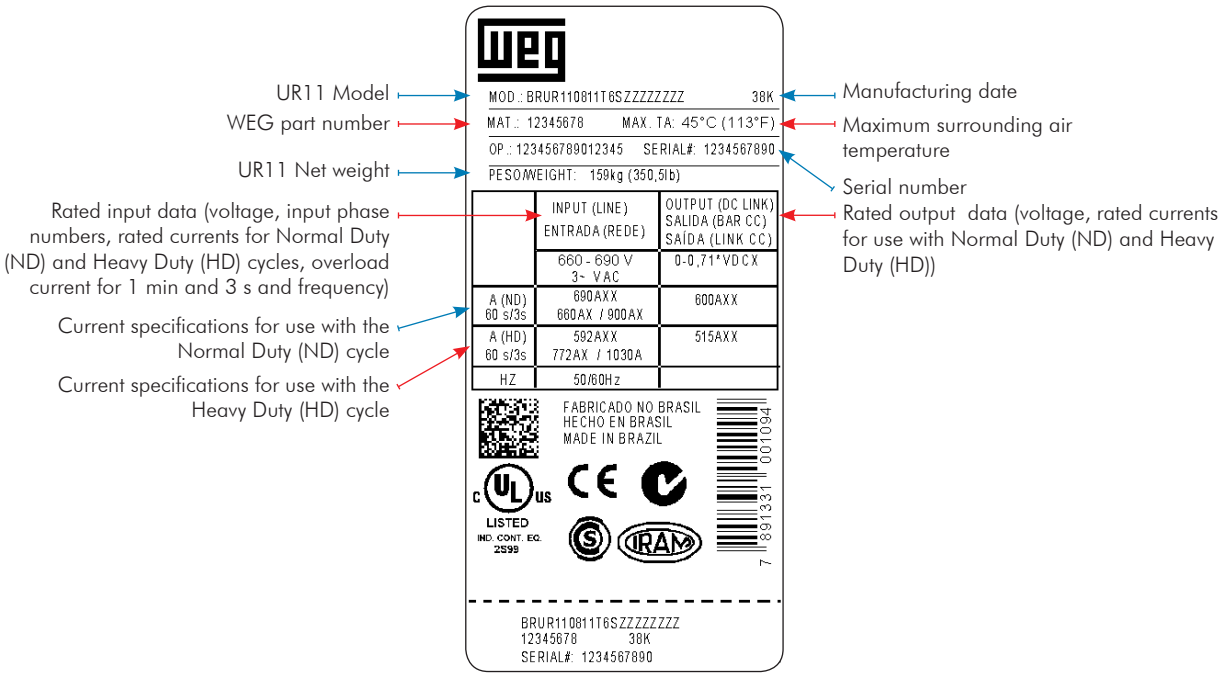


Figure 2.7 - *UR11 identification label*

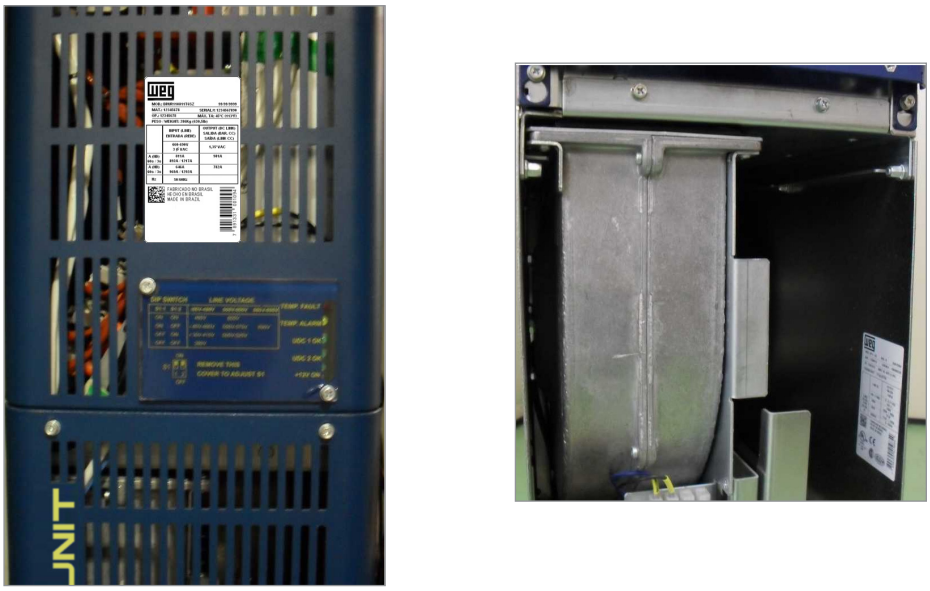


Figure 2.8 - *Location of the identification labels*

2.5 HOW TO SPECIFY THE UR11 MODEL (SMART CODE)

In order to specify the UR11 model it is necessary to indicate the desired voltage and current values in their respective fields for the nominal supply voltage and the rated input current for normal duty overload (ND) in the smart code according to the example of the Table 2.1 on page 2-9.

The available options for the rectifier input current on normal duty (ND) overload are presented at Table 2.2 on page 2-9 according to the input rated voltage. In order to check other data refer to the technical specifications at Table 7.1 on page 7-2.

Table 2.1 - *Smart code*

		Rectifier Model					
		Refer to chapter 7 TECHNICAL SPECIFICATIONS on page 7-1 for a list of models for the UR11 series and the rectifiers technical specification.					
Example	**EX**	**UR11**	**1140**	**T**	**4**	**S**	**Z**
Field description.	Market identification (defines the manual language).	WEG Rectifier Unit - 11 series.	Rated input current for use with the Normal Duty (ND) cycle.	Number of input phases.	Rated input voltage.	Option kit.	Character that identifies the code end.
Available options.				T= three-phase.	4 = 380...480 V. 5 = 500...600 V. 6 = 660...690 V.	S = standard product.	

E.g.: UR111140T4SZ corresponds to a 1140 A three-phase UR11 rectifier, with 380 V to 480 V input voltage (input power supply). A 500 / 600 V rectifier would be specified as UR110893T5SZ and a 660 / 690 V would be specified as UR110811T6SZ.

Table 2.2 - *Nominal currents at normal overload regime (ND)*

Voltage	Current
380 / 480 V	1140 =1140 A
500 / 600 V	0893 = 893 A
660 / 690 V	0811 = 811 A

2.6 RECEIVING AND STORAGE

The UR11 rectifier units are supplied packed in wooden boxes (refer to the Figure 2.9 on page 2-9).

Figure 2.9 - *UR11 packing*

There are identification labels outside these boxes, identical to the ones fixed on the product.

In order to open the box:

1. Put the box on the floor.

2. Open the wood crate.

3. Remove all the packing material (the cardboard or styrofoam protection) before removing the UR11.

Check the following items once the rectifier is delivered:

☑ Verify that the product identification label corresponds to the model number on your purchase order.

☑ Inspect the product for external damaging during transportation.

Report any damage immediately to the carrier that delivered your product.

If the products were note installed immediately, store them in a clean and dry place (temperature between -25 °C and 60 °C (77 °F and 140 °F)) with a cover in order to avoid the contamination with dust.

Figure 2.10 - *Do not tilt the rectifier units*

3 INSTALLATION AND CONNECTION

This chapter provides information on installing and wiring the UR11. The instructions and guidelines listed in this manual shall be followed in order to guarantee personnel and equipment safety, as well as the proper operation of the rectifier.

3.1 ENVIRONMENTAL CONDITIONS

Avoid installing the UR11 in an area with:

- ☑ Direct exposure to sunlight, rain, high humidity, or sea-air.
- ☑ Inflammable or corrosive gases or liquids.
- ☑ Excessive vibration.
- ☑ Dust, metallic particles, and oil mist.

Environment conditions for the operation:

- ☑ Temperature: -10 °C to 45 °C (14 °F to 113 °F) - nominal conditions (measured around the rectifier).
- ☑ From 45 °C to 55 °C (113 °F to 131°F) - 2 % current derating for each Celsius degree.
- ☑ Air relative humidity: from 5 % to 90 % non-condensing.
- ☑ Altitude: up to 1000 m (3.300 ft) - standard conditions.
- ☑ From 1000 m to 4000 m (3.300 ft to 13.200 ft) - 1 % of current derating for each 100 m (or 0.3 % each 100 ft) above 1000 m (3.300 ft) up to 4000 m (13.200 ft) maximum altitude.
- ☑ From 2000 m to 4000 m (6.600 ft to 13.200 ft) - 1,1 % of maximum voltage derating for each 100 m (or 0.33 % each 100 ft) above 2000 m (6.600 ft) up to 4000 m (13.200 ft) maximum altitude.
- ☑ Pollution degree: 2 (according to EN50178 and UL508C) with non-conductive pollution. Condensation shall not originate conduction through the accumulated residues.

3.2 LIST OF COMPONENTS

The UR11 rectifier was developed to perform the rectification of the incoming three-phase power supply and provide the proper DC link voltage to the CFW-11M line. It replaces the pre-charge circuit and the line reactor (or the interphase reactor when the 12 pulse configuration is required). It is possible to add rectifier units in parallel for applications that demand higher currents than the rated current of one rectifier unit (see Table 3.1 on page 3-2 to Table 3.3 on page 3-2).

Table 3.1 - *Currents and configuration in 380 / 480 V*

Nominal Current (A)		Number of Power Units UR11 in Parallel
ND	ND	
600	515	1
1140	979	1
1710	1468	2
2280	1957	2
2850	2446	3

Table 3.2 - *Currents and configuration in 500 / 600 V*

Nominal Current (A)		Number of Power Units UR11 in Parallel
ND	ND	
470	380	1
893	722	1
1340	1083	2
1786	1444	2
2232	1805	3

Table 3.3 - *Currents and configuration in 660 / 690 V*

Nominal Current (A)		Number of Power Units UR11 in Parallel
ND	ND	
427	340	1
811	646	1
1217	969	2
1622	1292	2
2028	1615	3

The other panel components are responsibility of the integrator. Among these components we can point out the AC input fuses, DC link fuses for power units protection, circuit breaker or disconnect switch, phase-shifting transformer for 12-pulse configuration, bus bars, panel fans, etc.

3.3 MECHANICAL INSTALLATION

The power units must be properly secured in the drive cabinet, making it possible the easy withdrawal and reinsertion in case of maintenance. The fastening must also be done so that it prevents panel transportation damage.

The "panel mounting rack" accessory simplifies the mounting of the power units and allows their simple fastening and movement. Refer to "Rack 2/Rack 3 Mounting Guide".

