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Service Manual DAE VFD main alarms troubleshooting



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1 DISCLAIMER

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2 SCOPE AND APPLICATION



The following information are intended only as a guide for authorized Daikin personnel with a sound basic knowledge of HVAC equipment, mechanical systems, electrical wiring, controls, & microprocessors. Attempts by untrained or unauthorized persons to start, operate and service the equipment can result in equipment failure, personal injury, or death, as well as invalidation of product warranty. It is the responsibility of the technician to ensure that proper safety equipment safe practices are used.

This document explains a common procedure to troubleshoot the Daikin Applied Europe made VFDs. For **troubleshooting** is meant <u>the identification of the faulty components within the VFD</u>.



INFORMATION

Before proceeding with the inverter troubleshooting procedures, make sure that the fault depends exclusively on the VFD. Any kind of anomalies chiller related are not described and faced in this guide since it is assumed that they have already been excluded.



NOTICE

As first step it is important to verify that all the alarms present on the inverter have been correctly downloaded.

Refer to the 7.4: VFD NAV ALARMS SAVING paragraph for more information

DAE VFD is different sizes: 90 kW,120 kW, 200 kW, 330 kW and 400 kW. DAE VFD layout is different depending on the VFD size, in particular DC BUS plates layout it is. To recognize inverter size, refer to the VFD label as on below.

	AIKIN APPLIED EUROPE S. wer Electronics Division a Giuseppe Ferrari, 31/37 100 Vicenza - Italia	p.A. Made in	n ITALY
			ć
PE-ADDA120AX000C0C - INV S/N PEV-D001703	ERTER 120kW C2.0	INVERTER CAP. BANK TOTAL	18 kg 6 kg 24 kg
VFD120X431FCD-H	S/W: c0.42-a1.05-b2 IP00 04/20	Conforms To UL STD 60730-1 Certified To	
VIN: 3 x (380-480)V ±10%, 50/ VOUT: 3 x 0-0.94VIN, 0-400Hz		CSA STD E60730-1	Intertek

The troubleshooting guide helps the technician on site to verify correct functioning of following main VFD parts such as:

- Regulation Card
- Power Card
- SCR section
- IGBT section
- Driver Card

In case of malfunctioning of Regulation Card and Power Card, the components can be replaced. In case of SCR section, IGBT section or Driver Card malfunctioning, the entire VFD must be replaced because the components replacement is not possible to be carried out since they are glued inside the VFD.

On the following pictures, the all sizes VFD layout are showed.

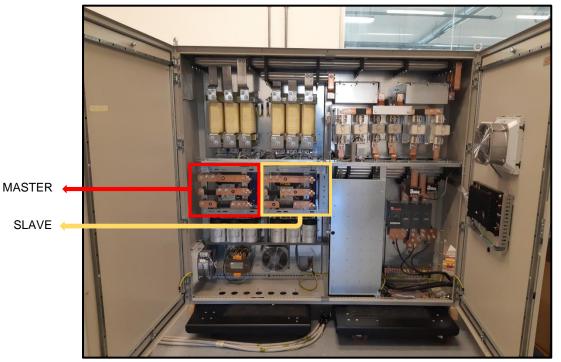


Figure 2 Master/Slave VFD in centrifugal application

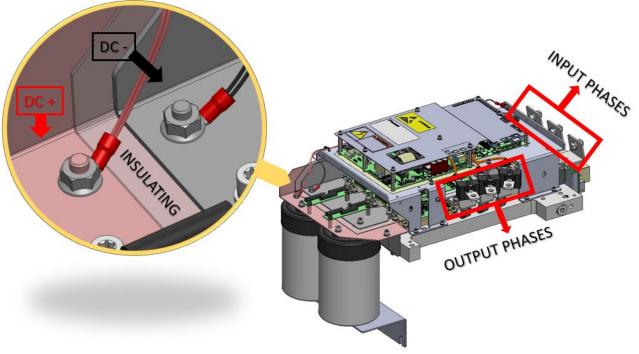


Figure 3 90 kW -120 kW DAE VFD layout

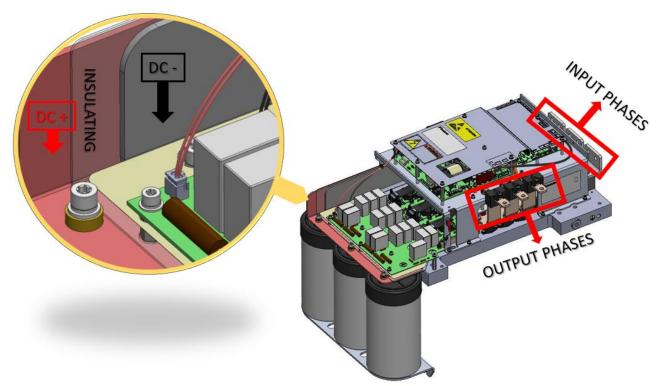


Figure 4 200kW DAE VFD layout

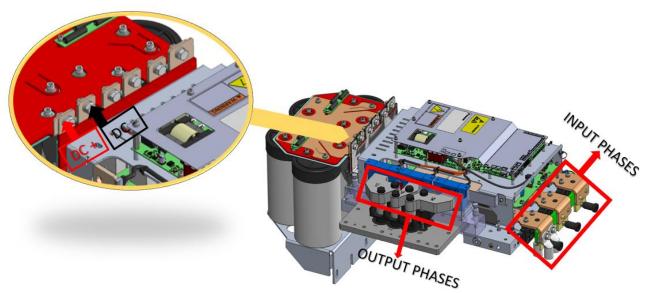


Figure 5 330/400kW DAE VFD layout



NOTICE

If the Alarms occurs systematically, proceed to install the latest correct VFD recipe before starting this Troubleshooting guide.

In chapter <u>5. ALARM TROUBLESHOOTING</u>, the most common field alarms are firstly described, in order to fully understand the issue root cause.

The checking procedures on each component are showed in chapter 6. ALARM TROUBLESHOOTING PROCEDURES.

Further procedures to verify the goodness of VFD are showed in chapter 7. ADDITIONAL PROCEDURES .

In case of remote factory support by Technical Service Support department (<u>servicesupport@daikinapplied.eu</u>), a detailed report of checks is requested. Table at chapter <u>10. COLLECTION TABLES</u> must be filled.

3 SAFETY

Installation, start-up and servicing of equipment can be hazardous if specific factors related to the installation are not considered: operating pressures, presence of electrical components and voltages and the installation site (elevated plinths and built-up up structures). Only properly qualified installation engineers and highly qualified installers and technicians, fully trained for the product, are authorised to install and start-up the equipment safely.

During all servicing operations, all instructions and recommendations, which appear in the installation and service instructions for the product, as well as on tags and labels fixed to the equipment and components and accompanying parts supplied separately, must be read, understood and followed.

Apply all standard safety codes and practices. Wear safety glasses and gloves. Use the proper tools to move heavy objects. Move units carefully and set them down gently.

Only personnel qualified in accordance with IEC (International Electrotechnical Commission) recommendations may be permitted access to electrical components. It is particularly recommended that all sources of electricity to the unit be shut off before any work is begun. Shut off main power supply at the main circuit breaker or isolator.

IMPORTANT: This equipment uses and emits electromagnetic signals. Tests have shown that the equipment conforms to all applicable codes with respect to electromagnetic compatibility.

DANGER: RISK OF ELECTROCUTION

Even when the main circuit breaker or isolator is switched off, certain circuits may still be energized, since they may be connected to a separate power source

DANGER: RISK OF BURNING

Electrical currents cause components to get hot either temporarily or permanently. Handle power cable, electrical cables and conduits, terminal box covers and motor frames with great care

Always disconnect the VFD from the power source before performing any maintenance or adjustment. The VFD shall be deemed off when at least one of the following conditions is met:

- · All fuses connected in series with the power supply have been removed
- The main switch is disconnected at all poles
- No power is supplied to the VFD
- The power supply to the solenoid valve circuit is disconnected<</p>
- The DC-Link capacitors are discharged

CAUTION: RISK OF ELECTRIC SHOCK

Before opening the enclosure, wait at least 20 minutes after disconnecting the power supply, as indicated on the label applied on the inverter enclosure. This to make sure that all live parts are discharged. NOTE: residual voltage (< 60 V) may still be present across the DC-Link after 20 minutes.

The device without its cover can be accessed only 20 minutes after the power supply has been switched off. This time allows the DC-Link capacitors to be discharged to a safe voltage level.

CAUTION: RISK OF ELECTRIC SHOCK

In case of malfunctioning of the discharge device integrated into the inverter, the DC-Link capacitors may remain charged even after 20 minutes since disconnection. Never touch the inverter while removing the enclosure. Always check the DC-Link capacitors are discharged at least below 60 V before initiating any operation on the inverter!

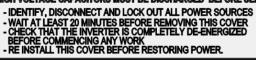


CAUTION: RISK OF ARC FLASH

A substantial amount of energy can be stored in the capacitor bank even if its voltage is below 60 V. Do not short-circuit the DC-Link unless the capacitor bank is completely discharged. Before commencing any mechanical work on the inverter, discharge completely the DC-Link by means of a suitable external device or allow enough time for the DC-Link to be completely discharged (< 5 V)



HAZARDOUS VOLTAGE ENCLOSED CONTACT MAY CAUSE INJURY OR DEATH HIGH VOLTAGE CAPACITORS MUST BE DISCHARGED BEFORE SERVICING





WARNING

Once the cover has been opened, observe ESD precautions and wear protective gloves against electrostatic discharge during maintenance or assembly.

DANGER: RISK OF ELECTROCUTION

Before to access the VFD

- Wear safety glasses and gloves •
- Disable the circuit involved by switch
- Main line fuses in series to the VFD must be disconnected
- Wait till the DC-link capacitor are discharged: wait almost 20 minutes (residual voltage must be under 5 V to be checked with multimeter)
- Once the cover has been opened, observe ESD precautions and wear protective • gloves against electrostatic discharge during maintenance or assembly



Figure 7 ESD precautions label

4 TOOLS

This manual requires different kind of measurement: voltage, current, resistances. Depending on the measurement requested, different specification must be respected.



WARNING Before taking the measurements, check the insultation class. The minimum insultation class ensures that the multimeter is suitable to reading a rectified voltage safely.

The instruments must have Minimum Instrument Safety Rating: CAT III 1000Vdc



Figure 8 Instrument Safety Rating

4.1 Compressor checks

4.1.1 Screw

4.1.1.1 Insulation Measurement

Tool to use is a Megger with the following characteristics



Figure 9 Megger tester

4.1.1.1.1 Motor Phases Insulation

Test functionality	Insulation test voltages: 1000 V
Insulation test resistance range	MΩ to any GΩ
Table 1 Magner abarratariation Mater Phases inculation	

Table 1 Megger characteristics – Motor Phases insulation

4.1.1.2 Thermal probe insulation (Ohm Mode)

Test functionality	Ω
Resistance range	kΩ to any MΩ
Table 2 Megger characteristics – Thermal probe insulation	

4.1.1.3 Resistance Measurement

On motor compressor, the phases and thermal probe, each component resistance can be measured.

Test functionality: Ohm measurement

Test functionality	Ω
Motor phases resistance test resolution	mΩ - 0.1 Ω
Motor phases resistance test range	Refer to 7.3.3 MOTOR PHASES ELECTRICAL CONTINUITY
Motor Thermal probe resistance test resolution	1Ω
Motor Thermal probe resistance test range	48Ω – 360Ω

Table 3 Megger characteristics – Resistance Measurement

4.1.2 VFD Measurement

On VFD components several test are required: AC/DC Voltages and output current. A general multimer is required with the following characteristics:

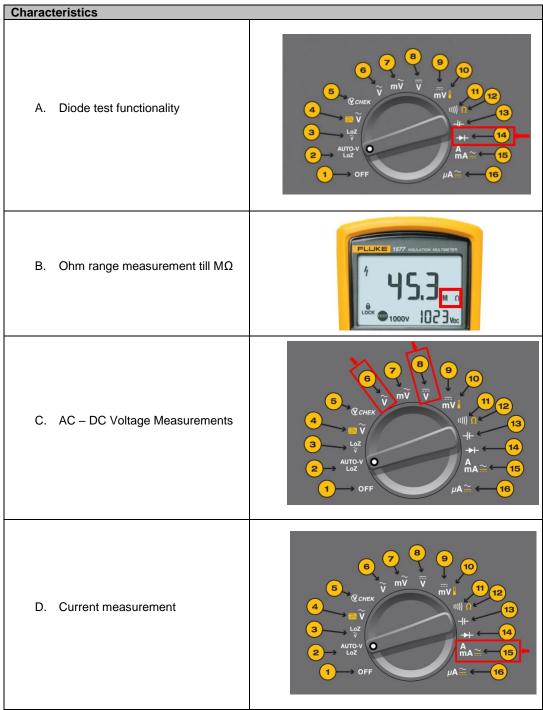


Table 4 Multimeter characteristics - VFD Measurement

5 ALARM TROUBLESHOOTING



INFORMATION

Before proceeding with the inverter troubleshooting procedures, make sure that the fault depends exclusively on the VFD. Any kind of anomalies chiller related are not described and faced in this guide since it is assumed that they have already been excluded. Compressor motor must be checked before to start the troubleshooting guide on below showed. Refer

to <u>7.3. COMPRESSOR TESTS</u>

In this chapter alarm troubleshooting for 13.1, 3.x, 5.0, 5.1 alarms are showed.

For each alarm a fault tree analysis is showed to guide the technician on site to follow a correct analysis looking for the root cause of the alarm.

When a component check is required in the fault tree analysis, the block contains a direct link to the procedure explained in <u>6. ALARM TROUBLESHOOTING PROCEDURES</u>

In case of any case related to warranty or general service case supported by DAE Technical service, the checklist contained in the chapter <u>10. COLLECTION TABLES</u> must be filled and sent to the factory (DAE Technical Service department).