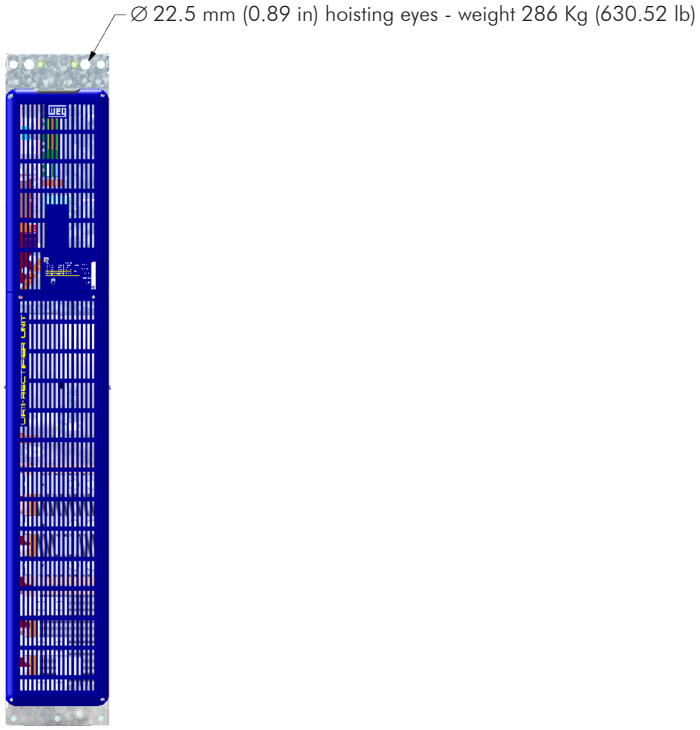


Figure 3.1 - *UR11: hoisting eyes*

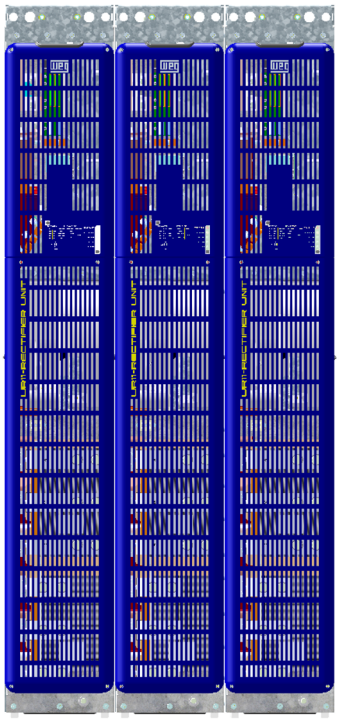


Figure 3.2 - *Mounting of the UR11 side by side without lateral spacing*

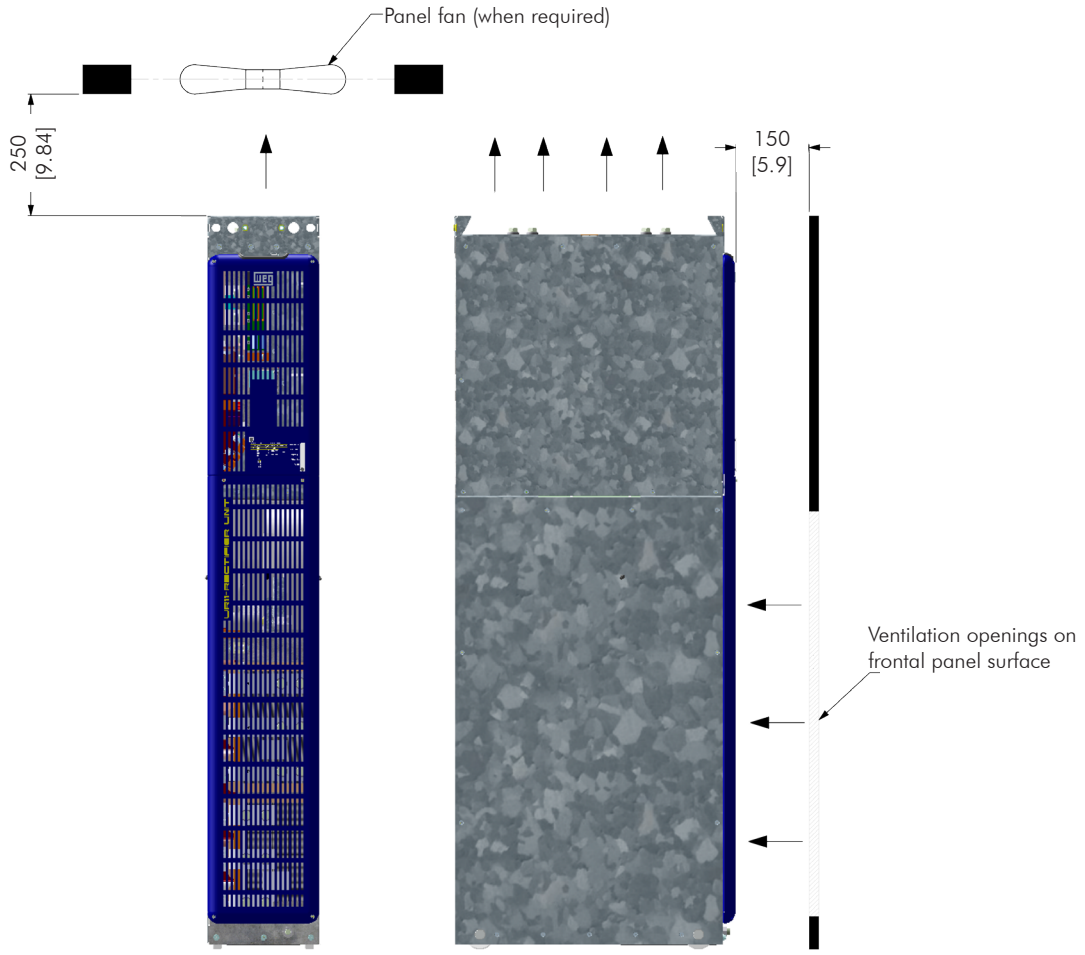


Figure 3.3 - *Ventilation clearances in mm [in]*

The total air outflow of the power unit is 1150 m³/h (320 l/s; 677 CFM). It is recommended an outflow of 1350 m³/h (375 l/s; 795 CFM) per power unit at the air exhaustion.

Figure 3.4 - *UR11: bottom view and the side cut view (mm [in])*

The UR11 wheels facilitate its insertion into and withdrawal from the panel (Figure 3.4 on page 3-4).

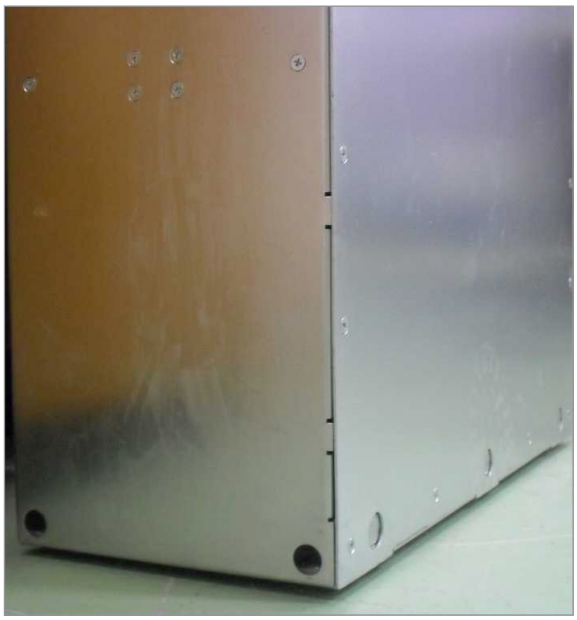


Figure 3.5 - *Fixing holes of the rectifier unit*

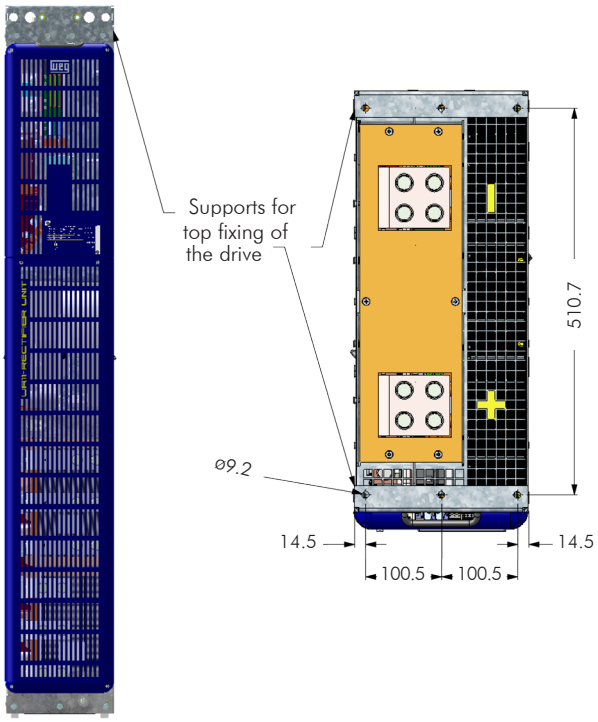


Figure 3.6 - *Supports for top fixing (mm [in])*

3.4 ELECTRICAL INSTALLATION

DANGER!
The following information is merely a guide for proper installation. Comply with applicable local regulations for electrical installations.

DANGER!
Make sure the AC power supply is disconnected before starting the installation.

ATTENTION!
The UR11 can be connected in circuits with symmetrical short circuit capability up to 150000 Arms (480 V/690 V maximum).

ATTENTION!
Branch circuit protection must be provided in accordance with applicable local codes.

3.4.1 Input Circuit Breaker

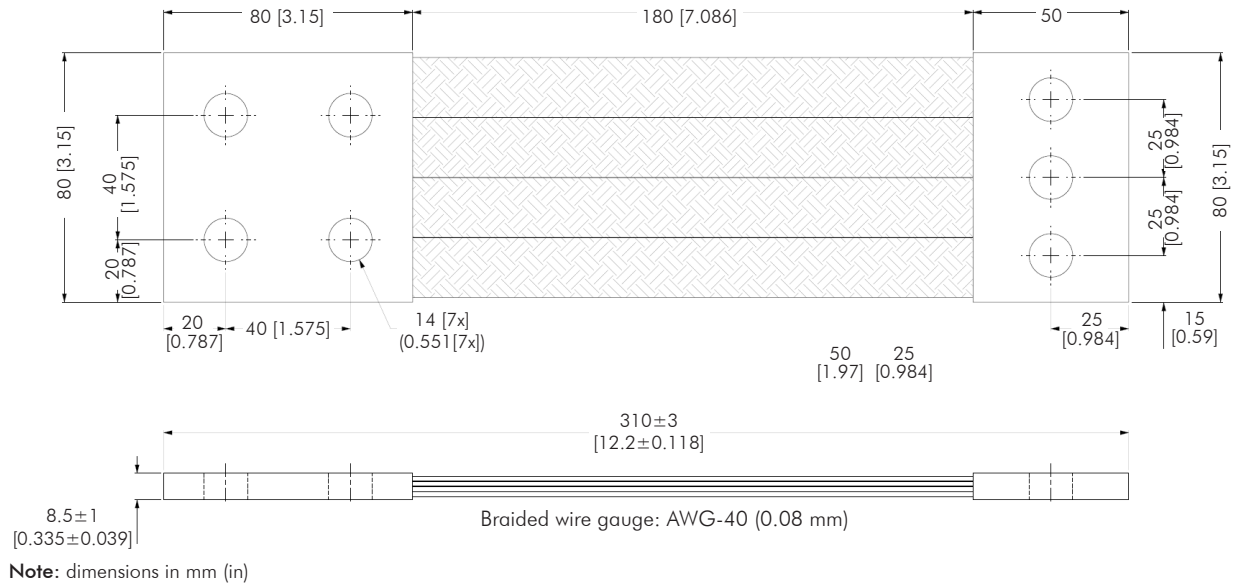
DANGER!
A switching device must be provided in order to perform the power supply connection/disconnection. This device must be able to disconnect the power supply from the rectifier whenever necessary (e.g.: under maintenance).

The main circuit breaker must be sized to withstand the inverter rated current and its short circuit level must be compatible to the application (see "AFW11M mounting guide" for more details). When the circuit breaker is closed, power is applied to the UR11 starting at the pre-charge of the DC link. In case of failure in some inverter, or emergency (remote or local), the circuit breaker can be switched off by the undervoltage release coil protection.

3.4.2 Cables/Bus Bars

The panel bus bars must be sized according to the panel input current and the rectifier output current. It is recommend the use of copper bars or cables. In case that aluminum bars have to be used, it is necessary to clean the contacts and to apply an antioxidant compound. If the compound is not used, any copper-aluminum junction will suffer accelerated oxidation. Refer to item 3.4.6 UR11 Connections on page 3-13 for more information.

The interconnection between the UR11 output and the DC bus can be done with flat braided cables sized to withstand the UR11 output DC current (see specifications at Table 7.1 on page 7-2). The Figure 3.7 on page 3-7 presents an example of flat braided cable used by WEG.



Note: dimensions in mm (in)

Figure 3.7 - *Example of flat braided cable*

The cable length represented by "A" must be sized according to the distance between the UR11 and the panel DC bus (copper bus), as presented at Figure 3.13 on page 3-13.

ATTENTION!

The braided cable presented at Figure 3.7 on page 3-7, used by WEG, was designed to withstand half the UR11 output DC current (see UR11 specifications at Table 7.1 on page 7-2). Therefore, two parallel braided cables are necessary for each connection (+UD and -UD). It is necessary to consult the braided cable manufacturer for proper sizing in case it is desired to use only one braided cable per connection.

3.4.3 Fuses

ATTENTION!

It is necessary to use individual fuses at the input of each UR11 diode bridge for the proper protection of the rectifier units.

The fuses should be connect according to the Figure 3.8 on page 3-8 and sized to protect and withstand the individual current of each individual module of the rectifier bridge.

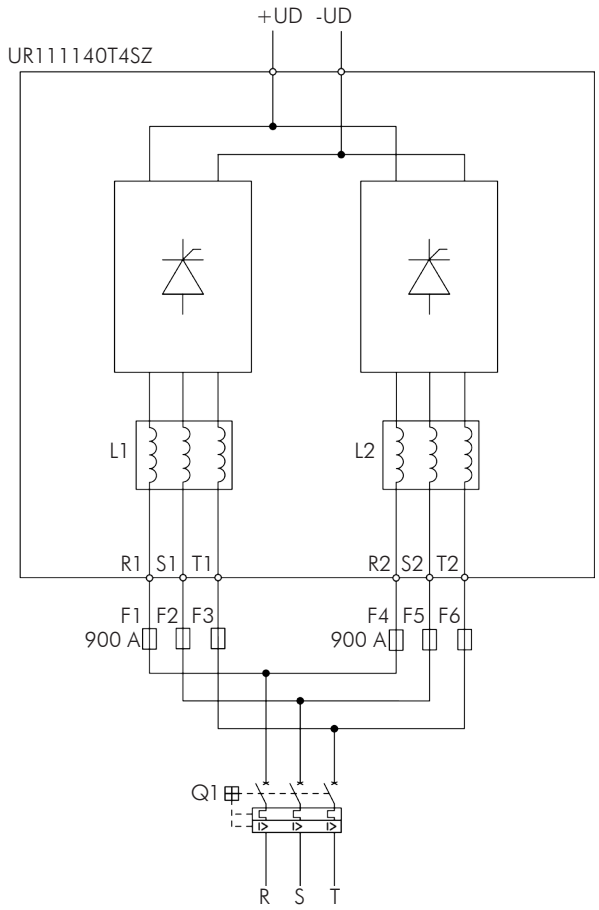


Figure 3.8 - *Example of 6 pulse configuration with one rectifier unit*

The Table 3.4 on page 3-8 presents WEG values according to the configuration presented at Figure 3.8 on page 3-8 (6 fuses per UR11).

Table 3.4 - *Recommended Fuses*

Nominal Voltage [V]	ND Current [A]	Fuse [A]	Maximum Fuse I^2t @ 25 °C [A^2s]
380 / 480	1140	900	1.445.000
500 / 600	893	700	1.445.000
660 / 690	811		1.445.000

The fuses must be sized according to the voltage supply of the rectifier in order it can be capable of providing the arc extinction and the I^2t must be smaller than the I^2t of each thyristor (1.445.000 A^2s), as indicated at Table 3.4 on page 3-8.