To find the number of the sub alarm:

- Insert Technician Password
- Move to Main Menu \rightarrow Alarms \rightarrow Snapshot \rightarrow Entry ## \rightarrow Al[xx]=1.x

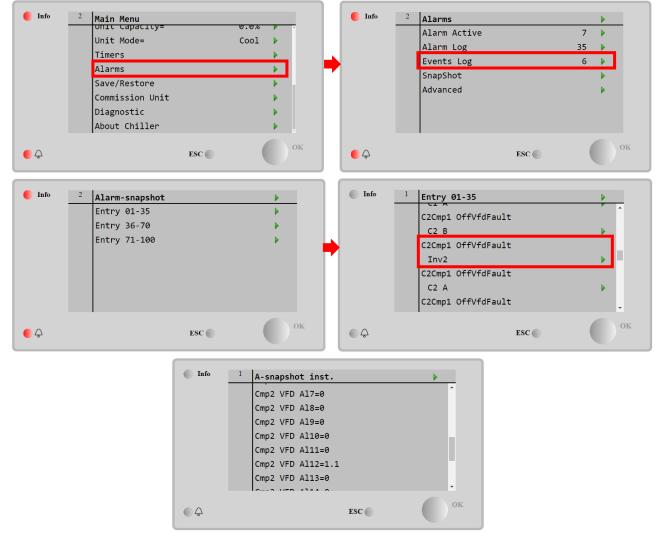


Figure 10 Alarm Snapshot Menu



NOTICE

With older versions of VFD Nav firmware an alarm saved as 12.1 could be fake as consequence of alarm 3.X. To verify the actual alarm, connect to VFD Nav and check the alarm section. Refer to **7.4. VFD NAV ALARMS SAVING**

Visible feedabck of VFD Alarm status is given by Regulation Card LED:

LED	Light	Meaning
L1	Red	Alarm
L2	Yellow	Warning
L3	Green	VFD Ready
L4	Green	Power Supply

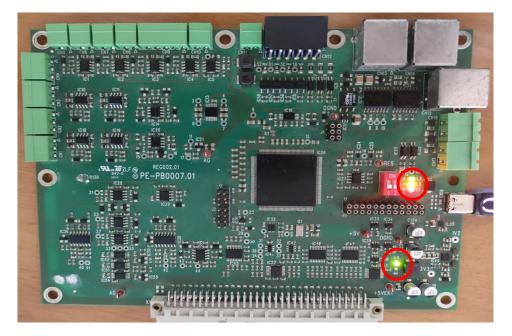


Table 5 Regulation Card Leds

Figure 11 Regulation Card Led

5.1 Alarm 13.1

13.1 alarm code means "Safe Torque Off". The VFD call this alarm when on the Regulation Card port REG_CN13 24V are missing.

The 24V can miss for the following reason:

- 1. The High-pressure Switches are open \rightarrow No VFD issue.
- 2. Failed Power Board.
- 3. Failed Regulation Card.

All the above possible root causes are deeply investigated in the following fault-tree analysis.



NOTICE

It is possible to update the VFD software through VFD inverter setup.

As standard, recipe upload procedure is not necessary on factory mounted regulation card VFD. Any recipe upload procedure on factory mounted regulation card VFD must be authorized by Service support department.

In case of any not authorized recipe upload procedure performed on factory mounted regulation card and consequent VFD malfunctioning, components damaging is not covered by warranty terms.

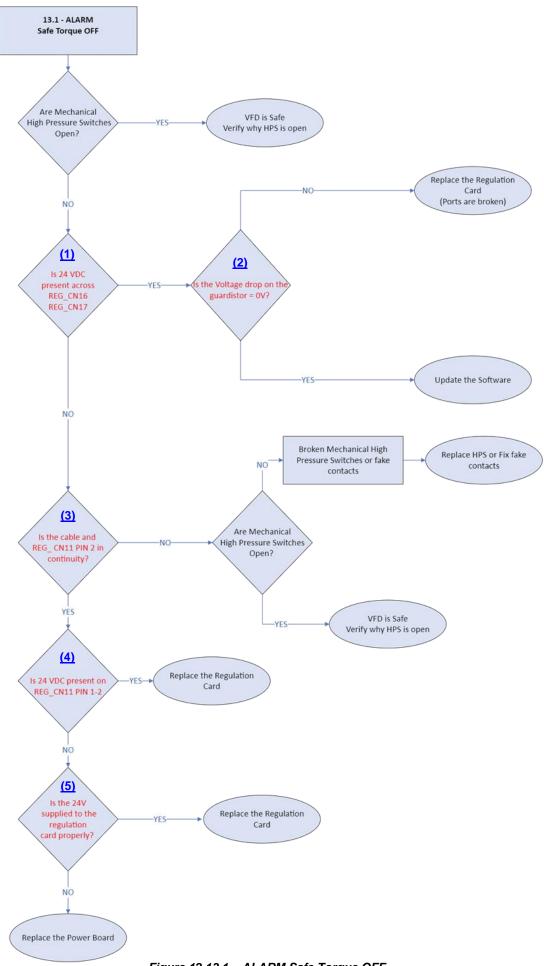


Figure 12 13.1 – ALARM Safe Torque OFF

5.2 Alarm 3.X

3.X alarm code means "Hardware Overcurrent". An extremely high VFD output current that can cause an hardware fault has reached a level that has set off the alarm .

An extremely high current can be detected for the following reason:

- 1. Faulty AMPs Transducers
- 2. Bolts not properly tightened
- 3. Faulty IGBT/SCR .
- 4. Faulty Reg. card.
- 5. Faulty Power Board.
- 6. Faulty DRV or Flat Cable .

All the above possible root causes are deeply investigated in the following fault-tree analysis.

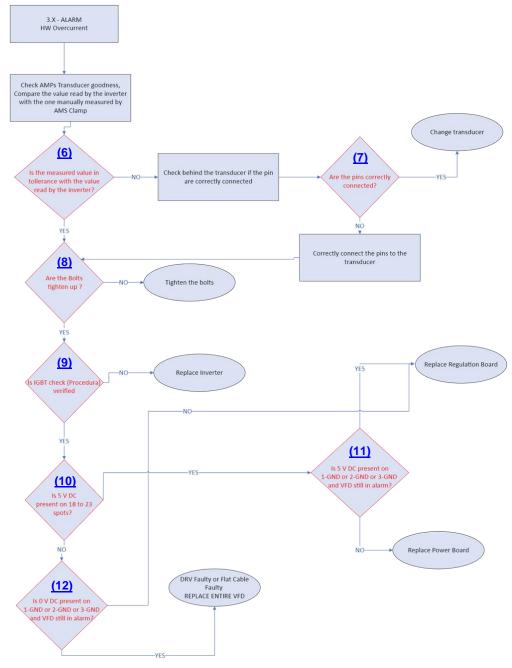


Figure 13 3.X – ALARM HW Overcurrent

5.3 Alarm 5.0

5.0 alarm code means "Motor Temperature Too High". This alarm is triggered when the inverter detect a high motor temperature.

A PTC sensor immersed in the motor windings is connected to the VFD. Depending on PTC resistance value, the inverter can detect a high motor temperature, or a PTC sensors disconnected.

An High Motor Temperature can be detected for the following reasons:

- 1. Faulty PTC sensor.
- 2. Other Software/Hardware reasons.

All the above possible root causes are deeply investigated in the following fault-tree analysis.

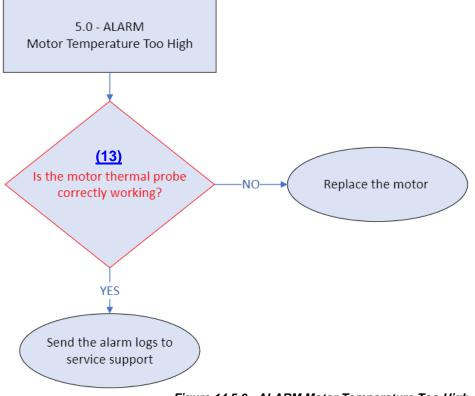


Figure 14 5.0 - ALARM Motor Temperature Too High

5.4 Alarm 5.1

5.1 alarm code means "Radiator Temperature too high". This alarm is triggered when the radiator temperature is higher than the maximum.

A High Radiator temperature can be detected for the following reasons:

- 1. VFD Cooling line solenoid valve not correctly mounted
- 2. Faulty solenoid valve.
- 3. Other Software/Hardware reasons.

All the above possible root causes are deeply investigated in the following fault-tree analysis.

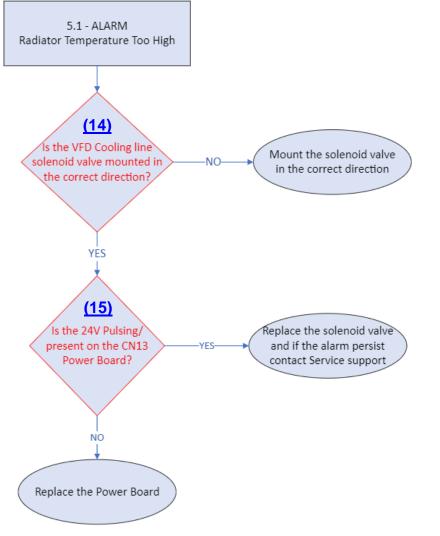


Figure 15 5.1 – ALARM Radiator Temperature Too High

6.1 REG CARD Check: 24V DC on CN16 - CN17

Is 24 V DC present across REG_CN16 REG_CN17?



DANGER: RISK OF ELECTROCUTION

The following check must be carried out with supplied VFD and VFD status in alarm. Take all safety precautions before proceeding.

Type of measurement: DC Voltage

Using a multimeter measure, the voltage across Regulation Card connectors: REG_CN16 and REG_CN17.

- Place the negative lead on the REG_CN16 PIN 2 (0V spot)
- Place the positive lead on the REG_CN16 PIN1 (+24V)

repeat the process for REG_CN17 PIN1 and PIN2. The two measurements must be respectively equal to 24V DC.

Connector	Red Lead	Black lead	Measurement expected
REG_CN16	PIN 1	PIN 2	24V DC
REG_CN17	PIN 1	PIN 2	24V DC

Table 6 REG CARD Check: 24V DC on CN16 - CN17 Measurement

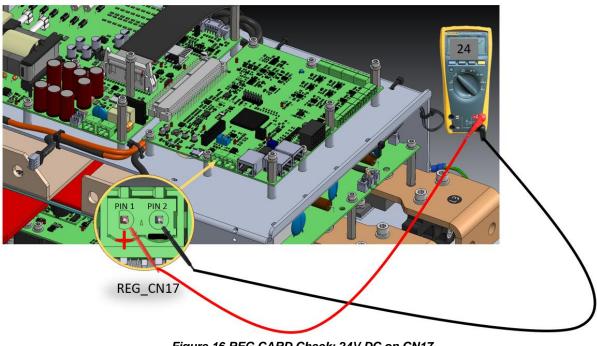


Figure 16 REG CARD Check: 24V DC on CN17

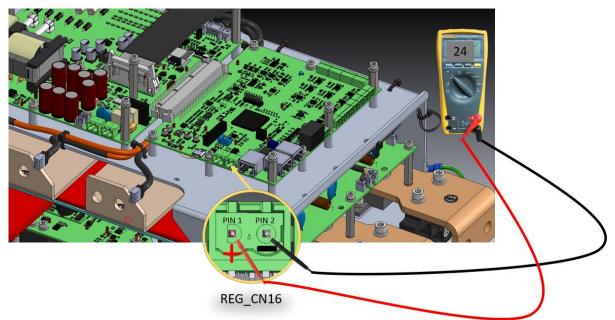


Figure 17 REG CARD Check: 24V DC on CN16

Is 24 V DC present across REG_CN16 REG_CN17?	Action
Yes	Continue with alarm troubleshooting tree. See <u>6.2 REG CARD CHECK:</u> <u>GUARDISTORS</u>
No	Continue with alarm troubleshooting tree. See <u>6.3. REG CARD CHECK: CN11-CN16</u> CONTINUITY

6.2 REG CARD Check: Guardistors

Is the Voltage drop on the guardistors = 0V?

DANGER: RISK OF ELECTROCUTION

The following check must be carried out with supplied VFD and VFD status in alarm. Take all safety precautions before proceeding.

Type of measurement: DC Voltage

Using a multimeter measure, the voltage across the two spots on the Regulation Card as per the image below.

- Place the negative lead on the spot (1)
- Switch the positive lead on the spot (3) and (2)

The two measurements must be respectively equal to 0V DC.

Red Lead	Black lead	Measurement expected
SPOT (1)	SPOT (3)	0V DC
SPOT (1)	SPOT (2)	0V DC

Table 7 REG CARD Check: Guardistors Measurement

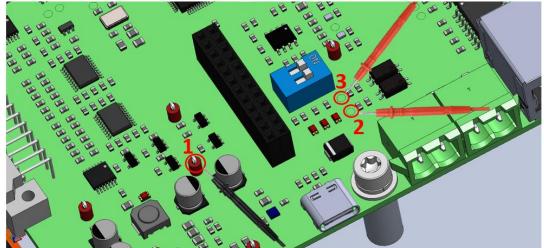


Figure 18 REG CARD Check: Guardistors

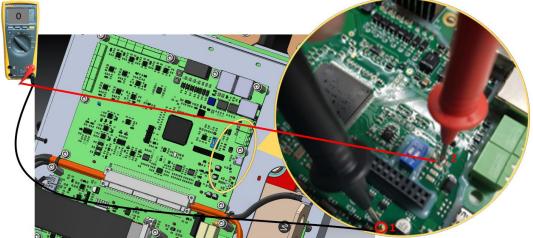


Figure 19 REG CARD Check: Guardistors

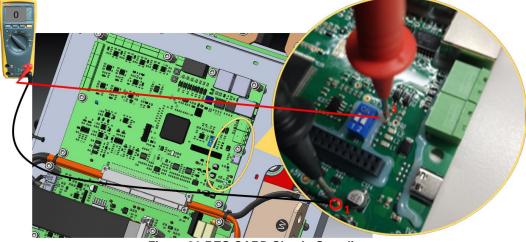


Figure 20 REG CARD Check: Guardistors

Is the Voltage drop on the guardistors = 0V?	Action
Yes	Update the software
No	Replace the Regulation Card (Ports are broken)

6.3 REG CARD Check: CN11-CN16 continuity

Is the cable and REG_CN11 PIN 2 in continuity?