Example of fuses used by WEG:

- ☑ 400 V line: 6,9URD33TTF0900 (FERRAZ, 900 A / 690 V / I^2t = 700.000 A^2s).
- ☑ Other lines: 6,9URD33TTF0700 (FERRAZ, 700 A / 690 V / I^2t = 300.000 A^2s).

3.4.4 Terminals Recommended for Power Cables

Table 3.5 - *(a) and (b) - Recommended cable lugs for power connections*

(a) Cable gauges in mm²

Wire Size [mm²]	Stud Size	Manufacturer	Ring Lug, P/N	Crimping (installation) Tool P/N	Number of Crimps
70	M12	Hollingsworth	RM 70-12	Hydraulic Tool: H6-500.	1
		Burndy (FCI)	YA26L6	Dieless tool: MY29-3 or Y644 or Y81. Tool + die: Y35 or Y750 / U26RT.	1
120	M12	Hollingsworth	RM120-12	Hydraulic Tool: H6-500.	1
		Burndy (FCI)	YA28L	Dieless tool: MY29-3 or Y644 or Y81. Tool + die: Y35 or Y750 / U29RT.	1
150	M12	Hollingsworth	RM150-12	Hydraulic Tool: H6-500.	1
		Burndy (FCI)	YA30L	Dieless tool: Y644 or Y81. Tool + die: Y35 or Y750 / U30RT.	1
185	M12	Hollingsworth	RM185-12	Hydraulic Tool: H6-500.	1
		Burndy (FCI)	YA31L	Dieless tool: Y644 or Y81. Tool + die: Y35 or Y750 / U31RT.	1
240	M12	Hollingsworth	RM240-12	Hydraulic Tool: H6-500.	1
		Burndy (FCI)	YA34L6	Dieless tool: Y644 or Y81. Tool + die: Y35 or Y750 / U34RT.	1

(b) Cable gauges in AWG / kcmil

Wire Size [AWG/ kcmil]	Stud Size	Manufacturer	Ring Lug, P/N	Crimping Tool P/N	Number of Crimps
2/0	M12	Hollingsworth	R 2012	Hydraulic Tool: H6-500.	1
		Burndy (FCI)	YA26L6	Dieless tool: MY29-3 or Y644 or Y81. Tool+die: Y35 or Y750 / U26RT.	1
4/0	M12	Hollingsworth	R 4012	Hydraulic Tool: H6-500.	1
		Burndy (FCI)	YA28L	Dieless tool: MY29-3 or Y644 or Y81. Tool+die: Y35 or Y750 / U29RT.	1
300	M12	Hollingsworth	R 30012	Hydraulic Tool H6-500.	1
		Burndy (FCI)	YA30L	Dieless tool: Y644 or Y81. Tool+die: Y35 or Y750 / U30RT.	1
350	M12	Hollingsworth	R 35012	Hydraulic Tool: H6-500.	1
		Burndy (FCI)	YA31L	Dieless tool: Y644 or Y81. Tool+die: Y35 or Y750 / U31RT.	1
500	M12	Hollingsworth	R 50012	Hydraulic Tool H6-500.	1
		Burndy (FCI)	YA34L6	Dieless tool: Y644 or Y81. Tool+die: Y35 or Y750 / U34RT.	1

3.4.5 Configurations of the Rectifier

The configuration of the UR11 to operate as 6 pulses and 12 pulses rectifier are presented in this section.

NOTE!

Several additional items are needed for the complete panel assembly, such as: output inverters, AC fuses, DC link fuses for the output power units protection, circuit breaker or disconnect switch at the input and in case of 12-pulse configuration is also necessary to provide a phase shifting transformer.

3.4.5.1 Operation as 6 Pulse Rectifier

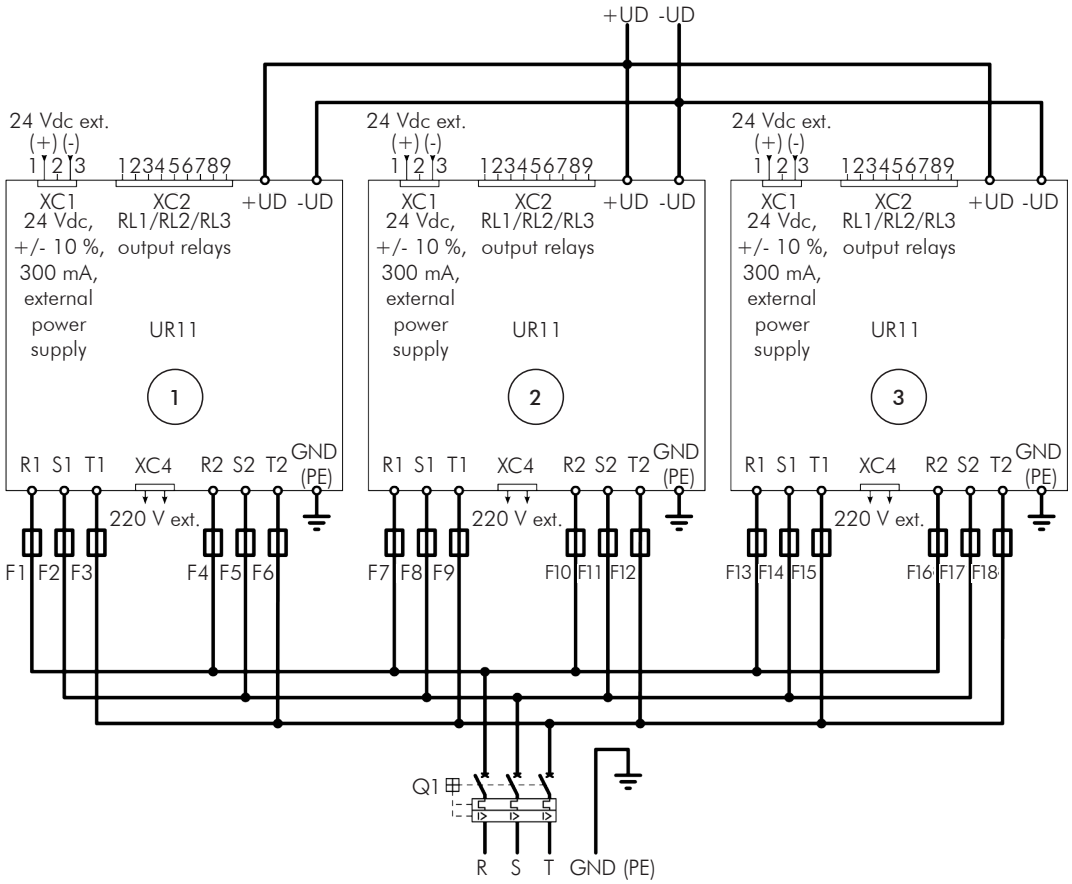


Figure 3.9 - *General connection diagram of a 6 pulse rectifier configuration with three parallel UR11 units*

The Figure 3.9 on page 3-10 presents the general connection diagram using three parallel UR11 units operating as a 6 pulse rectifier. For the operation with a reduced number of parallel UR11 units, consider the connection in the ascending order.

3.4.5.2 Operation as 12 Pulse Rectifier

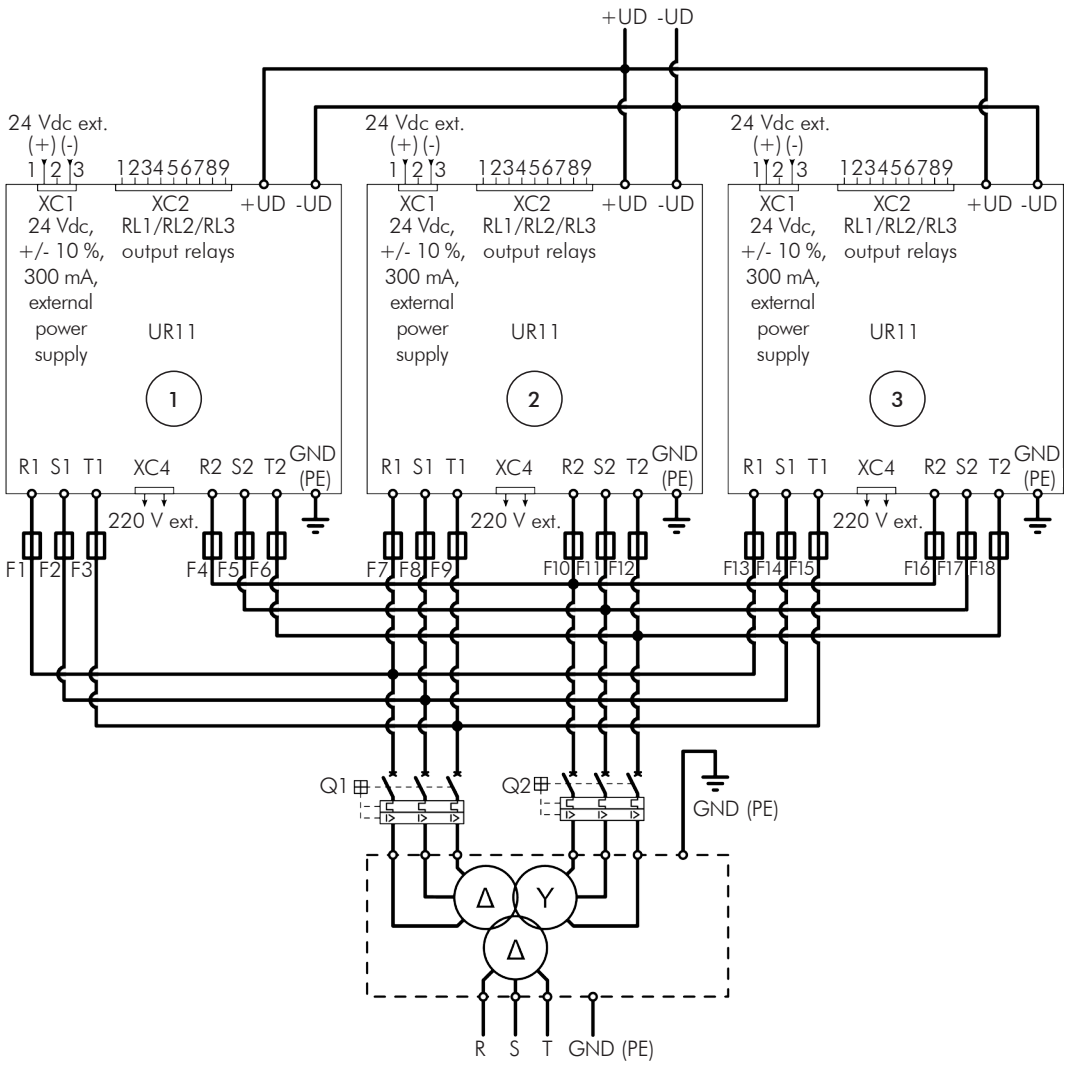


Figure 3.10 - *General connection diagram of a 12 pulse rectifier configuration with three parallel UR11 units*

The Figure 3.10 on page 3-11 presents the general connection diagram using three parallel UR11 units operating as a 12 pulse rectifier. The Figure 3.11 on page 3-12 presents the general connection diagram using two parallel UR11 units operating as a 12 pulse rectifier and the Figure 3.12 on page 3-12 presents the general connection diagram using one UR11 unit operating as a 12 pulse rectifier.

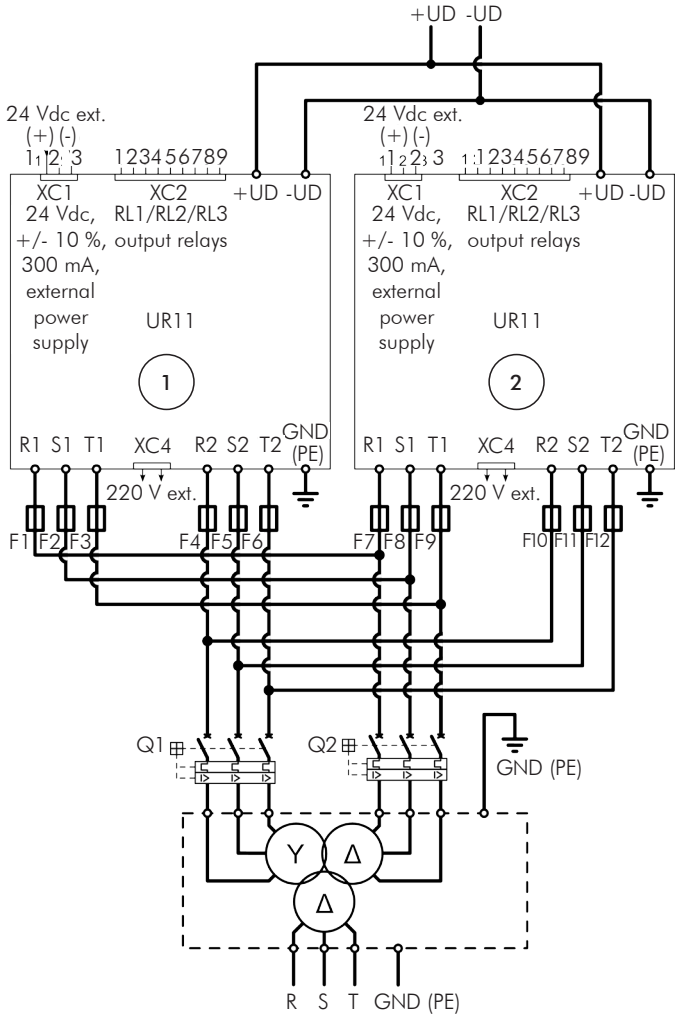


Figure 3.11 - *General connection diagram of a 12 pulse rectifier configuration with two parallel UR11 units*

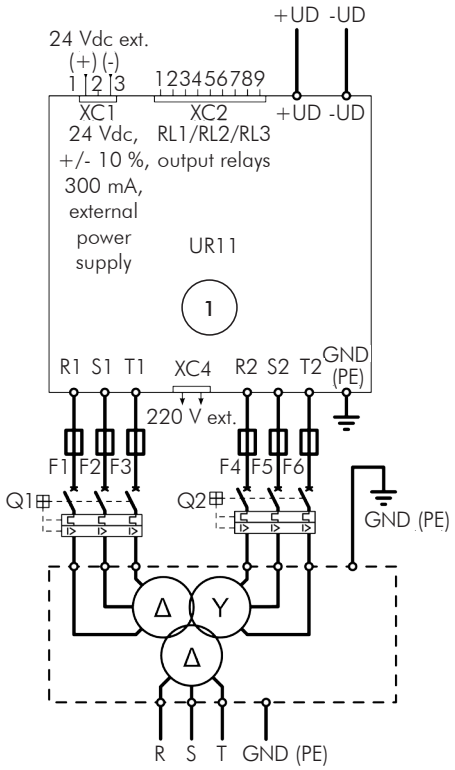


Figure 3.12 - *General connection diagram of a 12 pulse rectifier configuration with one UR11 unit*

3.4.6 UR11 Connections

3.4.6.1 Panel Layout and Connections

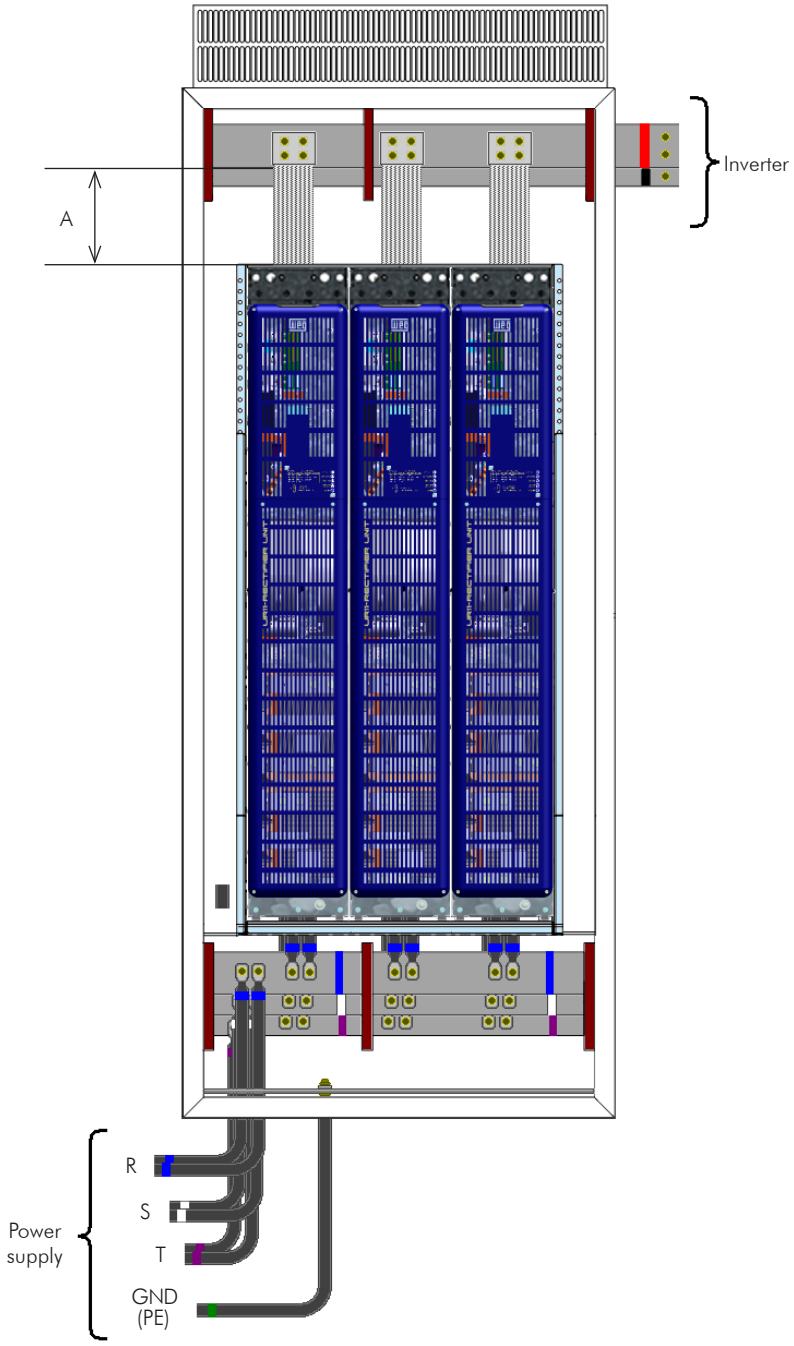


Figure 3.13 - *Example of adequate panel installation layout*

The Figure 3.13 on page 3-13 presents the adequate installation layout for three parallel UR11 rectifier units.

3.4.6.2 Power Connections

ATTENTION!

The power supply that feeds the rectifier must have a grounded neutral. In case of IT networks, follow the instructions described in item 3.4.6.3.1 IT Network on page 3-17.

NOTE!

The voltage must be compatible to the rectifier rated voltage. Refer to item 3.4.6.4 Control Connections on page 3-18 for the configuration of the UR11 rated operation voltage.

The fastening of the UR11 output connections is done with four M12 x 25 bolts (tightening torque: 60 N.m.), as presented at Figure 3.14 on page 3-14. Refer to item 3.4.2 Cables/Bus Bars on page 3-6 for more information.

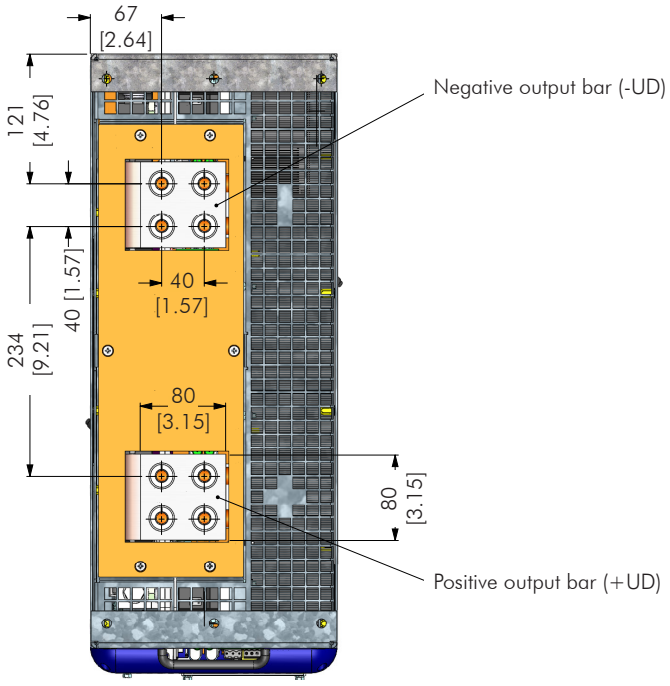


Figure 3.14 - *UR11 output bus bar, DC connections (mm [in])*

The input connections at the internal reactances are done by means of twelve M12 x 30 bolts (tightening torque: 60 N.m.), each reactor uses 6 bolts, 2 bolts per phase. The bus bars are of 40 x 10 mm (1.57 x 0.39 in) and the fastening is done through M12 nuts inserted into the bar, as presented at Figure 3.15 on page 3-15.

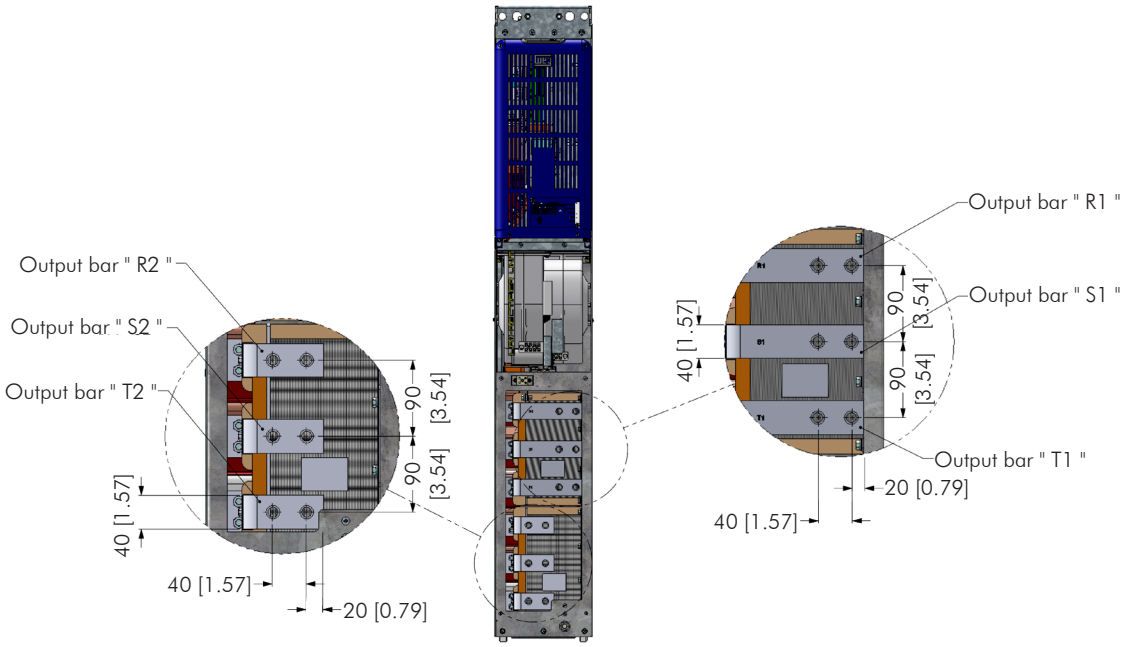


Figure 3.15 - *UR11 output bus bar, power supply output connections (mm [in])*

Use two cables in parallel, with the recommended gauge indicated in the Table 3.6 on page 3-15, for connecting each UR11 output reactor to the input bus bar (power supply).

Table 3.6 - *R/S/T output cables*

Current (A)	Voltage (V)	Overload	Minimum Cable Cross-section Area (mm²)
600	380 / 480	ND	(2x) 240
515		HD	(2x) 185
470	500 / 600	ND	(2x) 150
418		HD	(2x) 120
427	660 / 690	ND	(2x) 120
340		HD	(2x) 70

NOTE!

The cables are designed for 75 °C (167 °F) ambient temperature with PVC isolation. In case using cables with different isolating material, they must be sized according to the local standards.

It is necessary to provide 220 V external power supply for the two fans of the UR11 unit.

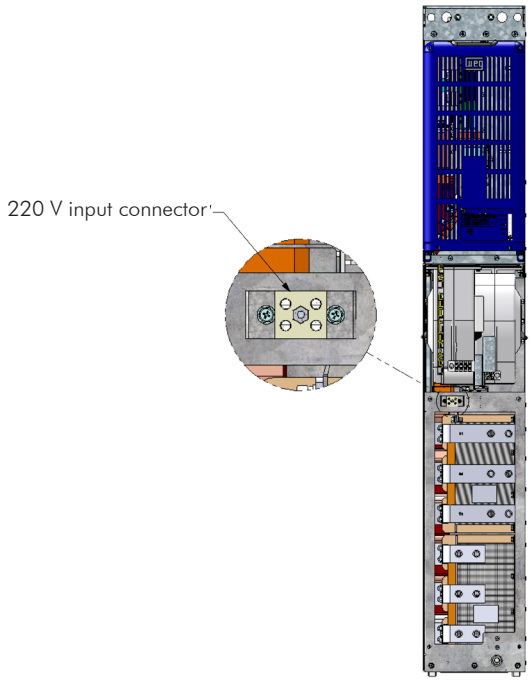


Figure 3.16 - *Fans supply terminals: 220 V / 4 A*

3.4.6.3 Grounding Connections

ATTENTION!

The neutral conductor of the network must be solidly grounded; however, this conductor must not be used to ground the rectifier.

ATTENTION!

The rectifier must be obligatorily connected to a protective ground (PE).

- ☑ Use cables with the recommended gauge indicated in the Table 3.7 on page 3-16. Local standards should be followed in case different gauges are requested.
- ☑ The rectifier grounding connection must be connected to the protective ground (PE).

The fastening of the UR11 ground cable connections is done with M12 x 30 bolts (tightening torque: 60 N.m.), as presented at Figure 3.17 on page 3-17.