DANGER: RISK OF ELECTROCUTION

The following check must be carried out with supplied VFD and VFD status in alarm. Take all safety precautions before proceeding.

Type of measurement: Continuity

Using a multimeter measure, the continuity on the cable across Regulation Card connector: REG_CN11 and REG_CN16.

- Place the negative lead on the REG_CN11 PIN 2 (0V spot)
- Place the positive lead on the REG_CN16 PIN 2 (0V spot)

In case of continuity the multimeter will beep.

Connector	Red Lead	Black lead
REG_CN11	REG_CN16	REG_CN11
and	PIN 2	PIN 2
REG CN16		

Table 8 REG CARD Check: CN11 – CN16 continuity Measurement



INFORMATION

The lack of continuity could be a symptom of opening of the high pressure switches or an open cabling (OL).

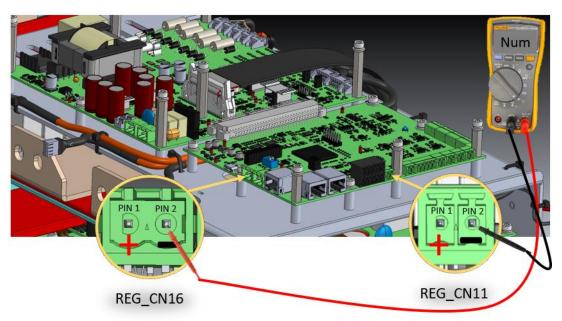


Figure 21 REG CARD Check: CN11 – CN16 Continuity

Is the cable and REG_CN11 PIN 2 in continuity?	Action	
Yes	Continue with alarm tro See <u>6.4. REG CARD</u> CN11	0
No	Check if the Mechanical High Pressure Switches are open.	Broken Mechanical High Pressure Switches or fake contacts, proceed to replace HPS or Fix fake contacts VFD is Safe, verify why HPS is open

6.4 REG CARD Check: 24V DC CN11

Is 24V DC present on REG_CN11 PIN 1-2?



DANGER: RISK OF ELECTROCUTION

The following check must be carried out with supplied VFD and VFD status in alarm. Take all safety precautions before proceeding.

Type of measurement: DC Voltage

Using a multimeter measure, the voltage across Regulation Card connector: REG_CN11

- Place the negative lead on the REG_CN11 PIN1 (0V spot)
- Place the positive lead on the REG_CN11 PIN2 (+24V DC)

The measurement must be 24V DC

Connector	Red Lead	Black lead	Measurement expected
REG_CN11	PIN 2	PIN 1	24V DC
Table 9 REG CARD Check: 24V DC CN11 Measurement			

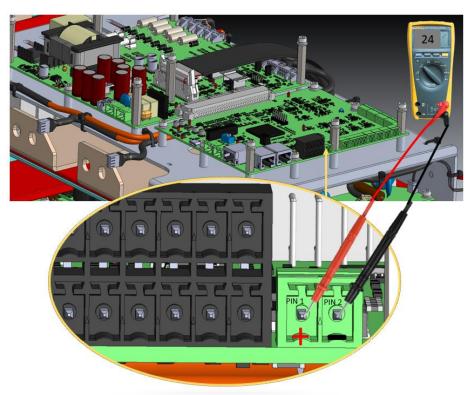


Figure 22 REG CARD Check: 24V DC on CN11

Is 24V DC present on REG_CN11 PIN 1-2?	Action
Yes	Replace the Regulation Card
No	Continue with alarm troubleshooting tree. See <u>6.5. REG CARD CHECK: 24V DC</u> <u>SUPPLY</u>

6.5 REG CARD Check: 24V DC Supply

Is the 24V DC supplied to the regulation card properly?



DANGER: RISK OF ELECTROCUTION

The following check must be carried out with supplied VFD and VFD status in alarm. Take all safety precautions before proceeding.

Type of measurement: DC Voltage

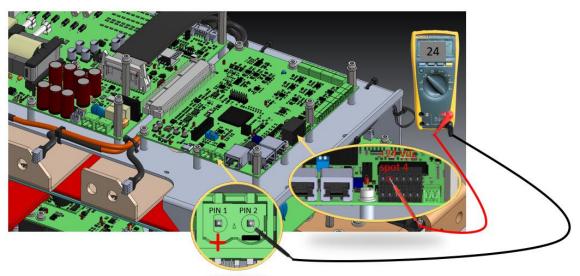
Using a multimeter measure, the voltage across Regulation Card connectors: REG_CN16, REG_CN17 and REG_CN12.

- Place the positive lead on the REG_CN12 (spot 4)
- Switch the negative lead on the REG_CN16 and REG_CN17 PIN2 (0V SPOT)

The two measurements must be respectively equal to 24V DC.

Connector	Red Lead	Black lead	Measurement expected
REG_CN12	REG_CN12	REG_CN16	24V DC
and	(spot 4)	PIN 2	
REG_CN16			
REG_CN12	REG_CN12	REG_CN17	24V DC
and	(spot 4)	PIN 2	
REG_CN17			

Table 10 REG CARD Check: 24V DC Supply Measurement



REG_CN16
Figure 23 REG CARD Check: 24V DC on CN16

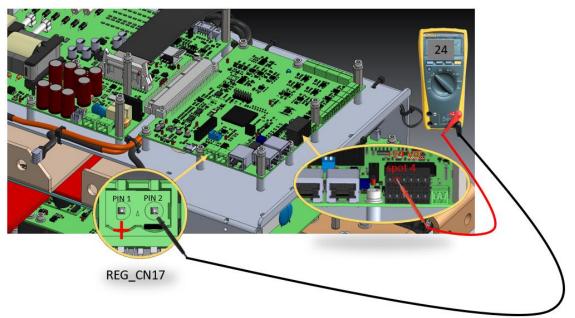


Figure 24 REG CARD Check: 24V DC on CN17

Is the 24V DC supplied to the regulation card properly?	Action
Yes	Replace the Regulation Card
No	Replace the Power Board

6.6 CURRENT TRANSDUCER Check: Output current measurement

Is the measured value in tolerance with the value read by the inverter?



Figure 25 Current measurement

Phase Current	Multimeter Measured Value [A]	Inverter Value [A]	VFD Nav Params
IU			N83
IV			N84
IW			N85

Table 11 Output current measurement



INFORMATION VFD Nav connection is Required.

Inverter AMPs Transducer VFD Nav Parameter code: N83, N84, N85

Is the measured value in tolerance with the value read by the inverter?	Action
Yes	Continue with alarm troubleshooting tree. See <u>6.8. MECHANICAL CHECK: OUTPUT</u> <u>SIDE BOLTS CHECK</u>
No	Continue with alarm troubleshooting tree. See <u>6.7. CURRENT TRANSDUCER</u> <u>CHECK: OUTPUT CURRENT</u> <u>TRANSDUCER</u>

6.7 CURRENT TRANSDUCER Check: Output current transducers

Are the pins correctly connected?

Visually check the pins behind the transducer are correctly connected, if not proceed to fix the connection.

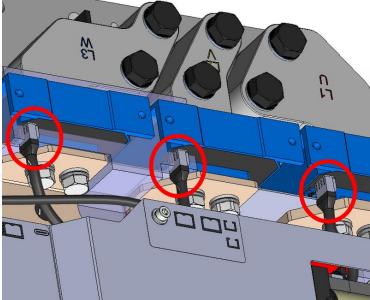


Figure 26 Output current transducer check

Are the pins correctly connected?	Action
Yes	Change transducer
No	Correctly connect the pins to the transducer. Continue with alarm troubleshooting tree. See <u>6.8 MECHANICAL CHECK: OUTPUT</u> <u>SIDE BOLTS CHECK</u>

6.8 MECHANICAL Check Output side bolts check

Are the Bolts correctly tighten up?

A. Connection bars to the compressor - the output bars of the inverter

For correct key size, refer to the following table:

VFD Size	Screw size	Tightening torque
330 kW – 400 kW	M10x75	35 Nm
200 kW	M10x45	35 Nm
90 kW – 120 kW	M10x60	35 Nm

Table 12 Connection bars to the compressors – the output bars of the inverter torque

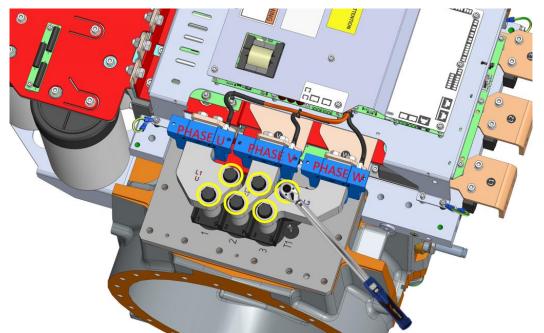


Figure 27 330/400kW DAE VFD Connection bar to the compressor

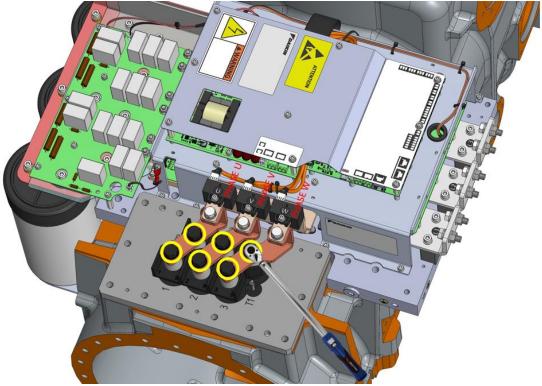


Figure 28 200kW DAE VFD Connection bar to the compressor

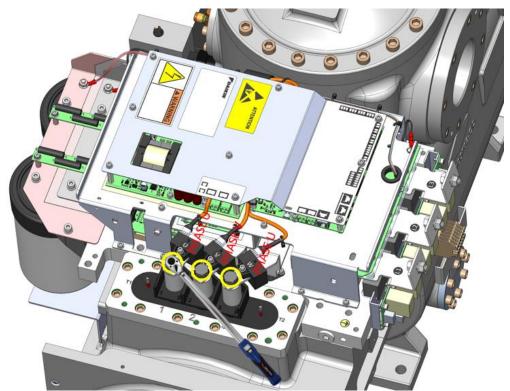


Figure 29 90/120kW DAE VFD Connection bar to the compressor



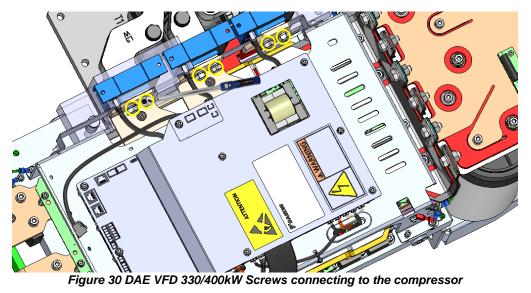
NOTICE Only 200kW and 330/400kW inverters

B. Screws connecting to the compressor

For correct key size, refer to the following table:

VFD Size	Screw size	Tightening torque
330 – 400kW	M8X25	25 Nm
200 kW	M8X25	25 Nm
Table 12 Serence compacting to the compresser torque		

Table 13 Screws connecting to the compressor torque



26/71

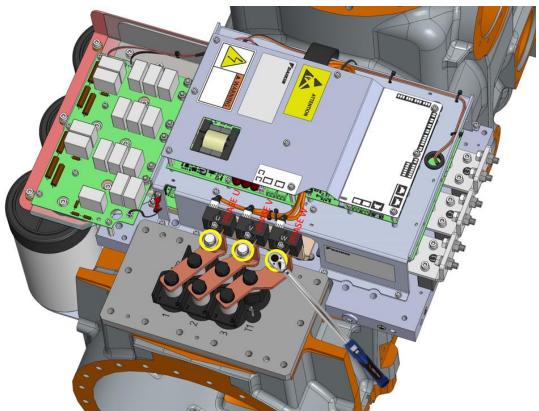


Figure 31 DAE VFD 200kW Screws connecting to the compressor

Are the Bolts correctly tighten up?	Action
Yes	Continue with alarm troubleshooting tree. See <u>6.9. IGBT CHECK</u>
No	Tighten the bolts

6.9 IGBT check

Is IGBT Check procedure verified?

For IGBT check, the parallel diode is checked.

The tests are carried out with the VFD disconnected and not powered.

CAUTION: RISK OF ARC FLASH A substantial amount of energy can be stored in the capacitor bank even if its voltage is below 60 V. Do not short-circuit the DC-Link unless the capacitor bank is completely discharged. Before commencing any mechanical work on the inverter, discharge completely the DC-Link by means of a suitable external device or allow enough time for the DC-Link to be completely discharged (< 5 V)

6.9.1 Diode test

Set your multimeter in "Diode test function" and perform a test to the bottom and top IGBT diode, directly and indirectly. Repeat the operation for all three phases

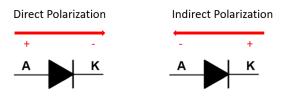


Figure 32 Direct and Indirect polarization in the diodes

- a) To perform the **direct polarization diode test** to the top IGBT diode, place the negative lead of the multimeter on DC+ node and switch with the positive lead on all three phase outputs, as shown in the diagram below
- b) To perform the direct polarization diode test to the bottom IGBT diode, place the positive lead of the multimeter on DC- node and switch with the negative lead on all three phases outputs, as shown in the diagram below

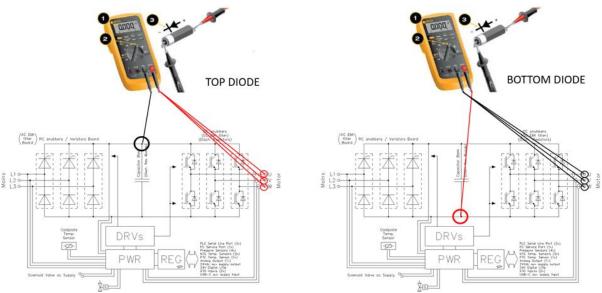


Figure 33 TOP/Bottom IGBT Direct polarization diode test

Refer to paragraph <u>8. INVERTER MEASURING POINTS</u> to place correctly the multimeter terminals on the phase and DC BUS plate.