Table 3.7 - *Grounding cables*

Current (A)	Voltage (V)	Overload	Minimum Cable Cross-section Area (mm²)
600	380 / 480	ND	240
515		HD	185
470	500 / 600	ND	150
418		HD	120
427	660 / 690	ND	120
340		HD	70

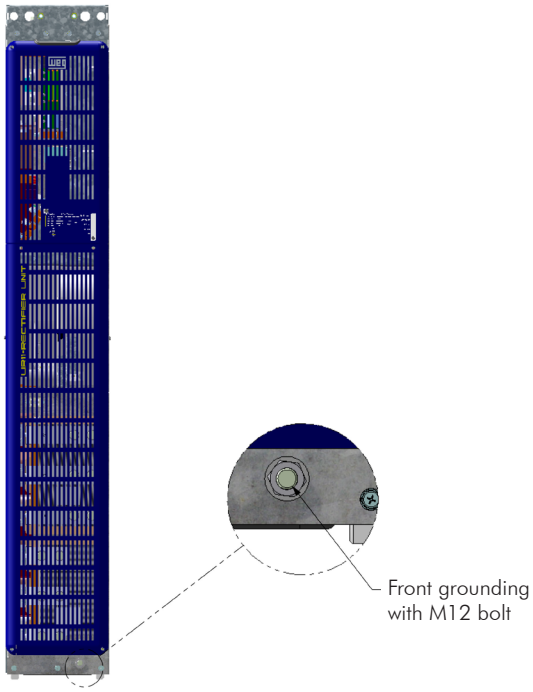


Figure 3.17 - *UR11 ground connection point*

3.4.6.3.1 IT Network

ATTENTION!

In order to use the rectifier unit in IT networks (not grounded or grounded via high impedance) or grounded delta networks (delta corner earth), it is necessary to disconnect the grounding cable located at the CLR1 board of the XE1 connector and connect it to the XIT connector located in the same board.

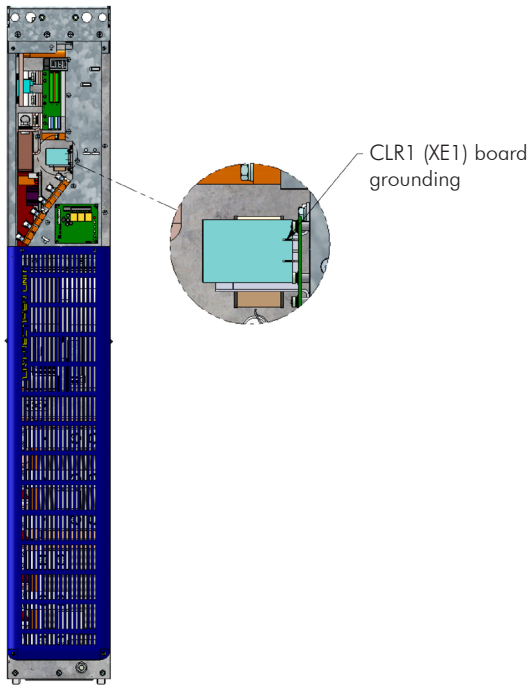


Figure 3.18 - *CLR1 board grounding point*

The UR11 rectifier series was developed to be used in application with the CFW-11M (Modular Drive) inverter series, which can be used in IT networks without modifications. In these cases consider the following:

☑ The phase to ground or isolation fault indication must be processed by the user to indicate the failure occurrence and/or block the inverter operation.

In order to use the UR11 for feeding other inverters, refer to the inverter respective manual.

3.4.6.4 Control Connections

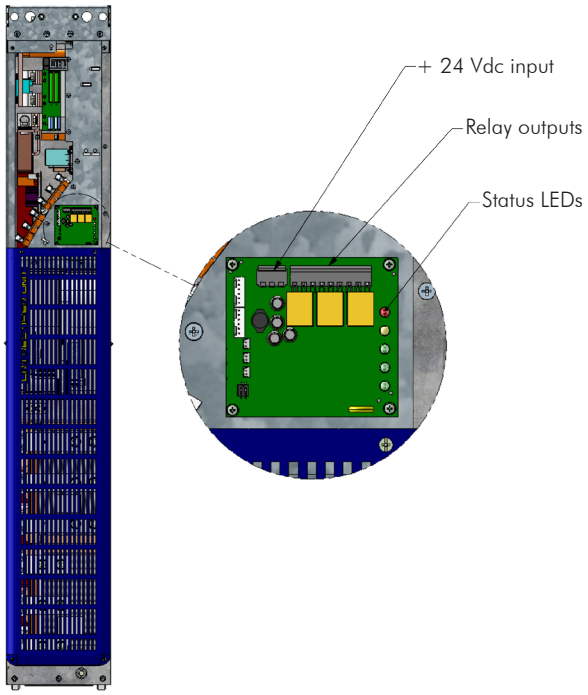


Figure 3.19 - *UR11 control cables connection points*

The CIR11 (Rectifier Interface Board) is presented at Figure 3.19 on page 3-18. It is necessary to provide a + 24 Vdc +/- 10 % external power supply to feed this board. This external power supply must have 300 mAdc minimum capacity.

Table 3.8 - *XC1 connector signals of the CIR11*

XC1		Standard Function	Specifications
1	+24 V	24 Vdc power supply.	24 Vdc @ 300 mA / ± 10 % external power supply.
2	-	No function.	
3	0 V	0 V reference for the 24 Vdc external power supply. High impedance grounded (4,7 MΩ).	

Table 3.9 - *XC2 Connector signals of the CIR11*

XC2		Standard Function	Specifications
1	NO1	RL1 digital output with DC bus OK function (UDC1 & UDC2 OK). - UDC1: DC bus of the rectifier bridge 1. - UDC2: DC bus of the rectifier bridge 2.	Contacts rating: 1 A. Maximum voltage: 240 Vac. NC - normally closed contact. C - common. NO - normally open contact.
2	C1		
3	NC1		
4	NO2	RL2 digital output with no temperature alarm function.	
5	C2		
6	NC2		
7	NO3	RL3 digital output with no temperature fault function.	
8	C3		
9	NC3		

The RL1, RL2 and RL3 relay digital outputs of the CIR11 board (Figure 3.20 on page 3-19) are used to monitor the operation status of the UR11 and the alarm and fault conditions of the temperature. The NO position indicates that the UR11 is under regular operation and the NC position indicates a fault/alarm situation. Refer to section 5.2 FAULTS, ALARMS, AND POSSIBLE CAUSES on page 5-1 for more details.

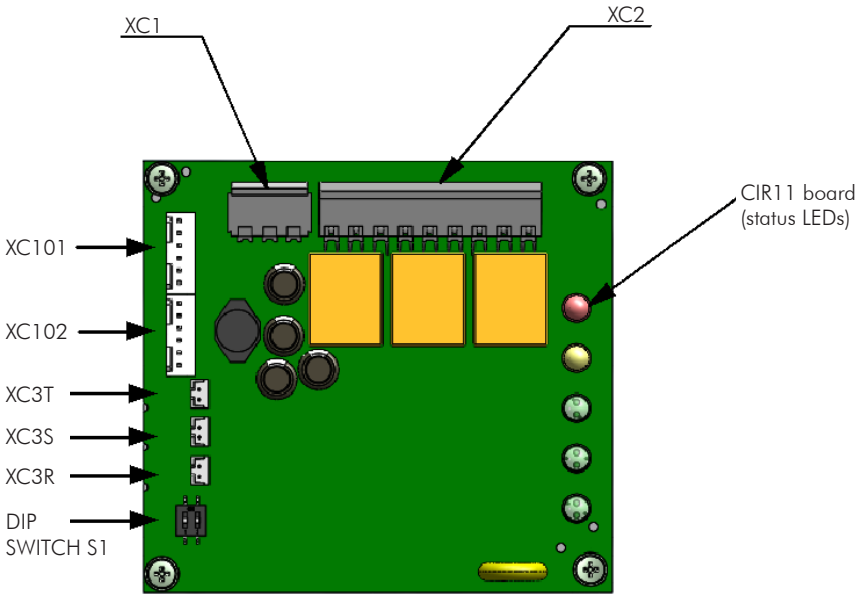


Figure 3.20 - *CIR11 board connection points*

The XC3R, XC3S, XC3T connectors located in the CIR11 board receive the NTCs signals that monitor the heatsink temperatures.

The CIR11 board sets the rated operation voltage of the UR11 through the DIP switch S1. The 400 V model (UR111140T4SZ) can be set to four different voltage levels: 380 V, 400 V / 415 V, 440 V / 460 V and 480 V (refer to Table 3.10 on page 3-19).

Table 3.10 - *Configuration of the DIP switch S1*

DIP Switch		Rated Voltage		
S1:1	S1:2	UR111140T4 (Line 400 V)	UR110893T5 (Line 500 V)	UR110811T6 (Line 690 V)
OFF	OFF	480 V	600 V	**660 V / 690 V***
OFF*	**ON***	**440 V / 460 V***	**550 V / 575 V***	
ON	OFF	400 V / 415 V	500 V / 525 V	
ON	ON	380 V		

* Factory default setting.

The DIP switch S1:1 is set to OFF and the DIP switch S1:2 is set to ON as factory default.

Follow instructions below for the proper installation of the control wiring:

- ☑ Wire gauge: 0.5 mm² (20 AWG) to 1.5 mm² (14 AWG).
- ☑ Maximum tightening torque: 0.5 N.m (4.50 lbf.in).
- ☑ Use shielded cables for the 24 Vdc power supply connections of the CIR11 board if necessary. The proper cable shield connection is shown in Figure 3.21 on page 3-20.

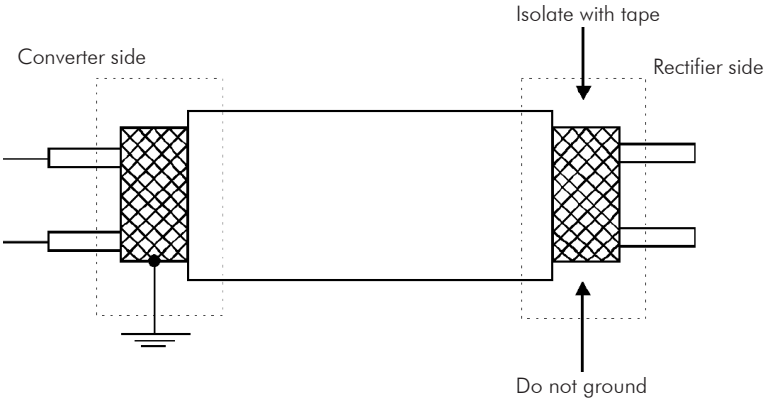
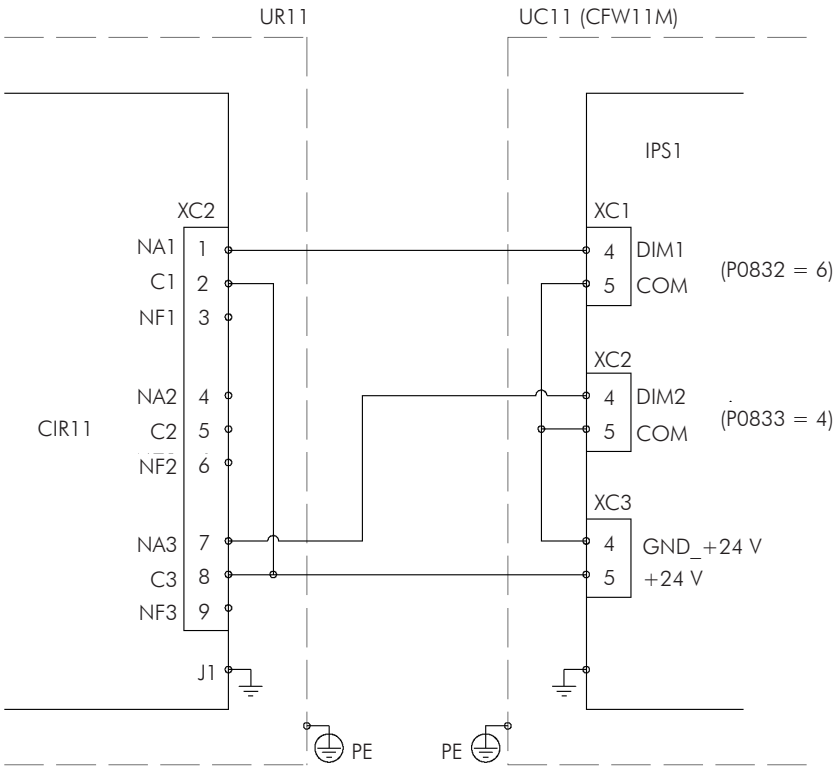


Figure 3.21 - *Cable shield connection*

- ☑ Relays, contactors, solenoids or coils of electromechanical brakes installed close to the inverter may eventually create interferences in the control circuit. To eliminate this effect, RC suppressors (with AC power supply) or free-wheel diodes (with DC power supply) must be connected in parallel to the coils of these devices.