Fill in the table in paragraph <u>10. COLLECTION TABLES</u> with the measurements obtained.



INFORMATION

Check the reference value for determining a functioning diode at paragraph <u>9.2.1 BOTTOM/TOP</u> IGBT DIODES DIRECT POLARIZATION REFERENCE VALUES

a) To perform the **indirect polarization diode test** to the top IGBT diode, place the positive lead of the multimeter on DC+ node and switch with the negative lead on all three phase outputs, as shown in the diagram below

b) To perform the **indirect polarization diode test** to the bottom IGBT diode, place the negative lead of the multimeter on DC- node and switch with the positive lead on all three phase outputs, as shown in the diagram below

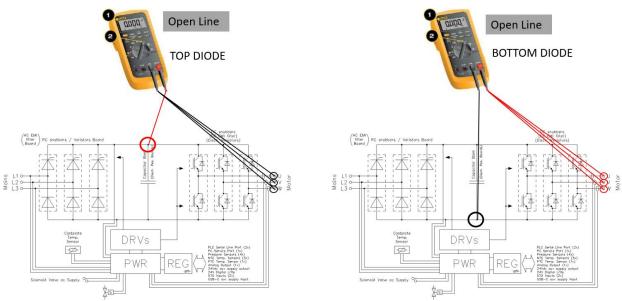


Figure 34 TOP/Bottom IGBT Indirect polarization diode test

Refer to paragraph <u>8. INVERTER MEASURING POINTS</u> to place correctly the multimeter terminals on the phase and DC BUS plate.

Fill in the table in paragraph 10. COLLECTION TABLES with the measurements obtained.



INFORMATION

The reference value for determining a functioning diode is "OL: OPEN LINE"

Is IGBT Check procedure verified?	Action
Yes	Continue with alarm troubleshooting tree. See 6.10. POWER CARD CHECK: 5V DC ON 18 – 23 SPOTS
No	Replace the inverter

6.10 POWER CARD Check: 5V DC on 18 – 23 spots

Is 5V DC present across 18 to 23 spots?



DANGER: RISK OF ELECTROCUTION

The following check must be carried out with supplied VFD and VFD status in alarm. Take all safety precautions before proceeding.

Type of measurement: DC Voltage

Using a multimeter measure, the voltage across Power spots: GND and 18 to 23 spots

- Place the negative lead on the GND spot
- Switch the positive lead from 18 to 23 spot, as shown in the image below

The measurements must be respectively equal to 5V DC.

Red Lead	Black lead	Measurement expected
SPOT (18)	SPOT (GND)	5V DC
SPOT (19)	SPOT (GND)	5V DC
SPOT (20)	SPOT (GND)	5V DC
SPOT (21)	SPOT (GND)	5V DC
SPOT (22)	SPOT (GND)	5V DC
SPOT (23)	SPOT (GND)	5V DC

Table 14 POWER CARD Check: 5V DC on 18 - 23 spots Measurement

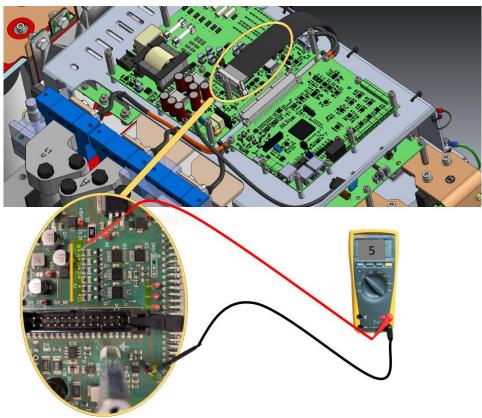


Figure 35 POWER CARD Check: 5V DC on 18 – 23 spots

Is 5V DC present across 18 to 23 spots?	Action
Yes	Continue with alarm troubleshooting tree. See <u>6.11. POWER CARD CHECK: 5V DC</u> ON 1 2 3 - GND
No	Continue with alarm troubleshooting tree. See <u>6.12. POWER CARD CHECK: 0V DC</u> ON 1 2 3 – GND

6.11 POWER CARD Check: 5V DC on 1 2 3 - GND

Is 5V DC present on 1-GND or/and 2-GND or/and 3-GND and VFD still in alarm?



DANGER: RISK OF ELECTROCUTION

The following check must be carried out with supplied VFD and VFD status in alarm. Take all safety precautions before proceeding.

Type of measurement: DC Voltage

Using a multimeter measure, the voltage across Power spots: GND and 1 to 3 spots

- Place the negative lead on the GND spot
- Switch the positive lead from 1 to 3 spot, as shown in the image below

The two measurements must be respectively equal to 5V DC.

Red Lead	Black lead	Measurement expected
SPOT (1)	SPOT (GND)	5V DC
SPOT (2)	SPOT (GND)	5V DC
SPOT (3)	SPOT (GND)	5V DC

Table 15 POWER CARD Check: 5V DC on 1 2 3 - GND Measurement

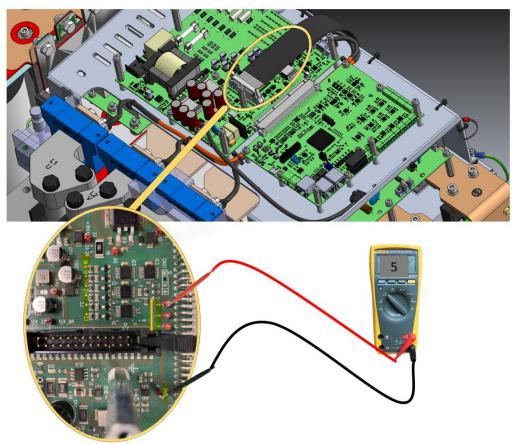


Figure 36 POWER CARD Check. 5V DC on 1 2 3 - GND

Is 5V DC present on 1-GND or/and 2-GND or/and 3-GND and VFD still in alarm?	Action
Yes	Replace Regulation Board
No	Replace Power Board

6.12 POWER CARD Check: 0V DC on 1 2 3 - GND

Is OV DC present on 1-GND or/and 2-GND or/and 3-GND and VFD still in alarm?



DANGER: RISK OF ELECTROCUTION

The following check must be carried out with supplied VFD and VFD status in alarm. Take all safety precautions before proceeding.

Type of measurement: DC Voltage

Using a multimeter measure, the voltage across Power spots: GND and 1 to 3 spots

- Place the negative lead on the GND spot
- Switch the positive lead from 1 to 3 spot, as shown in the image below

The two measurements must be respectively equal to 5V DC.

Red Lead	Black lead	Measurement expected
SPOT (1)	SPOT (GND)	0V DC
SPOT (2)	SPOT (GND)	0V DC
SPOT (3)	SPOT (GND)	0V DC

Table 16 POWER CARD Check: 0V DC on 1 2 3 - GND Measurement

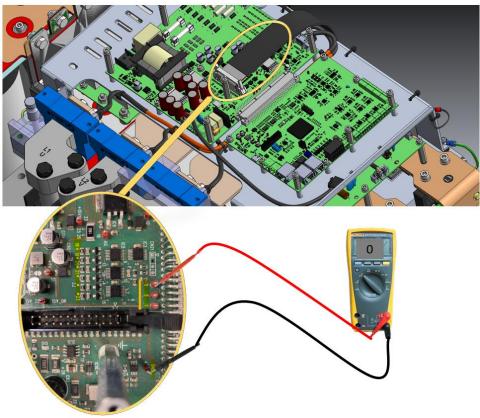


Figure 37 POWER CARD Check: 0V DC on 1 2 3 – GND

Is 0V DC present on 1-GND or/and 2-GND or/and 3-GND and VFD still in alarm?	Action
	DRV Faulty or Flat Cable Faulty REPLACE ENTIRE VFD
No	Replace Regulation Board

6.13 COMPRESSOR Check: Motor thermal probe check

Is the motor thermal probe correctly working?

6.13.1 Terminal thermistor electrical continuity test

Type of measurement: Resistance test - Ω mode

- Turn on the multimeter
- Connect the positive (red tip) and negative lead (black tip) on the two terminal thermistor on the motor terminal block.
- Measure the resistance

The measurement value must be in this range: $48 - 360 \Omega$ at the reference temperature of $15 \div 35^{\circ}C$

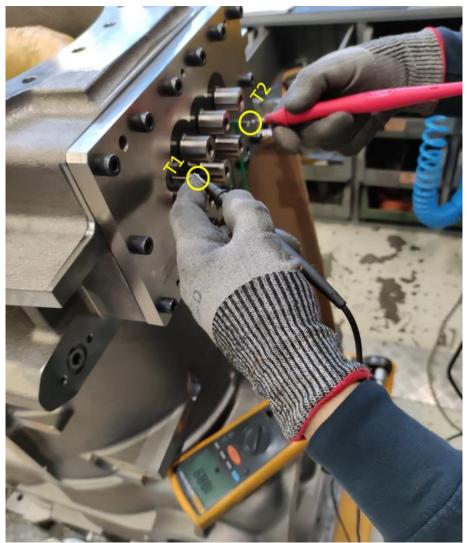


Figure 38 Terminal thermistor electrical continuity test

6.13.2 Electrical insulation terminal thermistor - earth

Type of measurement: Resistance test - Ω mode

- Turn on the multimeter
- Connect the positive (red tip) on each terminal thermistor
- Connect the negative lead (black tip) on the motor terminal plate.
- Measure the resistance

The measurement value must be >22 k Ω

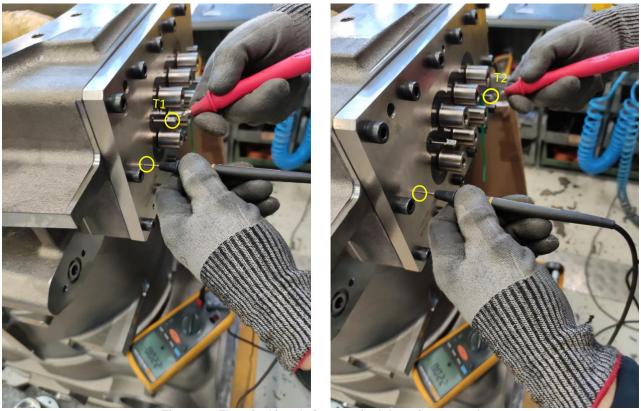


Figure 39 Electrical insulation terminal thermistor - earth

6.13.3 Electrical insulation terminal thermistor - motor phases

Type of measurement: Resistance test - Ω mode

- Turn on the multimeter
- Connect the positive (red tip) on each terminal thermistor
- Connect the negative lead (black tip) on each power terminal
- Measure the resistance

The measurement value must be more than 22 $k\Omega$

RED LEAD	BLACK LEAD	Accettable Value
Thermistor 1	Terminal 1	>22kΩ
Thermistor 1	Terminal 2	>22kΩ
Thermistor 1	Terminal 3	>22kΩ
Thermistor 1	Terminal 4 (if available)	>22kΩ
Thermistor 1	Terminal 5 (if available)	>22kΩ
Thermistor 1	Terminal 6 (if available)	>22kΩ
Table 17 Electrical insulation terminal thermistor 1 - motor phases		

 Table 17 Electrical insulation terminal thermistor 1 – motor phases

RED LEAD	BLACK LEAD	Accettable Value
Thermistor 2	Terminal 1	>22kΩ
Thermistor 2	Terminal 2	>22kΩ
Thermistor 2	Terminal 3	>22kΩ
Thermistor 2	Terminal 4 (if available)	>22kΩ
Thermistor 2	Terminal 5 (if available)	>22kΩ
Thermistor 2	Terminal 6 (if available)	>22kΩ
Table 18 Electrical insulation terminal thermistor 2 - motor phases		

Table 18 Electrical insulation terminal thermistor 2 – motor phases

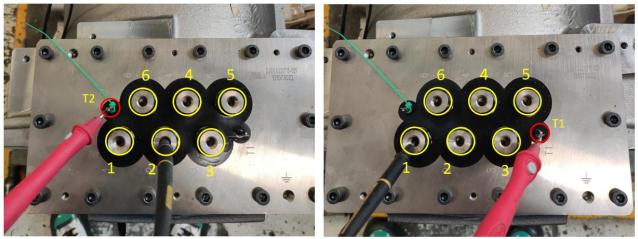


Figure 40 Electrical insulation terminal thermistor – motor phases

Is the motor thermal probe correctly working?	Action
Yes	Send the alarm logs to service support. Refer to <u>7.4. VFD NAV ALARMS SAVING</u>
No	Replace the motor

6.14 MECHANICAL Check: VFD Cooling line solenoid valve correct assembly

Is the VFD Cooling line solenoid valve mounted in the correct direction?

Ensure the solenoid valve for the VFD cooling line is mounted correctly, and that it isn't upside down. As demonstrated in the image below, you must align the high pressure inlet gas with the valve inlet.

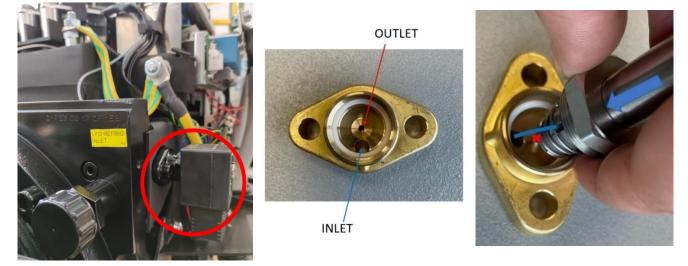


Figure 41 VFD Solenoid Valve installation

Is the VFD Cooling line solenoid valve mounted in the correct direction?	Action
Yes	Continue with alarm troubleshooting tree. See <u>6.15. POWER CARD CHECK: 24V DC</u> <u>ON CN13</u>
No	Mount the solenoid valve in the correct direction

6.15 POWER CARD Check: 24V DC on CN13

Is 24V DC Pulsing/present on the PWR_CN13



DANGER: RISK OF ELECTROCUTION

The following check must be carried out with supplied VFD and VFD status in alarm. Take all safety precautions before proceeding.

Type of measurement: DC Voltage

Using a multimeter measure, the voltage across Regulation Card connector: PWR_CN13

- Place the negative lead on the PWR_CN13 PIN2 (0V spot)
- Place the positive lead on the PWR_CN13 PIN1 (+24V DC)

The measurement must be 24V DC.