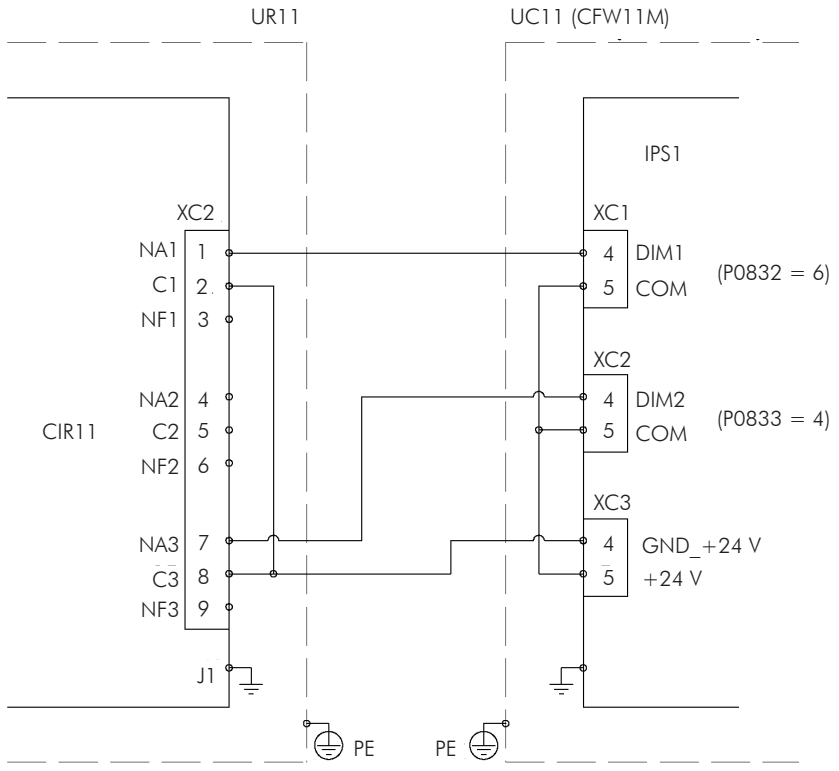
3.4.7 Typical Connections

In order the CFW-11M inverter can monitor the rectifier, it is recommended the interconnection between the fault and/or alarm signals, available at the relays outputs in the CIR11 board, with the DIM1 and DIM2 digital inputs of the CFW-11M, located at the IPS board of the CFW-11M Control Unit (UC11).



* NO - normally open contact.
C - common.
NC - normally closed contact.

Figure 3.22 - *Application example with active high signal at the DIs of the CFW-11M*



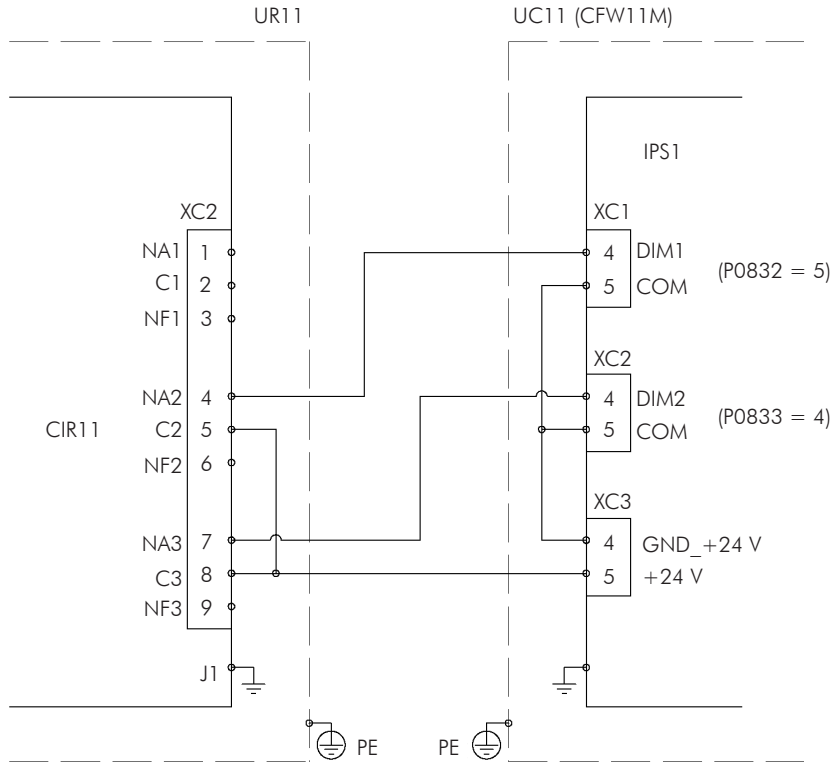
* NO - normally open contact.
C - common.
NC - normally closed contact.

Figure 3.23 - *Application example with active low signal at the DIs of the CFW-11M*

NOTE!
Make sure the CFW-11M inverter has the 2.0x software version or above. For more details, refer to the "CFW-11M user manual" and the "CFW-11 programming manual".

The examples of Figure 3.22 on page 3-21 and Figure 3.23 on page 3-21 show that the DIM1 and DIM2 digital inputs are set to "Without External Rectifier Fault" (P0832 = 6) and "Without External Rectifier Overtemperature" (P0833 = 4) respectively. On both examples, the CFW-11M will show F414 ("External Rectifier Fault") if DIM1 input (and therefore the RL1 output relay - "UCD1_OK / UDC2_OK" - of the CIR11) opens when the DC bus voltage is higher than the undervoltage level and the CFW-11M PWM is enabled; or it will display F412 ("External Rectifier Overtemperature") if DIM2 input (and therefore the output relay RL3 - "Without Temperature Fault" - of CIR11) opens.

Figure 3.24 on page 3-22 shows DIM1 and DIM2 digital inputs set to "Without External Rectifier Alarm" (P0832 = 5) and "Without External Rectifier Overtemperature Fault" (P0833 = 4), respectively. In this case, the CFW-11M will display A415 ("External Rectifier High Temperature" alarm) if the DIM1 (and therefore the RL2 relay output - "Without Temperature Alarm" - of CIR11) opens, and it will display F412 ("External Rectifier Overtemperature") if the DIM2 input (and therefore the RL3 relay output - "Without Temperature Fault" - of CIR11) opens.



* NO - normally open contact.
C - common.
NC - normally closed contact.

Figure 3.24 - *Application example with active high signal at the DIs of the CFW-11M*

3.5 INSTALLATION ACCORDING TO THE EUROPEAN DIRECTIVE OF ELECTROMAGNETIC COMPATIBILITY

ATTENTION!
The conformity with European directives of electromagnetic compatibility "EMC Directive 2004/108/EC" also depends on the inverters connected to the UR11 output.
Always follow the installation instructions as presented in the inverter manual.

3.5.1 Conformal Installation with the CFW-11M

When the CFW-11M is installed according to the user's manual instructions presented at chapter 3.5 INSTALLATION ACCORDING TO THE EUROPEAN DIRECTIVE OF ELECTROMAGNETIC COMPATIBILITY on page 3-23 - and all the next recommendations are followed for the UR11 installation, the complete panel will be in accordance with IEC/EN 61800-3 "Adjustable Speed Electrical Power Drive Systems" category C4.

UR11 installation recommendations:

1. UR11 grounding according to the instructions on item 3.4.6.3 Grounding Connections on page 3-16 of this manual.

2. Shielded control cables on XC1.

3.5.2 Standard Definitions

IEC/EN 61800-3: "Adjustable Speed Electrical Power Drives Systems"

☑ **Environment:**

First Environment: includes domestic premises. It also includes establishments directly connected without intermediate transformer to a low-voltage power supply network which supplies buildings used for domestic purposes.
Example: houses, apartments, commercial installations, or offices located in residential buildings.

Second Environment: includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes.
Example: industrial area, technical area of any building supplied by a dedicated transformer.

☑ **Categories:**

Category C1: inverters with a voltage rating less than 1000 V and intended for use in the First Environment.

Category C2: inverters with a voltage rating less than 1000 V, intended for use in the First Environment, not provided with a plug connector or a movable installations. They must be installed and commissioned by a professional.

Note: a professional is a person or organization familiar with the installation and/or commissioning of inverters, including their EMC aspects.

Category C3: inverters with a voltage rating less than 1000 V and intended for use in the Second Environment only (not designed for use in the First Environment).

Category C4: inverters with a voltage rating equal to or greater than 1000 V, or with a current rating equal to or greater than 400 Amps, or intended for use in complex systems in the Second Environment.

EN 55011: "Threshold values and measuring methods for radio interference from industrial, scientific and medical (ISM) high-frequency equipment"

Class B: equipment intended for use in the low-voltage power supply network (residential, commercial, and light industrial environments).

Class A1: equipment intended for use in the low-voltage power supply network. Restricted distribution.
Note: it must be installed and commissioned by a professional when applied in the low-voltage power supply network.

Class A2: equipment intended for use in industrial environments.

3.5.3 Emission and Immunity Levels

Table 3.11 - Emission and immunity levels

EMC Phenomenon	Basic Standard	Level
Emission:		
Mains terminal disturbance voltage Frequency range: 150 kHz to 30 MHz).	IEC/EN61800-3	☑ Without external filter: C4 category. ☑ With external filter: C2 or C3 category.
Electromagnetic radiation disturbance Frequency range: 30 kHz to 1 GHz).		
Immunity:		
Electrostatic discharge (ESD).	IEC/EN61000-4-2	4 kV for contact discharge and 8 kV for air discharge.
Fast transient-burst.	IEC/EN61000-4-4	2 kV/5 kHz (coupling capacitor) power input cables. 1 kV/5 kHz control cables, and remote keypad cables. 2 kV/5 kHz (coupling capacitor) motor output cables.
Conducted radio-frequency common mode.	IEC/EN61000-4-6	0.15 to 80 MHz; 10 V; 80 % AM (1 kHz). Motor cables, control cables, and remote keypad cables.
Surge immunity.	IEC/EN61000- 4-5	1.2/50 μs, 8/20 μs. 1 kV line-to-line coupling. 2 kV line-to-ground coupling.
Radio-frequency electromagnetic field.	IEC/EN61000-4-3	80 to 1000 MHz. 10 V/m. 80 % AM (1 kHz).

3.5.4 External RFI Filters

To be used only if necessary to comply with conducted emission levels category C2 or C3 according to IEC/EN61800-3. For the CFW-11M inverters, the connection diagram for 6 pulses configuration presented at Figure 3.25 on page 3-25 should be used and the connection diagram for 12 pulses configuration presented at Figure 3.26 on page 3-25 should be used.

Refer to the CFW-11M user's manual for the external filters and more information.

ATTENTION!

Use the listed filters only in lines with a solidly grounded neutral point. Do not use them in IT networks, lines that are not grounded or grounded via a high impedance.

ATTENTION!

The filters presented in the CFW-11M user's manual are for low voltage power supply. When the filter is to be used in the primary of the input power transformer (in case the UR11 is set for 12 pulse rectifier operation) and its input voltage is medium or high voltage, contact the filter manufacturer (EPCOS or other) in order to check possible configurations.

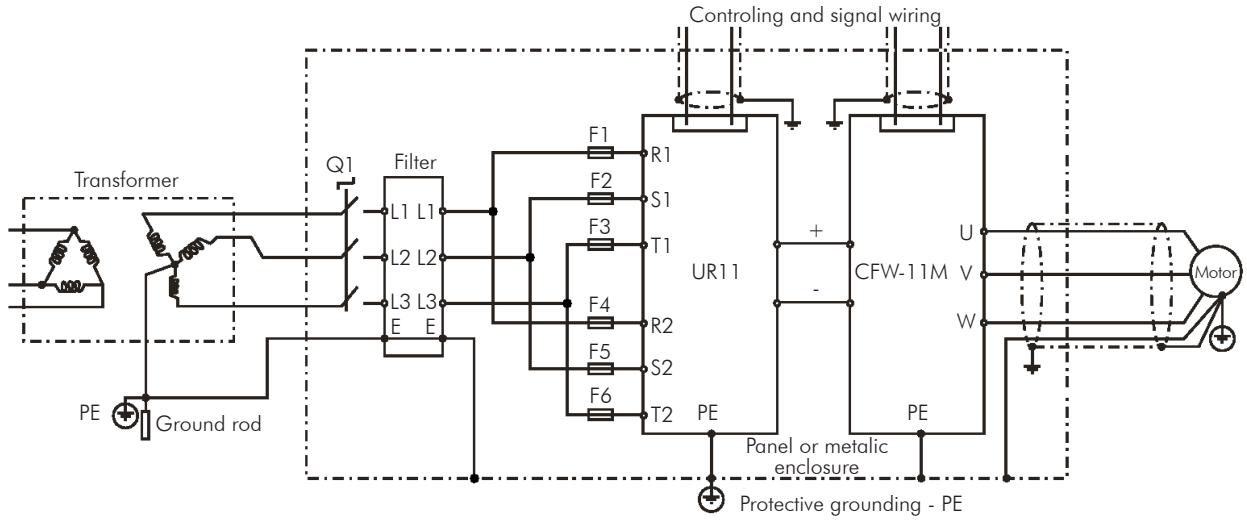


Figure 3.25 - *External RFI filter connection for 6 pulse configuration*

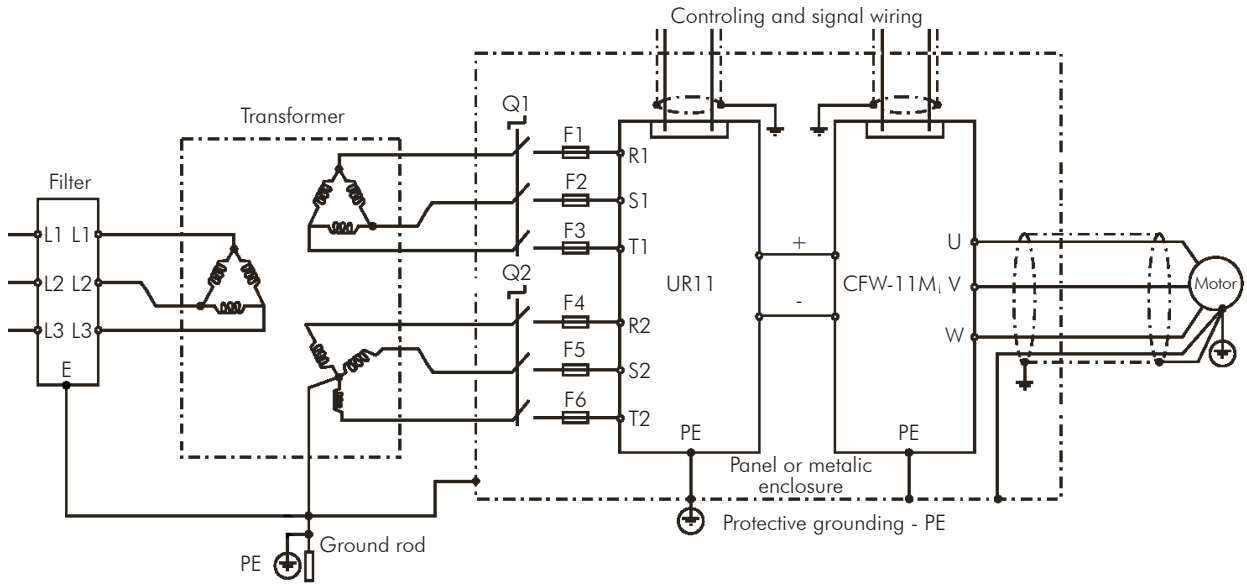


Figure 3.26 - *External RFI filter connection for 12 pulse configuration*

4 FIRST TIME POWER-UP AND START-UP

This chapter describes how to:

- ☑ Check and prepare the rectifier before power-up.
- ☑ Power-up the rectifier and check the result.
- ☑ Set the rectifier for the operation with the power supply chosen for the application.