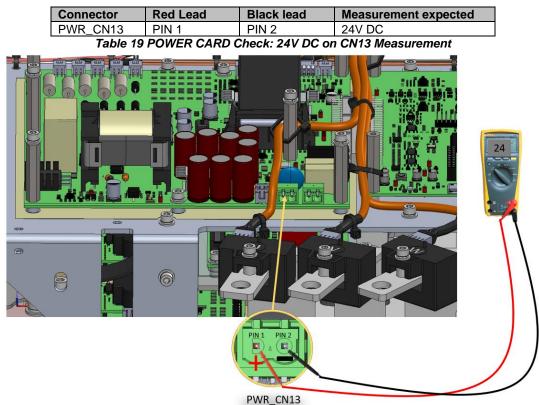


Figure 42 POWER CARD Check: 24V DC on CN13

Is 24V DC Pulsing/present PWR_CN13	on the	Action
Yes		Replace the solenoid valve and if the alarm persist contact Service Support
No		Replace the Power Board

7 ADDITIONAL PROCEDURES

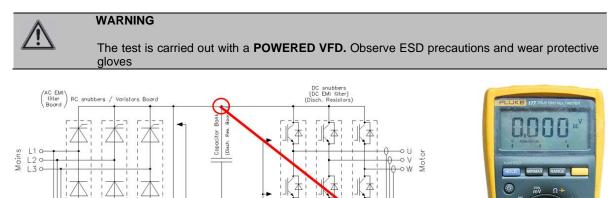
In case of DAE VFD failure, the service team may request to send the Alarm logs and to perform additional checks needed to deeply investigate the issues.

In particular, the following procedures are explained in this chapter:

- DC Bus Check
- SCR check
- Megger Test
- VFD Nav Alarms saving

7.1 DC Bus Check

This check consists in measuring the voltage across the DC BUS. Set your multimeter in "DC Voltage" and perform a test to the DC BUS, **VFD must be powered**.



Refer to paragraph <u>8. INVERTER MEASURING POINTS</u> to place correctly the multimeter terminals on the phase and DC BUS plate.

Figure 43 DC-BUS Voltage measurement

Fill in the table in paragraph 10. COLLECTION TABLES with the measurements obtained.

DRVs

PWR

<u>_</u>____



INFORMATION

Solenoid Valve ac Supply O

The reference value for determining a functioning DC-Bus can be determined with average power supply measured * (1,35 to 1,41) Range. For example if the average power supply is 402V and DC-BUS is 554,8V, the DC-BUS is ok.

(2)

7.2 SCR check

SCR section is made by a series of "bottom" diode and a "top" thyristor. The bottom diode must be checked in diode test function. Top thyristor must be checked in Ohm mode. **The tests are carried out with the VFD disconnected and not powered**



CAUTION: RISK OF ARC FLASH

A substantial amount of energy can be stored in the capacitor bank even if its voltage is below 60 V. Do not short-circuit the DC-Link unless the capacitor bank is completely discharged. Before commencing any mechanical work on the inverter, discharge completely the DC-Link by means of a suitable external device or allow enough time for the DC-Link to be completely discharged (< 5 V)

7.2.1 Diode test

Set your multimeter in "Diode test function" and perform a test to the bottom SCR diode, directly and indirectly. Repeat the operation for all three phases

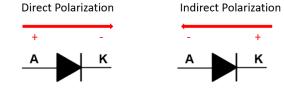


Figure 44 Direct and Indirect polarization in the diodes



INFORMATION

It is not possible to use the diode test for top thyristors. Refer to paragraph 7.2.2. Ohm mode test for Ohm mode test explanation

Refer to paragraph <u>8. INVERTER MEASURING POINTS</u> to place correctly the multimeter terminals on the phase and DC BUS plate.

Fill in the table in paragraph 10. COLLECTION TABLES with the measurements obtained.

To perform the **direct polarization diode test** to the bottom SCR diode, place the positive lead of the multimeter on DCnode and switch with the negative lead on all three phase inputs, as shown in the diagram below

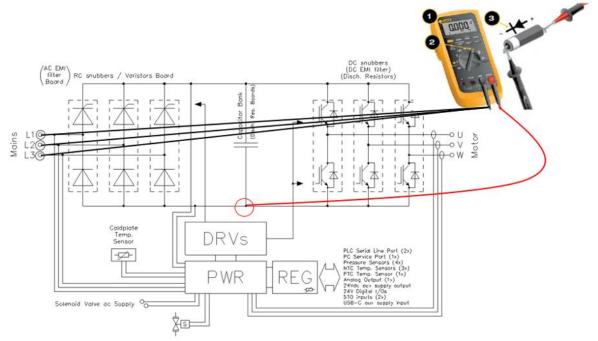


Figure 45 Bottom SCR Direct polarization diode test

Refer to paragraph 8. INVERTER MEASURING POINTS to place correctly the multimeter terminals on the phase and DC BUS plate.

Fill in the table in paragraph <u>10. COLLECTION TABLES</u> with the measurements obtained.



INFORMATION

Check the reference value for determining a functioning diode at paragraph <u>9.1.1 BOTTOM SCR</u> <u>DIODES REFERENCE VALUES</u>

To perform the **indirect polarization diode test** to the bottom SCR diode, place the negative lead of the multimeter on DC- node and switch with the positive lead on all three phase inputs, as shown in the diagram below

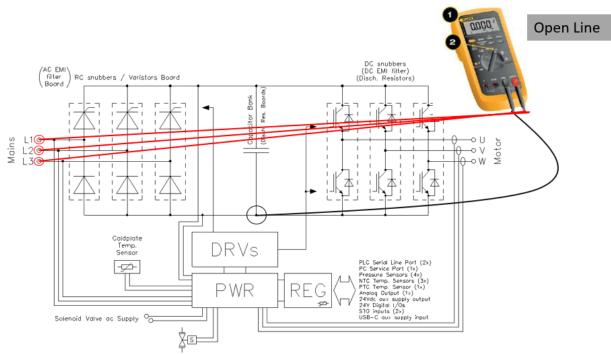


Figure 46 Bottom SCR indirect polarization diode test

Refer to paragraph <u>8. INVERTER MEASURING POINTS</u> to place correctly the multimeter terminals on the phase and DC BUS plate.

Fill in the table in paragraph 10. COLLECTION TABLES with the measurements obtained.



INFORMATION

The reference value for determining a functioning diode is "OL: OPEN LINE"

7.2.2 Ohm mode test

Set your multimeter in "Ohm mode function" and perform a test to the top thyristor directly and indirectly. Repeat the operation for all three phases.

To perform the **ohm mode test** to the top SCR thyristor, place the positive lead of the multimeter on DC- node and switch with the negative lead on all three phase inputs, as shown in the diagram below.

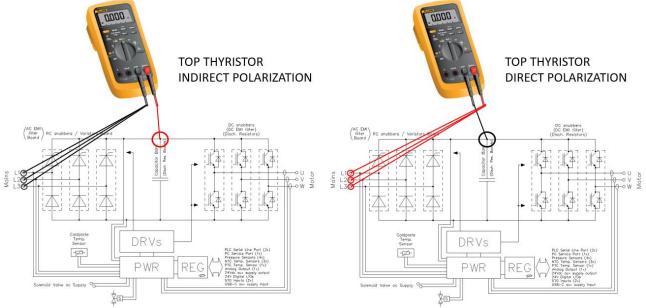


Figure 47 TOP SCR direct/indirect thyristor ohm mode test

Refer to paragraph <u>8. INVERTER MEASURING POINTS</u> to place correctly the multimeter terminals on the phase and DC BUS plate.

Fill in the table in paragraph <u>10. COLLECTION TABLES</u> with the measurements obtained.



INFORMATION

The expected measured value is a very high resistance. Refer to paragraph <u>9.2.1 TOP SCR THYRISTORS RESISTANCE REFERENCE VALUES</u> for more details

7.3 Compressor Tests



Figure 48 Megger tester

7.3.1 Electrical insulation Motor Phases - Earth

Type of measurement: Insulation test at 1000V

- Turn on the Megger
- Select Megger full scale to 1000V
- Connect the negative lead (black tip) to a metal point of the compressor frame.
- Connect the positive lead (red tip) to the terminal 1 of the compressor terminal block.
- Measure the resistance

Value measure must be more than $11 M \Omega.$

Repeat the test for the terminals 2,3,4,5 and 6 of the terminal block.

RED LEAD	BLACK LEAD	Accettable Value
Terminal 1	Compressor frame	>11MΩ
Terminal 2	Compressor frame	>11MΩ
Terminal 3	Compressor frame	>11MΩ
Terminal 4 (if available)	Compressor frame	>11MΩ
Terminal 5 (if available)	Compressor frame	>11MΩ
Terminal 6 (if available)	Compressor frame	>11MΩ

Table 20 Electrical insulation Motor Phases – Earth sequence



NOTICE The tests described above must not be performed between the terminals of the electric motor protection thermistors

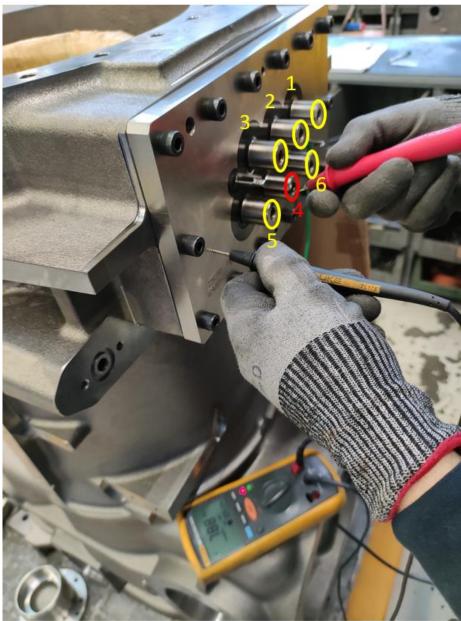


Figure 49 Electrical insulation Motor Phases – Earth

In case any motor phase is not insulated from earth, motor compressor must be replaced.

7.3.2 Electrical insulation between Motor Phases

Type of measurement: Insulation test at 1000V

- Turn on the Megger
- Select Megger full scale to 1000V
- Connect the positive lead (red tip) to the terminal 1 of the compressor terminal block
- Connect the negative lead (black tip) to other terminal winding of the compressor terminal block, respecting the table below
- Measure the resistance

Value measure must be more than $11M\Omega$.

Check the electrical insulation of each winding with respect to the others respecting the following sequence:

RED LEAD	BLACK LEAD	Accettable Value
Terminal 1	Terminal 2 – 3 – 5 -6	>11MΩ
Terminal 2	Terminal 1 – 3 – 4 - 6	>11MΩ
Terminal 3	Terminal 1 – 2 – 4 - 5	>11MΩ

Terminal 4 (if available)	Terminal 2 – 3 – 5 - 6	>11MΩ
Terminal 5 (if available)	Terminal 1 – 3 – 4 - 6	>11MΩ
Terminal 6 (if available)	Terminal 1 – 2 – 4 - 5	>11MΩ

Table 21 Electrical insulation between Motor Phases sequence



NOTICE The tests described above must not be performed between the terminals of the electric motor protection thermistors

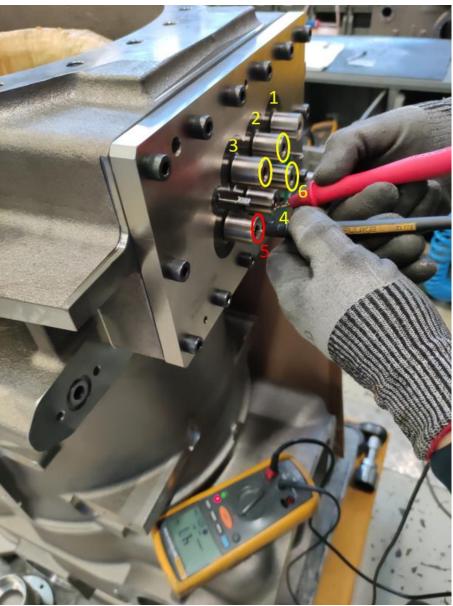


Figure 50 Electrical insulation between Motor Phases

In case any motor phases is not insulated from another one, motor compressor must be replaced.

7.3.3 Motor phases electrical continuity

Type of measurement: Resistance test - Ω mode



INFO Result of the test depends on multimeter resolution. In this paragraph are showed result for lower and higher resolution

- Turn on the multimeter
- Connect the positive lead (red tip) to the terminal 1 of the compressor terminal block

- Connect the negative lead (black tip) to other terminal of same winding on the compressor terminal block (4), respecting the table below
- Measure the resistance

Lower resolution: The measurement value must be in this range: 0.1 \div 0.3 Ω

Check the electrical continuity of each phase, respecting the following sequence

RED LEAD	BLACK LEAD	Accettable Value
Terminal 1	Terminal 4	0.1 ÷ 0.3 Ω
Terminal 2	Terminal 5	0.1 ÷ 0.3 Ω
Terminal 3	Terminal 6	0.1 ÷ 0.3 Ω

 Table 22 Motor phases electrical continuity sequence

Higher resolution: the measurement value depends on Motor Type and compressor model

Motore Type	Code	Compressor Model	Motor terminal resistance from 15 and 35°C [mOhm]
82kW/400V-83Hz	332107677	3100 VVR INV.	50÷60
82kW/380V-60Hz	332107663		60÷70
43kW/400-460V	M331314027	3100	240÷280
60kW/400-460V	M331314047		160÷200
82kW/400-460V	M331314067		78÷130
82kW/400-460V	M330563267	3200	78÷130
138kW/690V	M330870893		90÷100
138kW/400-460V	M330870887		60÷80
82kW/400-460V	332101467	F3AS/L	100÷130
82KW/380V-60Hz	332101464		
180kW/400-460V	332114667	F4AS/L	35÷70
216KW/380V-60Hz	332114664		260÷290

Table 23 Compressor Motor Terminal resistance reference values



Figure 51 Motor phases electrical continuity

7.4 VFD NAV Alarms saving

- TOOLS REQUIRED
 - 1. Software "VFD Nav"
 - 2. Laptop
 - 3. USB-C cable
 - 4. PN 5902821: INVERTER VFD DAE TO PC CONNECTING KIT
 - o USB RS485 Converter
 - 0 Connecting cable RS485 Converter to VFD Regulation Card
 - o USB-USB type B CABLE

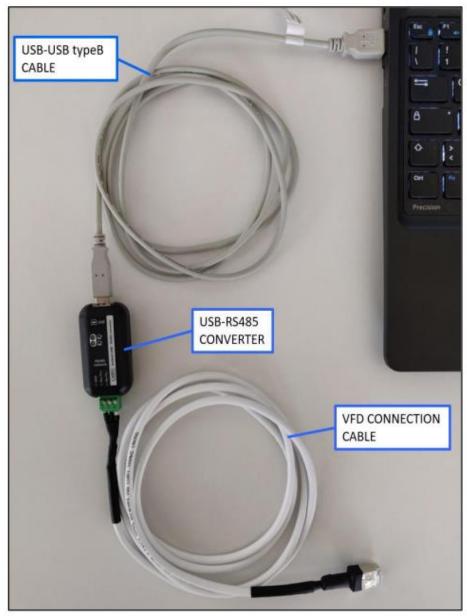


Figure 52 Tools Required

CONNECTION

1. Connect the CONNECTING KIT PN 5902821 to the laptop (USB connection) and to VFD (ethernet connection on REG_CN15)

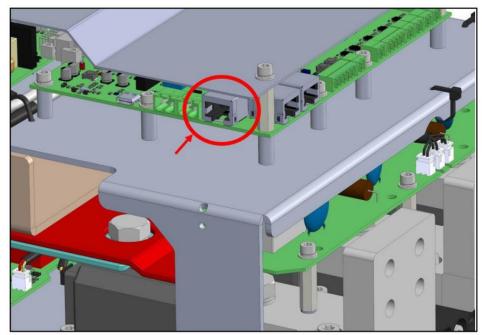


Figure 53 CN15 Connector on regulation board

Regulation card must be supplied providing +5V with USB-C connector

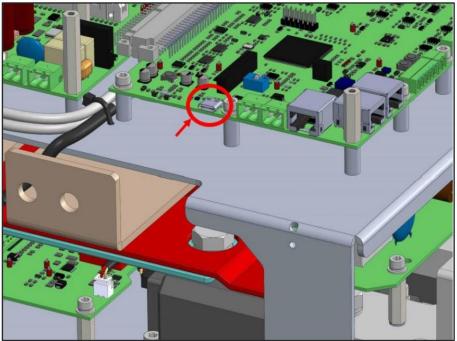


Figure 54 USB-C Connector



NOTICE

It's important that regulation board receive just one power supply. In the case regulation board is mounted on the VFD, it normally receives supply from power board; then verify that there is no residual voltage on DC-link before to supply regulation board by USB-C connector. Power supply both coming from power board and USB-C connector can damage the regulation board

2. Open the software VFD NAV and Using network scan to find out the devices connected. On the "Advanced" button to show the scan parameters

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File View Parameters Recipes Target Service Options Help		
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Tree 4 ×	Catalog	
Untitled Network scan	Device name	Version
Advanced >>	DAE SAF Application	
	DAE VFD Application	0.5
Protocol: Modbus		
Protocol: Involutos		
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Scan Stop	Connection Status	ųх
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Device Version Application Version Address Baud rate		
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Device Name Value Subldx Um Descripti		
-5000		0
		H
Track Um	Min value Max value	Cur value
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Redy C		TED

Figure 55 VFD Nav Network scan

3. Set the correct COM port (check in Device Manager of your PC in order to set the correct port) and start the scan by clicking on the "Scan" button.

device Manager	-	×
File Action View Help		
V 🗄 ITCE-WK-L-191		Â
> II Audio inputs and outputs		
> 🥪 Batteries		
> 8 Bluetooth		
> @ Cameras		
> 💻 Computer		
> Disk drives		
> 🖼 Display adapters		
> Firmware		
> 🐺 Human Interface Devices		
> 🚡 Imaging devices		
> 🥅 Keyboards		
> 🕘 Mice and other pointing devices		
> 🛄 Monitors		
> 🔄 Network adapters		
✓		
USB Serial Port (COM3)		
> 🕞 Print queues		
> 🕞 Printers		
> Processors		
> P Security devices		
> P* Software components		
> Software devices		
> 🖞 Sound, video and game controllers		
> Storage controllers		
System devices		~

Figure 56 Device Manager

💯 Untitled - VFD Nav		- 0	×
File View Parameters Recipes Target Service Options Help			
₩ \$ C = R W \$ 8 10 65 9			
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Tree 4 X		Catalog	ч×
Dutitled	^		Version
		DAE SAF Application	
Advanced <<		DAE VFD Application	0.5
Protocol: Modbus V Port COM 3			
Baud range: 19200 V 57600 V			
Address range: 1 15		<	>
Line conf. N.8,1		Connection Status	ч×
		Device name Description	2n
Scan Stop			
Device Version Application Version Address Baud rate	~		
Monitor # X Output # X Graph		<	× # ×
			* ^
Device Name Value Sublick Um Descripti			
uevice Name Value Sublix Um Uescripti	ma/div: 5000.00		
	-50000	harlenden bester den trotten b	0
Track	Um Mir	value Max value C	Cur value
		-	>
Ready		S 💥 DISCONNECTER	D .::

Figure 57 VFD Nav COM Port settings

4. At the end a list of the found devices is shown. Click on the "Add" button to start project.

Network scan							_
						Advanced	<<
Protocol: Modbus		Port	сом	3			
		Baud range:	19200)	✓ 570	600	~
		Address range:	1	15			
		Line conf.	N,8,1				
	Sca	n Sto	n				
		L devices found	P				
Device	Version	Application		Version	Addross	Baud rate	1
			ontrol	-	Address 2	· · · · · · · · · · · · · · · · · · ·	
Add DAE VFD Application	0.5	Compressor_C	ontrol	1.07	2	57600	
T							
		Add ALL	1				
	_		_				

Figure 58 VFD Nav add Device

5. Connect with VFD using the button in the following window

Co	nnection Statu	s
×	Device name DAE VFD A	

Figure 59 VFD Nav Connection status

- 6. Change the Menu access level by clicking on the toolbar "File" > "Change Menu Access Level"
- 7. Select "Advanced (RW)" and insert password: Daikin18

New Ctrl+N	1.08 ≠ 18 °	Options Help												
Open Ctrl+O														
Save Ctrl+S														
Save As	_													
Print., Ctrl+P	<						A	II param	eters		Filter	Help	Catalog	
Print Preview	PA	Name	Typ	e Value	Un	Default	Mo	Max	Description				Device name	Ve
Print Setup		K COND 300HZ	REAL	e vaue	Um	1.24	0.00	100.00	P00 - K capacitors at 300Hz					
Change Language	2	K_COND_FSW	REAL	1.45		1.45	0.00	100.00	P01 - K capacitors at foundamental frequency					
	3	I COND NOM	REAL	24.8		24.8	0.0	2000.0	P02 - Capacitors nominal current					
Change Menu Access Level	4	C BANKS	INT	2		2	0	1000	P03 - Capacitors banks in parallel					
Recent File	5	K_COND_NOM	RE					100.00	P04 - K capacitors at nominal value for the life					
Exit	6	K COND MARGIN		elect Menu	Access Lava		×	100.00	P05 - K capacitors margin					
tu 🖹 👘	7	CAPACITORS VALUE	UIN	elect Menu	ACCESS LEVE		~	60000	P06 - Total Capacitors value					
6- i tput	8	ric TF	RE					2000.0	P07 - Capacitor current filter time constant					
B-III Fields		ric Ovri tmax	RE					1000	P08 - Capacitor current protection overload max time					
dbus rtu	10	ric Ovri Max	RE	Select menu	access level:			200.0	P09 - Capacitor current protection overload max					
D_communication	11	FAN_TEMP_MAX_ON	RE					150.0	P10 - Max Temperature for Fan control always on					
🖃 💼 Gerac Parameters	12	SYNC REG KP	INT	Advanced (RW)		~	200	P11 - SYNC loop regulator Proportional gain					
	13	SYNC REG TA	INT	Harrancea				20000	P12 - SYNC loop regulator lead time constant				<	
ta storing	14	SYNC_CORRECTION	INT					30000	P13 - SYNC offset correction term				Connection Status	
set and gain	15	OFFSET GRID ANGLE	RE	Insert passv	vord:			100.00	P14 - Offset Grid Angle				Device name De	
Last Trace	16	OFFSET VRS	RE					100.00	P15 - Offset VRS grid				DAE VFD A., Co	
Application	17	OFFSET_VST	RE					100.00	P16 - Offset VST grid				T DAE VED A CO	onnected
Compressor_Control	18	FAN_TEMP_MIN_ON	RE/	L				150.0	P17 - Min Temperature for Fan control always on					
🕀 🚄 Ntc	19	PRC_CW_SPD_REF_M						105.0	P18 - Max CW speed reference value limit					
B Pressure	20	PRC_CCW_SPD_REF_M						105.0	P19 - Max. CCW speed reference value limit					
B- Speed_ref	21	SPD_LOOP_BW	RE	OK		Cano	-	200.0	P20 - Speed loop bandwidth					
Generation	22	CW_ACC_TIME	RE					199.99	P21 - CW acceleration time					
	23	CW_DEC_TIME	REAL	10.00	8	10.00	0.01	199.99	P22 - CW deceleration time					
- DDU_Communication	24	CCW_ACC_TIME	REAL	10.00	s	10.00	0.01	199.99	P23 - CCW acceleration time					
AnalogOut	25	CCW_DEC_TIME	REAL	10.00	5	10.00	0.01	199.99	P24 - CCW deceleration time					
Alarms	26	TF_RND_RAMP	REAL	0.100	8	0.100	0.001	10.000	P25 - Rounded filter time constant					
Warnings	27	RECEIPE_N	UDINT	0.000		0.000	0.000		P26 - Recipe number					
Recipes	29	MOT_WAIT_DEMAGN	INT	0	ms	0	0	3000	P28 - Motor demagnetization waiting time					
	30	MOT WAIT MAGN	INT	300	ms	300	50	3000	P29 - Motor magnetization waiting time				< c	
itor					Output				4 X Graph					
ាព៩ 1 + +				÷ ^ [ouiput									
										그의 미 첫 첫 더 원 원				_
e Name	Value S	ubldx Um Description								ms/dv: 5000.00				
										1				
										-50000				e
									Track	Um	Min value	Max value C	arvalue Value/Div	Descript

Figure 60 VFD Nav select Menu Access Level

- 8. Select folder All parameters on the project tree9. On the toolbar go to "Parameters > Read all

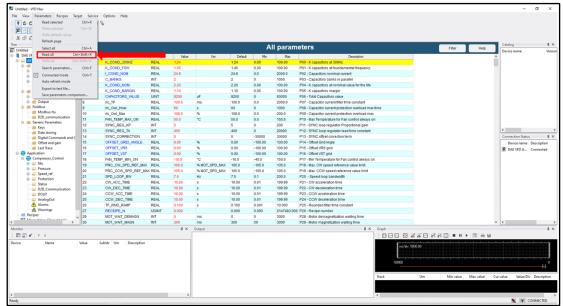


Figure 61 VFD Nav Read all parameters

• ALARM LOG TRACE DOWNLOADING

1. Go to Alarm folder in the project tree

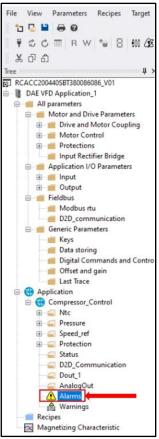


Figure 62 VFD Nav Alarm folder

2. The following window is showed, please make a screenshot

A15.0 Parame	ter setting error alarm	
Update Alarm History	Save Alarm History	J
Logs from current conn	ected target	
A12.1 Internal alarm Run wit	hout power soft start	
trace time 4 hours	Load t	race
A03.4 Power fault SW Overcu	irrent	
trace time 7 hours	Load trace	
A05.1 Thermal alarm Radiate	or temperature too high	
trace time 7 hours	Loa	ad trace
History log archive		
Save date	Application	Num trace

Figure 63 VFD Nav Alarm logs

3. Click on button

Save Alarm History

Then for each alarm follow this procedure:

a) Click on Load trace

button (Opening soft scope windows)

b) Click on the button 🖄 on the toolbar (show all values: in this way the trend is showed on the graph)

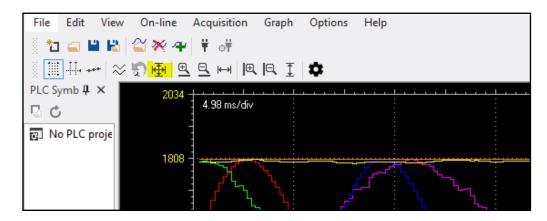
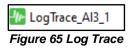


Figure 64 VFD Nav Trend on the graph

c) Save as (give a name as Logtrace_AI3_1: Al3 is ref to kind of VFD alarm, "1" is for first time is occurred, "2" second, etc..)