4.1 PREPARE FOR START-UP

The rectifier must have been already installed according to the recommendations listed in chapter 3 INSTALLATION AND CONNECTION on page 3-1. The following recommendations are applicable even if the application design is different from the suggested control connections.

DANGER!
Always disconnect the main power supply before performing any connection.

4.1.1 Precautions During the Energization/Start-up

1. Verify all the connections of the panel.
2. Search for short-circuits at the input, DC bus, etc.
3. Verify the condition of all the fuses.
4. Inspect all the ground connections (panel, the door where the control is installed, etc.).
5. Remove all the remaining extra material from the inverter or panel interior.
6. Close the rectifier or panel covers.

4.2 START-UP

1. Set the power supply voltage according to the rectifier model, as presented in Table 3.10 on page 3-19, through the DIP switches located in the CIR11 board.
2. Measure the line voltage making sure it is inside the permitted range.
3. Energize the control (+24 Vdc power supply). The LED + 12V_ON must light. The remaining LEDs must be off.
4. Command the panel, perform the DC link pre-charge and close the main contactor/circuit breaker.
5. Verify the proper operation of the fans.

6. Observe the existence of faults/alarms at the relay outputs and LEDs. In case of any fault or alarm, verify the possible causes and solve the problem.

7. Check the input current of each rectifier unit with a current meter. The current must be smaller than 5 % the ND rated current as the rectifier is under no load.

8. De-energize the panel. Then connect the inverters without load. Check the inverter connections and if the current and voltage are according to the UR11.

9. Command the panel, perform the DC link pre-charge and close the main contactor/circuit breaker.

10. Enable inverters output and check the input current of each phase of the UR11: the maximum current unbalance of each phase must be 5 %.

5 TROUBLESHOOTING AND MAINTENANCE

This chapter:

- ☑ Lists all faults and alarms that may occur.
- ☑ Indicates the possible causes of each fault and alarm.
- ☑ Lists most frequent problems and corrective actions.
- ☑ Presents instructions for periodic inspections and preventive maintenance in the equipment.

5.1 OPERATION OF THE FAULTS AND ALARMS

When the high temperature alarm is detected:

- ☑ The status LED "TEMP_ALARM" (yellow) lights.
- ☑ There is no blocking of the thyristors gate pulse, the rectifier remains in operation.

When a fault is detected:

- ☑ Thyristors gate pulse blocking.
- ☑ The LED(s) "UDC1(2)_OK" turns off, showing which rectifier unit is under fault condition.
- ☑ The RL1 output relay opens.
- ☑ In case of overtemperature (heatsink temperature higher than 90 °C (194 °F)), the "TEMP_FAULT" LED (red) lights. In this case:
  - RL3 relay output opens simultaneously to RL1.
  - "TEMP_ALARM" LED must be light previously indicating alarm, as well as RL2 should be open.
- ☑ In case of undertemperature (heatsink temperature smaller than -9 °C (16 °F)) or the NTC cables rupture, the "TEMP_FAULT" LED (red) lights. In this case:
  - RL3 relay output opens simultaneously to RL1.

The rectifier is back to the normal operation right after the fault is solved, in case it is properly connected to the power supply.

5.2 FAULTS, ALARMS, AND POSSIBLE CAUSES

The Table 5.1 on page 5-2 summarizes the faults and alarms operation.

The monitoring signals that can indicate fault/alarm and the status outputs are presented at Table 5.2 on page 5-2.

Table 5.1 - *Operation of faults and alarms*

	Name	Description
Inputs.	+24 Vdc.	+24 Vdc power supply of the CIR11 board.
	R, S, T.	R1, S1, T1, R2, S2 and T2 input power connections.
	Pre-charge.	Pre-charge status: "Not-performed", "In progress" or "Completed".
	Temperature.	UR11 heatsink temperature measured through the NTCs.
RL outputs.	RL1.	Relay output with the pre-charge status indication function (UDC1_OK & UDC2_OK). It closes when the two UR11 rectifier diode bridges completed the pre-charge.
	RL2.	Output relay with "No Temperature Alarm" function. It opens under alarm condition.
	RL3.	Output relay with "No Temperature Fault" function. It opens under fault condition.
LEDs.	12 V ON.	Green LED with +12 V ON power supply indication, generated at CIR11 from the + 24 Vdc.
	UDC_1 OK.	Green LED with status function indication of one UR11 input rectifier bridge - it lights when its pre-charge is completed.
	UDC_2 OK.	Green LED with status function indication of the other UR11 input rectifier bridge - it lights when its pre-charge is completed.
	TEMP_ALARM.	Yellow LED that lights when the UR11 temperature is too high (alarm).
	TEMP_FAULT.	Red LED that lights under overtemperature or undertemperature fault condition

Table 5.2 - *Faults, alarms and possible causes*

Inputs				Outputs			LEDs					Possible Causes
+24 Vdc	R, S, T	Pre-charge	Temperature	RL1	RL2	RL3	+12 V ON	UDC_1 OK	UDC_2 OK	Temp Alarm	Temp Fault	
OK	OFF	OFF	$T_{MIN} \leq T \leq T_{AL}$	OFF	ON	ON	ON	OFF	OFF	OFF	OFF	☑ + 24 Vdc applied to the control circuit (CIR11) and the main power supply (R, S and T) is missing. Ready for power energization.
OK	OK	In progress (1)	$T_{MIN} \leq T \leq T_{AL}$	OFF	ON	ON	ON	OFF	OFF	OFF	OFF	☑ Power supply connected, pre-charge in progress.
OK	**OK**	**Completed**	**$T_{MIN} \leq T \leq T_{AL}$**	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**	**OFF**	**OFF**	**REGULAR OPERATION.**
OK	Phase fault undervoltage.	OFF	$T_{MIN} \leq T \leq T_{AL}$	OFF	ON	ON	ON	OFF(2)	OFF (3)	OFF	OFF	☑ Phase fault or undervoltage at the input power (2) (3). ☑ Open fuse. ☑ Open circuit breaker.
OK	OK	OFF	$T_{MIN} \leq T \leq T_{AL}$	OFF	ON	ON	ON	OFF(2)	OFF (3)	OFF	OFF	☑ Defective UR11.
OK	OK	Completed	T_{AL} (4) $< T$	ON	OFF	ON	ON	ON	ON	ON	OFF	☑ Heatsink temperature higher than 80 °C (176 °F) (alarm temperature).
OK	OK	OFF	T_{FAULT} (4) $< T$	OFF	OFF	OFF	ON	OFF	OFF	ON	ON	☑ Heatsink overtemperature, higher than 90 °C (194 °F) (fault temperature).
OFF	(5)	(5)	(5)	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	☑ Control (CIR11) without +24 Vdc power supply.
OK	OK	OFF	$T < T_{MIN}$	OFF	ON	OFF	ON	OFF	OFF	OFF	ON	☑ Heatsink undertemperature, smaller than -9 °C (16 °F). ☑ Defective or opened NTC.

Note:
(1) Temporary operation condition.
(2) Phase fault / undervoltage / defective rectifier bridge 1 - refer to Figure 2.5 on page 2-7.
(3) Phase fault / undervoltage / defective rectifier bridge 2 - refer to Figure 2.5 on page 2-7.
(4) The monitoring temperatures are:
- High temperature alarm: active with $T_{AL} \cong 80$ °C (TEMP_ALARM).
- Overtemperature fault: active with $T_{FAULT} \cong 90$ °C (TEMP_FAULT).
- Undertemperature fault: active with $T_{MIN} \cong -9$ °C (TEMP_FAULT).

(5) The input state is not decisive for the outputs state.

5.3 SOLUTIONS FOR THE MOST FREQUENT PROBLEMS

Table 5.3 - *Solutions for the most frequent problems*

Problem	Point to be Verified	Corrective Action
+12 V LED ON does not light, +12 Vdc power supply does not start.	+24 Vdc supply cable connection inverted, loose connection or broken wiring.	1. Connect the +24 Vdc cabling with the proper polarity to the XC1 connector of CIR11 board.
Rectifier does not start.	Power supply connections (R1, S1, T1, R2, S2, T2), +24 Vdc connections, input fuses, input circuit breaker, DIP Switch S1 configuration at CIR11 board.	1. Provide +24 Vdc supply to the CIR11 control. 2. Provide proper voltage to R, S and T. 3. Setting S1 DIP Switch at CIR11 board according to the input power supply.
Phase fault or undervoltage at the input power	Input power supply, fuses, circuit breaker and connections.	1. Replace damaged fuses. 2. Check main circuit breaker switching. 3. Provide proper voltage to R, S and T.
High temperature alarm in the heatsink (temperature higher than 80 °C (176 °F))	UR11 fans, cleaning of the heatsink fins. Phase current balance of the UR11 input. Check if the current waveform is typical to a 6/12 pulse rectifier, if all pulses are present at all the input phases (R1, S1, T1, R1, S2 and T2).	1. Provide proper voltage to the fans. 2. Cleaning of the heatsink fins according to item 5.5.1 Cleaning Instructions on page 5-5. 3. Replacement of the fans. 4. Replacement of the defective UR11.
Heatsink overtemperature (temperature higher than 90 °C).		
Heatsink Undertemperature, smaller than -9 °C. Open or defective NTC.	CIR11 board connections (XC3R, XC3S, XC3T) and NTCs.	1. Tightening of the CIR11 board connections. 2. Replacement of the defective UR11.

5.4 INFORMATION FOR CONTACTING TECHNICAL SUPPORT

NOTE!

For technical support and servicing, it is important to have the following information in hand:

- ☑ Rectifier model.
- ☑ Serial number and manufacturing date that are listed in the product nameplate (refer to section 2.4 IDENTIFICATION LABEL FOR THE UR11 on page 2-8).
- ☑ Application data and rectifier settings.

5.5 PREVENTIVE MAINTENANCE

DANGER!

Always turn off the mains power supply before touching any electrical component associated to the rectifier.

- ☑ High voltage may still be present even after disconnecting the power supply.
- ☑ To prevent electric shock, wait at least 10 minutes after turning off the input power for the complete discharge of the power capacitors.
- ☑ Always connect the equipment frame to the protective ground (PE). Use the adequate connection terminal in the rectifier.

ATTENTION!

The electronic boards have electrostatic discharge sensitive components. Do not touch the components or connectors directly. If needed, first touch the grounded metallic frame or wear a ground strap.

Do not perform any withstand voltage test!
If needed, consult WEG.

The rectifiers require low maintenance when properly installed and operated.

Besides the periodic cleaning of the heatsink fins, it is recommended to exchange the fans after 50.000 hours operation. Figure 5.1 on page 5-4 shows the UR11 fans exchanging procedure. It is recommended periodic inspections to be performed every 6 months after rectifier start-up.

Table 5.4 - *Recommended periodic inspections - Every 6 months*

Component	Problem	Corrective Action
Terminals, connectors.	Loose screws.	Tighten.
	Loose connectors.	
Fans / Cooling system.	Dirty fans.	Cleaning.
	Abnormal acoustic noise.	Replace fan. Refer to Figure 5.1 on page 5-4. Check the fan connection.
	Blocked fan.	
	Abnormal vibration.	
	Dust in the cabinet air filter.	Cleaning or replacement.
Printed circuit boards.	Accumulation of dust, oil, humidity, etc.	Cleaning.
	Odor.	Replacement.
Power module / Power connections.	Accumulation of dust, oil, humidity, etc.	Cleaning.
	Loose connection screws.	Tighten.
Heatsink.	Dust accumulation.	Cleaning.
	Dirty.	

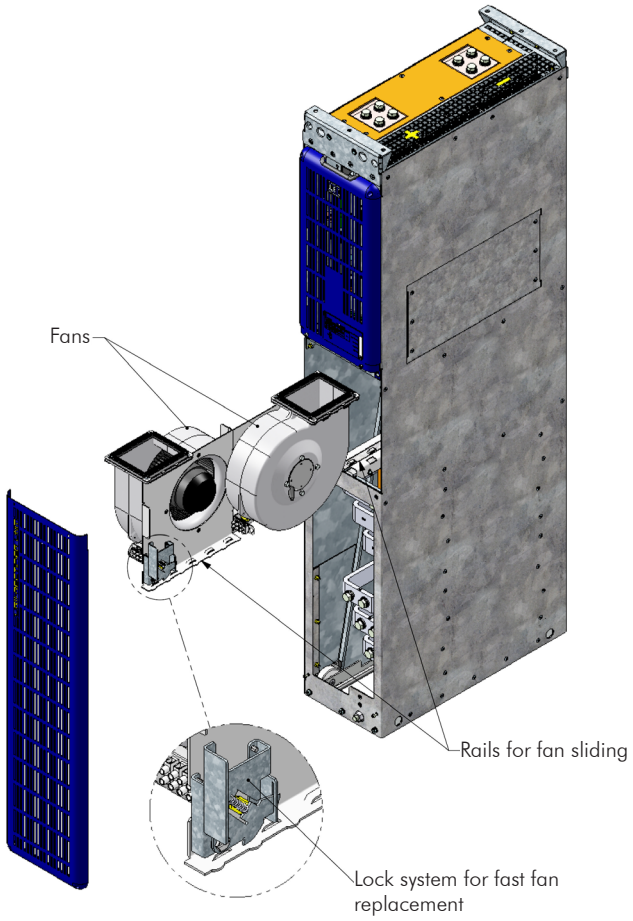


Figure 5.1 - *Fan replacement*

5.5.1 Cleaning Instructions

When it becomes necessary to clean the rectifier, follow the instructions below:

Ventilation system:

- ☑ Cut off the rectifier supply and wait 10 minutes.
- ☑ Remove the dust accumulated at the ventilation inlets with a plastic brush or a flannel.
- ☑ Remove the dust accumulated on the heatsink fins and on fan blades using compressed air.

Electronic boards:

- ☑ Cut off the rectifier supply and wait 10 minutes.
- ☑ Remove the dust accumulated on the boards using an anti-static brush or ionized compressed air (E.g.: Charges Burtes Ion Gun (non nuclear) reference A6030-6DESCO).
- ☑ If necessary, remove the boards from the rectifier.
- ☑ Use always an ESD wrist strap.

Inspect the heatsink fins of the power units regularly verifying if there is any dirt accumulation that could impair the rectifier cooling. In order to do that, remove the power unit side cover.

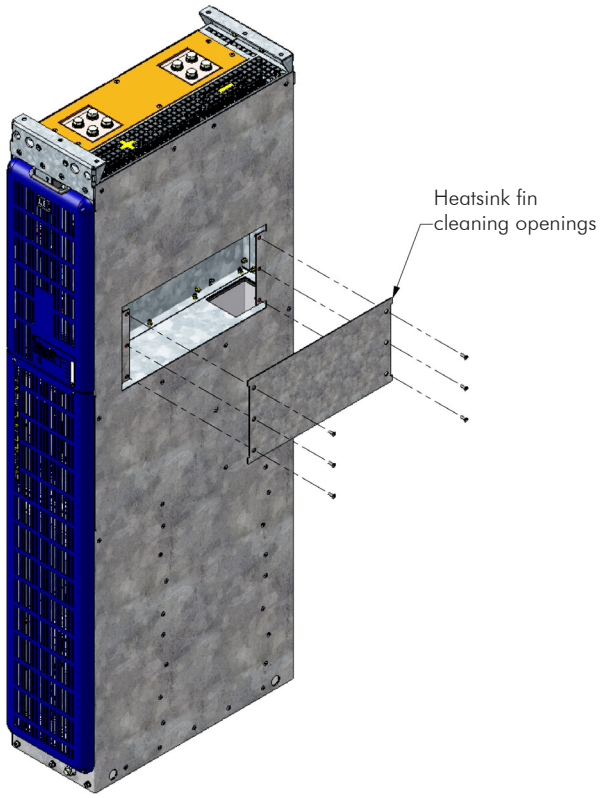


Figure 5.2 - *Cover to get access for inspection/cleaning of the heatsink fins*

6 OPTION KITS AND ACCESSORIES

This chapter presents:

☑ The accessories that can be incorporated to the rectifiers.

Instructions for the installation, operation, and programming of the accessories are described in their own manuals and are not present in this chapter.

6.1 OPTION KITS

The UR11 rectifier unit does not have any option kits.

6.2 ACCESSORIES

6.2.1 Rack Panel Assembly

The UR11 has a mechanical accessory for panel assembly, named Rack. This accessory is the same one used for the CFW-11M inverter line. Refer to the Rack 2 / Rack 3 mounting guide for more details.

7 TECHNICAL SPECIFICATIONS

This chapter describes the technical specifications (electrical and mechanical) of the UR11 Rectifier Unit.

7.1 POWER DATA

Power supply:

- ☑ Maximum rated input voltage: 480 V for 380...480 V models, 600 V for 500...600 V models and 690 V for 660...690 V models, up to 2000 m altitude. The voltage derating for higher altitudes is 1,1 % for each 100 m above 2000 m - maximum altitude: 4000 m.
- ☑ Voltage tolerance: -15 to 10 %.
- ☑ Frequency: 50/60 Hz (48 Hz to 62 Hz).
- ☑ Phase imbalance: ≤ 3 % of the rated phase-phase input voltage.
- ☑ Overvoltage according to Category III (EN 61010/UL 508C).
- ☑ Transient voltages according to Category III.
- ☑ Maximum of 60 connections per hour (1 every minute).
- ☑ Typical efficiency: ≥ 97 %.
- ☑ Typical input power factor:
  - 6 pulses: 0.92 at rated condition.
  - 12 pulses: 0.97 at rated condition.

Table 7.1 - *UR11 technical specifications*

Model			UR111140T4SZ	UR110893T5SZ	UR110811T6SZ
Power Supply [Vac]			380 / 480 V	500 / 600 V	660 / 690 V
Output Voltage [Vdc]			513 / 648 V	675 / 810 V	891 / 932 V
ND Overload	Rated Input Current [Amps]		1140	893	811
	Overload Current [Arms]	1 min	1254	982	892
		3 s	1710	1340	1217
	Rated Output Current (3) [Adc]		1379	1081	981
	Dissipated power (5) [kW]		3,3	2,6	2,3
	Maximum Motor (1) (2) (4) CV/kW		900/700	900/710	1000/800
HD Overload	Rated Input Current [Arms]		979	722	646
	Overload Current [Arms]	1 min	1469	1083	969
		3 s	1958	1444	1292
	Rated Output Current (3) [Adc]		1185	874	782
	Dissipated Power (5) [kW]		3,3	2,6	2,3
	Maximum Motor (1) (2) (4) CV/kW		800/600	800/630	800/630

Note:
(1) Application with one UR11 rectifier unit feeding a CFW-11M with the same power rating.
(2) Add more UR11 for bigger motor power ratings, according to section 3.2 LIST OF COMPONENTS on page 3-1.
(3) Nominal current in permanent regimen at the following conditions:
- Temperature around the rectifier: -10 °C to 45 °C (14 °F to 113 °F). The rectifier is able to operate in environments with temperatures up to 55 °C (131 °F), if a reduction of 2 % in the output current is applied for each Celsius degree (or 1.11 % each °F) above 45 °C (113 °F).
- Relative humidity: 5 % to 90 % without condensation.
- Altitude: 1000 m (3.300 ft). Above 1000 m up to 4000 m (3.300 ft to 13.200 ft) the output current must be reduced in 1 % for each 100 m (or 0.6 % each 100 ft) above 1000 m (3.300 ft).
- Environment with pollution degree 2 (according to EN50178 and UL508C).

(4) The motor ratings are merely a guide for 440 V (400 V line), 575 V (500 V line) and 690 V (600 V line), IV pole WEG motors. The adequate rectifier sizing shall be based on the rated current of the motor used.
(5) The information provided about the rectifier losses is valid for the rated operating condition, i.e., for rated output current.

7.2 ELECTRICAL / GENERAL SPECIFICATIONS

POWER SUPPLY (CIR11 board).	EXTERNAL.	☑ +24 Vdc / 300 mA ± 10 % power supply.
OUTPUTS (CIR11 board).	RELAY.	☑ 3 relays with NO/NC contacts, 240 Vac, 1 A.
SAFETY.	PROTECTION.	☑ Input power under/overvoltage. ☑ Overtemperature.
ENCLOSURE.	IP00.	

7.2.1 Codes and Standards

SAFETY STANDARDS.	☑ UL 508C - power conversion equipment. ☑ UL 8340 - insulation coordination including clearances and creepage distances for electrical equipment. ☑ EN61800-5-1 - safety requirements electrical, thermal and energy. ☑ EN 50178 - electronic equipment for use in power installations. ☑ EN 60204-1 - safety of machinery. Electrical equipment of machines. part 1: general requirements. **Note:** the final assembler of the machine is responsible for installing an safety stop device and a supply disconnecting device. ☑ EN 60146 (IEC 146) - semiconductor converters. ☑ EN 61800-2 - adjustable speed electrical power drive systems - part 2: general requirements - rating specifications for low voltage adjustable frequency AC power drive systems.
ELECTROMAGNETIC COMPATIBILITY (EMC).	☑ EN 61800-3 - adjustable speed electrical power drive systems - part 3: EMC product standard including specific test methods. ☑ EN 55011 - limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment. ☑ CISPR 11 - industrial, scientific and medical (ISM) radio-frequency equipment - electro-magnetic disturbance characteristics - limits and methods of measurement. ☑ EN 61000-4-2 - electromagnetic compatibility (EMC) - part 4: testing and measurement techniques - section 2: electrostatic discharge immunity test. ☑ EN 61000-4-3 - electromagnetic compatibility (EMC) - part 4: testing and measurement techniques - section 3: radiated, radio-frequency, electromagnetic field immunity test. ☑ EN 61000-4-4 - electromagnetic compatibility (EMC) - part 4: testing and measurement techniques - section 4: electrical fast transient/burst immunity test. ☑ EN 61000-4-5 - electromagnetic compatibility (EMC) - part 4: testing and measurement techniques - section 5: surge immunity test. ☑ EN 61000-4-6 - electromagnetic compatibility (EMC)- Part 4: testing and measurement techniques - section 6: immunity to conducted disturbances, induced by radio-frequency fields.
MECHANICAL STANDARDS.	☑ EN 60529 - degrees of protection provided by enclosures (IP code). ☑ UL 50 - eEnclosures for electrical equipment.

7.3 MECHANICAL DATA

7.3.1 Weight

The UR11 net weight is 286 kg (630.5 lb).

7.3.2 Dimensions

The UR11 dimensions are presented at Figure 7.1 on page 7-4.

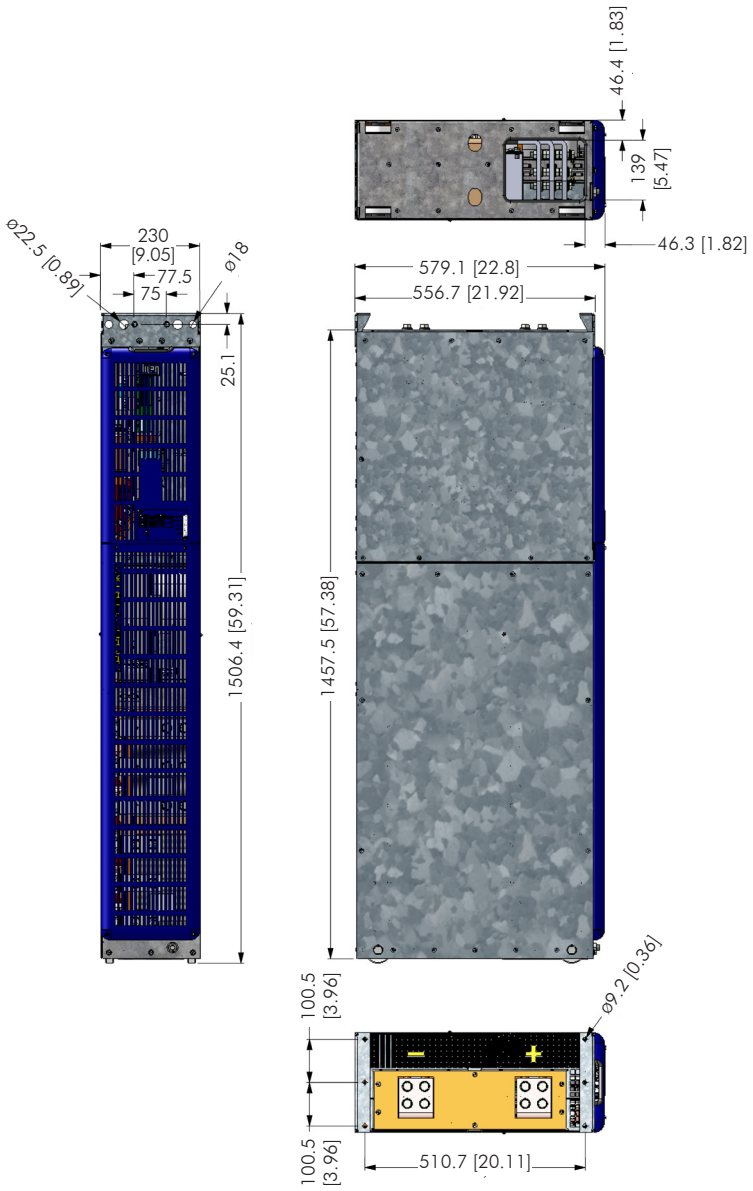


Figure 7.1 - *UR11 dimensions in mm [in]*