- d) Close soft scope window
- e) Click on Last Trace on the project tree
- f) Select all data in Last Trace menu (shift + click)
- g) Go to Parameter > Read All
- h) Save as (save the project) and rename as Recepit log_Al3_1 (corresponding number of the point 3)



Figure 66 Recepit log

The purpose is to save soft scope file and corresponding project with parameters (at the end you have "n" log traces files and "n" corresponding project files)

For example, in this case we have Alarm 3 on inverter with 3 occurrences



Figure 67 Log Trace and Recipe Log

8 INVERTER MEASURING POINTS



NOTICE

VFD measurements may require the assistance of two technicians, particularly on units with soundproof cabins

8.1 Inverter 90/120kW

8.1.1 DC-BUS Check



Figure 68 90 kW -120 kW DAE VFD - DC-BUS Check



WARNING Before carrying out the tests on SCR and IGBT • VFD Fuses OFF • VDC Bus = 0 V

8.1.2 Bottom SCR Direct polarization

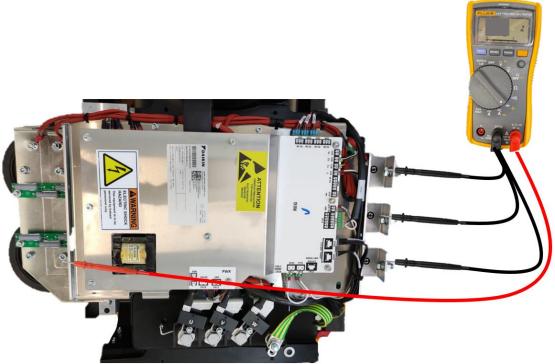


Figure 69 90 kW -120 kW DAE VFD - Bottom SCR Direct polarization

8.1.3 Bottom SCR Indirect polarization



Figure 70 90 kW -120 kW DAE VFD – Bottom SCR Indirect polarization

8.1.4 Top SCR Resistance direct polarization



Figure 71 90 kW -120 kW DAE VFD – TOP SCR Resistance direct polarization

8.1.5 Top SCR Resistance indirect polarization

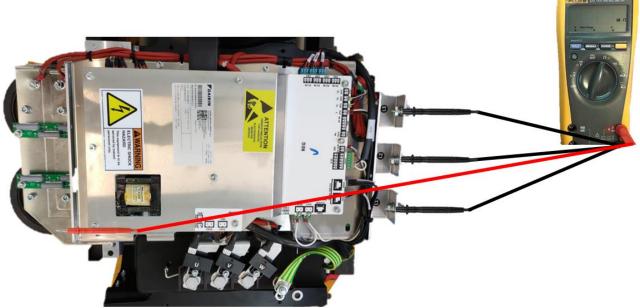


Figure 72 90 kW -120 kW DAE VFD – TOP SCR Resistance indirect polarization

8.1.6 Bottom IGBT Direct polarization



Figure 73 90 kW -120 kW DAE VFD – Bottom IGBT Direct polarization

8.1.7 Bottom IGBT Indirect polarization



Figure 74 90 kW -120 kW DAE VFD – Bottom IGBT Indirect polarization

8.1.8 Top IGBT Direct polarization



Figure 75 90 kW -120 kW DAE VFD - TOP IGBT Direct polarization

8.1.9 Top IGBT Indirect polarization



Figure 76 90 kW -120 kW DAE VFD - TOP IGBT Indirect polarization

8.2 Inverter 200kW

8.2.1 DC-BUS Check

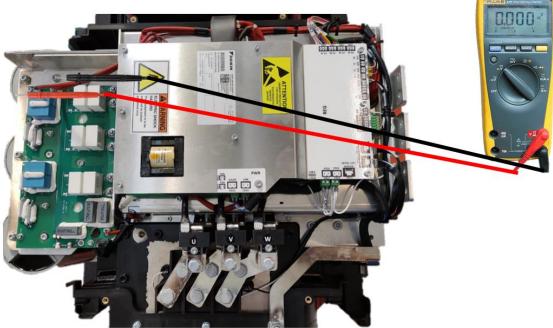


Figure 77 200 kW DAE VFD – DC-BUS Check

8.2.2 Bottom SCR Direct polarization



Figure 78 200 kW DAE VFD – Bottom SCR Direct polarization

8.2.3 Bottom SCR Indirect polarization



Figure 79 200 kW DAE VFD – Bottom SCR Indirect polarization

8.2.4 Top SCR Resistance direct polarization

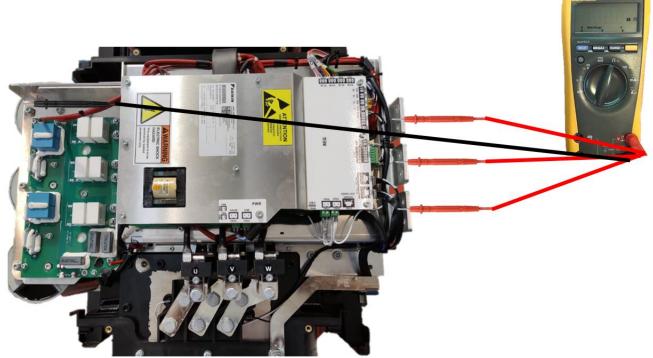


Figure 80 200 kW DAE VFD – TOP SCR Resistance direct polarization

8.2.5 Top SCR Resistance indirect polarization



Figure 81 200 kW DAE VFD – TOP SCR Resistance indirect polarization

8.2.6 Bottom IGBT Direct polarization

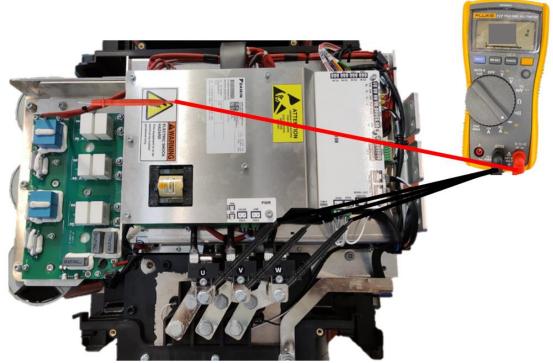


Figure 82 200 kW DAE VFD – Bottom IGBT Direct polarization

8.2.7 Bottom IGBT Indirect polarization

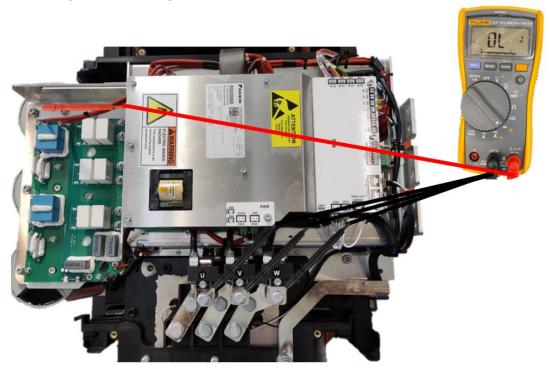


Figure 83 200 kW DAE VFD – Bottom IGBT Indirect polarization

8.2.8 Top IGBT Direct polarization



Figure 84 200 kW DAE VFD – TOP IGBT Direct polarization



8.2.9 Top IGBT Indirect polarization

Figure 85 200 kW DAE VFD – TOP IGBT Indirect polarization

8.3 Inverter 330/400kW

8.3.1 DC-BUS Check



Figure 86 330 kW - 400 kW DAE VFD – DC-BUS Check

8.3.2 Bottom SCR Direct polarization



Figure 87 330 kW - 400 kW DAE VFD – Bottom SCR Direct polarization

8.3.3 Bottom SCR Indirect polarization



Figure 88 330 kW - 400 kW DAE VFD – Bottom SCR Indirect polarization

8.3.4 Top SCR Resistance direct polarization

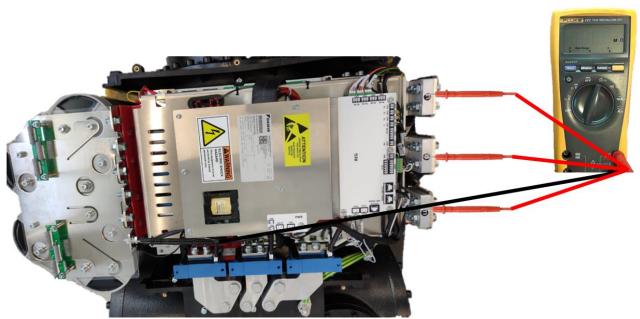


Figure 89 330 kW - 400 kW DAE VFD – TOP SCR Resistance direct polarization

8.3.5 Top SCR Resistance indirect polarization

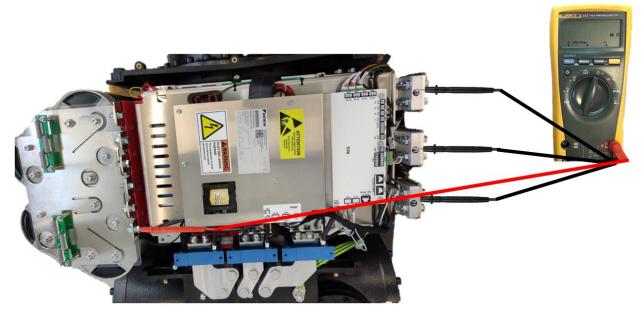


Figure 90 330 kW - 400 kW DAE VFD – TOP SCR Resistance indirect polarization

8.3.6 Bottom IGBT Direct polarization

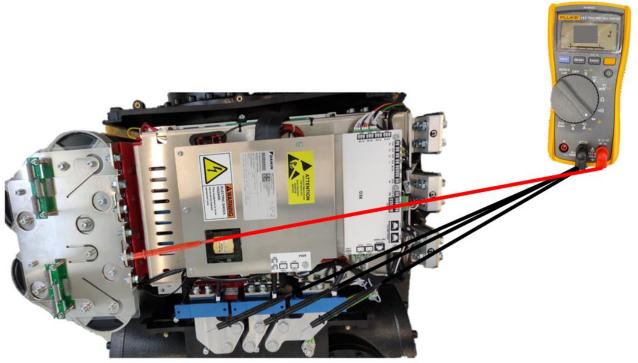


Figure 91 330 kW - 400 kW DAE VFD – Bottom IGBT Direct polarization

8.3.7 Bottom IGBT Indirect polarization

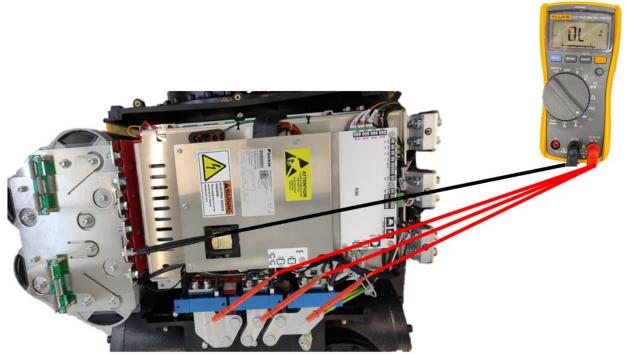


Figure 92 330 kW - 400 kW DAE VFD – Bottom IGBT Indirect polarization

8.3.8 Top IGBT Direct polarization

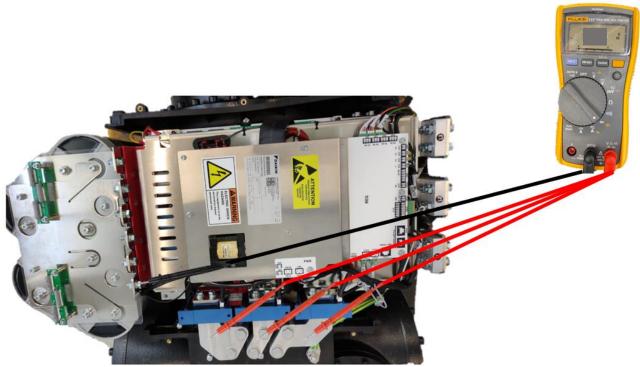


Figure 93 330 kW - 400 kW DAE VFD – TOP IGBT Direct polarization

8.3.9 Top IGBT Indirect polarization

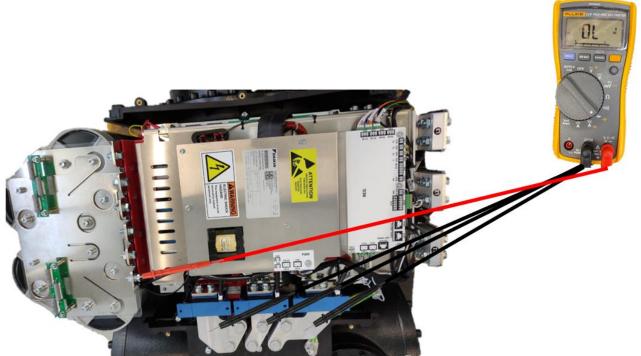


Figure 94 330 kW - 400 kW DAE VFD – TOP IGBT Indirect polarization

9 MEASURMENT REFERENCE VALUES TABLE



INFORMATION

The reference value for each SCR/IGBT model is to be considered for all the three phases. A damaged SCR/IGBT will cause you to get far out of tolerance measurements

9.1 SCR section

9.1.1 Bottom SCR Diodes reference values

VED Size		CR Direct V]	
[]	Min	Max	
90kW	0,37	0,48	
120kW	0,38	0,48	
200kW	0,35	0,46	
330/400kW	0,38	0,45	

Table 24 Bottom SCR direct reference values

VFD Size [kW]	Bottom SCR Indirect [V]		
[]	Min	Max	
90kW	OL	OL	
120kW	OL	OL	
200kW	OL	OL	
330/400kW	OL	OL	

Table 25 Bottom SCR indirect reference values

i

INFORMATION

- In forward bias measurement, an indication of 0,1V or lower indicates a problem with the diode.
- When the readout value is the same in forward and reversed bias the diode is *shorted!*
- When performing reversed biased measurement, the reading should be OL, indicating an open switch diode.
- If reading is OL in both reversed and forward biasing the diode is bad.

9.1.2 TOP SCR Thyristors resistance reference values

The Ohm mode function is a less accurate measurement than diode test mode.

Moreover, depending on the DAE VFD connection in the electrical switchbox and system the measurement can variate differently in each application.

To evaluate a thyristor as "good", direct and indirect resistance measurement are "OL: Open Line" or more than hundreds Ω kOhm.

A shorted thyristor reports measurements of very low resistance like 0 Ω Ohm or similar.

9.2 IGBT section

9.2.1 Bottom/TOP IGBT Diodes direct polarization reference values

VFD Size [kW]	Bottom/Top IGBT Direct [V]	
[]	Min M	Max
90kW	0,32	0,42
120kW	0,28	0,4
200kW	0,3	0,4
330kW	0,29	0,37
400kW	0,28	0,36

Table 26 Bottom/Top direct reference values

9.2.2 Bottom/TOP IGBT Diodes indirect polarization reference values

VFD Size [kW]	Bottom/Top IGBT Indirect [V]	
[]	Min M	Max
90kW	OL	OL
120kW	OL	OL
200kW	OL	OL
330kW	OL	OL
400kW	OL	OL

Table 27 Bottom/Top indirect reference values



INFORMATION

- In forward bias measurement, an indication of 0,1V or lower indicates a problem with the • diode.
- When the readout value is the same in forward and reversed bias the diode is shorted! •
- When performing reversed biased measurement, the reading should be OL, indicating an ٠ open switch diode. •
 - If reading is OL in both reversed and forward biasing the diode is bad.

10 COLLECTION TABLES

In this section you can find the service sheet that can be filled on site for service checks on the compressor motor and DAE VFD.

The numbers of the checks in the sheet are referred to number of procedure of chapters 7 and 8.

Use also the following pictures for components models and serial numbers references

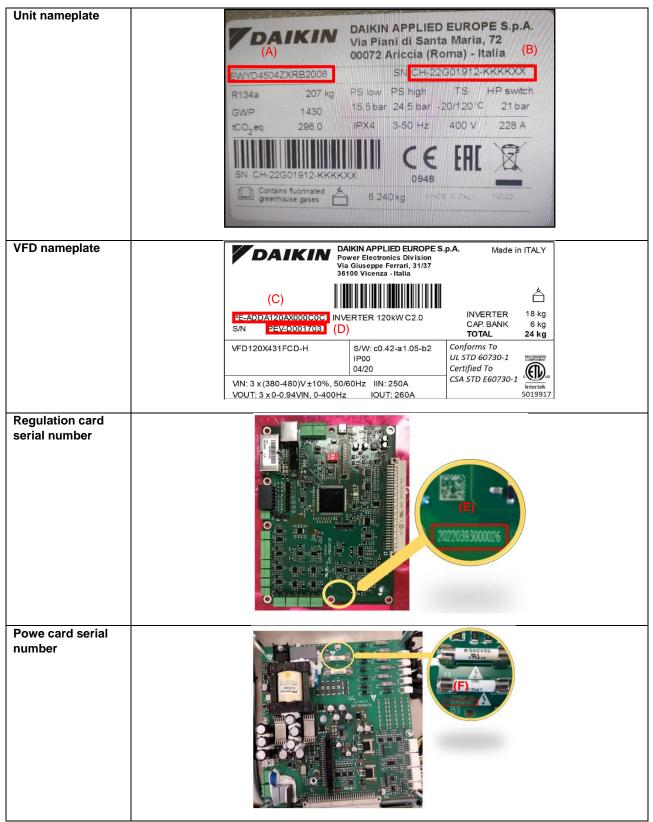


Table 28 VFD Labels

DA	IKIN

ALARM TROUBLESHOOTING PROCEDURES

COMPRESSOR MOTOR Checks 7.3.1 Before Troubleshooting Electrical insulation Motor Phases - Earth						
INPUT SERIAL INR (B): REGULATION BOARD SERIAL INR (E): Site:: Check by VED Nuv on reg, board INVERTER NOBEL (C): Distributor: Check by VED Nuv on reg, board ONE OF Checks Result Colspan="2">Result OK Colspan="2">Result OK OK Colspan="2">Result OK OK Colspan="2">Result OK OK Colspan="2">Result OK Colspan="2">Result OK Colspan="2">Result OK Colspan="2">Result Colspan="2">Colspan="2">Result Colspan="2"Colspa	UNIT MODEL (A) :		INVERTER SERIAL NR (D):	Date:	
Check w/ED NAV or on reac. board Distributor: NUMERTE MORE (G): Distributor: Check vFD Label Distributor: WASTER ORD SERIAL NR (F): Distributor: Only for Canthylag application Save PROCEDURES LIST Result COMPRESSOR MOTOR Checks						
Inverse NOBL (C): POWER BOARD SERIAL NR (F): Distributor: Check VFD Label Check on power board Check on power board Distributor: MASTER of SLAVE VFD: Master Result Ok. Not Of COMPRESSOR MOTOR Checks Image: Comparison of the compariso	1 · · · · ·				Site:	
Check on power board Master Check on power board Master Result Control contribuility Control contro control control control control control control control control					Diatributor	
MARTER or SLAVE VPD: Only for Centrifugal application Marter PROCEDURES LIST Result OK Not CO COMPRESSOR MOTOR Checks Compressors MOTOR Checks Compressors MOTOR Checks State for Enclobeshooting Electrical insulation between Moor Phases 7.3.3 Before Troubleshooting Electrical insulation between Moor Phases				AL NR (F):	DISTIDUTO	•
Result Result Result Colspan="2">Result Colspan="2">Colspan="2"Colspan="2">Colspan="2"		Master	encen en pener seara			
PROCEDURES LIST Ok Not Of COMPRESSOR MOTOR Checks Image: Comparison of the second of the						
COMPRESSOR MOTOR Checks Oik Not Di 7.3.1 Before Troubleshooting Electrical insulation Motor Phases - Earth	DDOCEDUDE	C LICT			Re	sult
7.3.1 Before Troubleshooting Electrical insulation Motor Phases - Earth 7.3.2 Before Troubleshooting Electrical insulation between Motor Phases 7.3.3 Endere Troubleshooting Motor thema probe check Is the motor thermal probe correctly working? 6.13 Motor thermal probe check Is the motor thermal probe correctly working? 6.13.1 Terminal thermistor electrical continuity test	PROCEDURE	3 LI3 I			Ok	Not Ok
10.1.2006 OreSummed Field Stream (Section Continuity) 1 7.3.2 Before Troubleshooting Motor phases electrical continuity 1 6.13 Motor thermal probe check Is the motor thermal probe correctly working? 6.13.1 Terminal thermistor relectrical continuity test 1 6.13.2 Electrical insulation terminal thermistor - earth 1 6.13.3 Electrical insulation terminal thermistor - motor phases 1 7.3.3 Before Troubleshooting Electrical insulation terminal thermistor - earth 1 6.13.2 Electrical insulation terminal thermistor - motor phases 1 8.13.3 Electrical insulation terminal thermistor - motor phases 1 8.14 24V DC on CN16 - CN17 Is 24V DC present across REG_CN17 1 6.2 Guardistors Is the voltage drop on the guardistors = 0V? 1 6.3 CN11 - CN16 Continuity Is the voltage drop on the guardistors = 0V? 1 6.4 24V DC CN11 Is 24V DC present on REG_CN11 PIN 1.2 1 6.5 24V DC Supply Is the 24V DC supply content or regulation card properly 1 CURRENT TRANSUCER Checks 6.6 Output current measurement Check	COMPRESSOR MO	TOR Checks				
7.33 Before Troubleshooting Motor phases electrical continuity 6.13 Motor thermal probe check Is the motor thermal probe correctly working? 6.13.1 Terminal thermistor electrical continuity test Image: Control of the contrecont of the control of the control of the con	7.3.1 Before Troubleshooting	Electrical insulation	n Motor Phases - Earth			T T
7.3.3 Before Troubleshooting Motor phases electrical continuity 6.13 Motor thermal probe check Is the motor thermal probe correctly working? 6.13.1 Terminal thermistor electrical continuity test Image: Control of Control o	7.3.2 Before Troubleshooting	Electrical insulation	n between Motor Phases			
6.13 Motor thermal probe check Is the motor thermal probe correctly working? 6.13.1 Terminal thermistor electrical continuity test 6.13.2 6.13.2 Electrical insulation terminal thermistor - earth 1 6.13.3 Electrical insulation terminal thermistor - earth 1 6.13.2 Electrical insulation terminal thermistor - motor phases 1 REGULATION CARD Checks 6.1 24V DC on CN16 - CN17 Is 24V DC present across REG_CN17 6.2 Guardistors Is the voltage drop on the guardistors = 0/? 6.3 CN11 - CN16 Continuity Is the cable and REG_CN11 PIN 2 6.4 24V DC CN11 Is 24V DC present on REG_CN11 PIN 12 6.5 24V DC Supply Is the 24V DC supplied to the regulation card property CURRENT TRANSDUCER Checks 6.6 Output current measurement Check Is the measured value in tolerance with the value read by the inverter ? 6.7 Output current transducers Check Are the pins correctly connected? MECHANICAL Checks 6.8 Output side bolts check Are the Bolts correctly tighten up? 6.10 SV DC on 18 - 23 spots Is SV DC present across 18 to 23 spots?	7.3.3 Before Troubleshooting	Motor phases elec	trical continuity			<u> </u>
6.13.1 Terminal thermistor electrical continuity test 6.13.2 Electrical insulation terminal thermistor - earth 6.13.3 Electrical insulation terminal thermistor - motor phases REGULATION CARD Checks 6.1 24V DC on CN16 - CN17 Is 24V DC present across REG_CN16 and REG_CN17 6.2 Guardistors Is the voltage drop on the guardistors = 0V? 6.3 CN11 - CN16 Continuity Is the cable and REG_CN11 PIN 2 in continuity? 6.4 24V DC CN11 Is 24V DC present on REG_CN11 PIN 1-2 6.5 24V DC Supply Is the 24V DC supply Is the 24V DC supplied to the regulation card properly CURRENT TRANSDUCER Checks 6.6 Output current measurement Check Is the measured value in tolerance with the value read by the inverter ? 6.7 Output current transducers Check Are the Bolts correctly connected? MECHANICAL Checks 6.8 Output side bolts check Are the Bolts correctly tighten up? 6.10 5V DC on 18 - 23 spots Is 5V DC present across 18 to 23 spots? 6.10 5V DC on 12 3 - GND Is 5V DC pr	<u></u>	Motor thermal prol	be check	Is the motor thermal probe correctly working?	1	
6.13.2 Electrical insulation terminal thermistor - earth 6.13.3 Electrical insulation terminal thermistor - motor phases REGULATION CARD Checks 6.1 24V DC on CN16 - CN17 is 24V DC present across REG_CN16 and REG_CN17 6.2 Guardistors is the voltage drop on the guardistors = 0V? 6.3 CN11 - CN16 Continuity is the cable and REG_CN11 PIN 2 in continuity? 6.4 24V DC CN11 is 24V DC present on REG_CN11 PIN 1-2 6.5 24V DC Supply is the regulation card property CURRENT TRANSDUCER Checks 6.6 Output current measurement Check is the measured value in tolerance with the value read by the inverter ? 6.7 Output current transducers Check Are the poins correctly tighten up? 6.8 Output current transducers Check Are the Bolts correctly tighten up? 6.14 VFD Cooling line solenoid valve mounted in the correct direction? POWER CARD Checks 6.10 5V DC on 18 - 23 spots is 5V DC present across 18 to 23 spots? 5V 5V DC on 12 3 - GND 6.11 OV Dc on 12 3 - GND is 5V DC present on 1-GND or/and 3-GND or/and 3-GND and VFD still in alarm? OV Dc on 12 3 - GND		Terminal thermisto	or electrical continuity test		1	
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				and VFD still in alarm?		
6.12 or/and 2-GND or/and 3-GND		0V DC on 1 2 3 - 0	GND	•		
	6.12					
and VFD still in alarm?					 	+
6.15 Is 24V DC on CN13 Is 24V DC Pulsing/present	6.15	24V DC 01 CN13		÷.		
on the PWR_CN13				on the PWR_CN13	<u> </u>	<u> </u>

PROCEDURES LIST

Res	sult
Ok	Not Ok

IGBT Checks

IGBT Checks				
	IGBT CHECK	Is IGBT Check procedure verified?		
	Bottom IGBT Diodes Measurements (Diode test function)			
	PHASES	Bottom IGBT Direct [V]	1	
		DC - [(+) Red lead]	4	
	∪ [(-) Black Lead]		4	
	V [(-) Black Lead]		4	
	W [(-) Black Lead]		4	
		Detter LODT to Prost 8/1	4	
	PHASES	DC - [(-) Black Lead]	4	
	U [(+) Red lead]		1	
	∨ [(+) Red lead]		1	
6.9	W [(+) Red lead]		1	
		urements (Diode test function)	1	
		TOP IGBT Direct [V]	1	
	PHASES	DC + [(-) Black Lead]	1	
	U [(+) Red lead]]	
	V [(+) Red lead]			
	W [(+) Red lead]]	
			1	
	PHASES	TOP IGBT Indirect [V]	4	
		DC + [(+) Red lead]	4	
	U [(-) Black Lead]		4	
	V [(-) Black Lead] W [(-) Black Lead]		1	
			<u> </u>	
SCR Checks				
	SCR CHECK	Is SCR Check procedure verified?		
	Bottom SCR Diodes Me	asurement (Diode test function)	4	
	PHASES	Bottom IGBT Direct [V]	4	
		DC - [(+) Red lead]	4	
	L1 [(-) Black Lead]		4	
	L2 [(-) Black Lead] L3 [(-) Black Lead]		4	
			1	
		Bottom IGBT Indirect [V]	1	
	PHASES	DC - (-)	1	
	L1 [(+) Red lead]		1	
	L2 [(+) Red lead]]	
7.2	L3 [(+) Red lead]			
	Top SCR Thyristors Mea	surements (Ohm mode function)	1	
	PHASES	Bottom IGBT Direct [Ω]	1	
		DC + (-)	4	
	L1 [(+) Red lead]		4	
	L2 [(+) Red lead]		4	
	L3 [(+) Red lead]		4	
		Bottom ICPT Indirect 101	4	
	PHASES	Bottom IGBT Indirect [Ω] DC + [(+) Red lead]	1	
	L1 [(-) Black Lead]		1	
	L2 [(-) Black Lead]		1	
	L3 [(-) Black Lead]		1	
DC BUS CHECK	• · · · · · · · · · · ·		-	
7.1	DC BUS Voltage [V] :			
			I l	

PRE-TROUBLESHOOTING COMMENTS

POST-TROUBLESHOOTING COMMENTS

Defective items found?

Present during service		
Name :	Company:	
Name :	Company:	
Name :	Company:	
Author:	Installer:	
Signature:	Signature:	
Title: Service Engineer	Title:	

These information are intended only as a guide for authorized personnel with a sound basic knowledge of HVAC equipment, mechanical systems, electrical wiring, controls, & microprocessors.

Attempts by untrained or unauthorized persons to start, operate and service this equipment can result in equipment failure, personal injury, or death, as well as invalidation of product warranty. It is the responsibility of the technician to ensure that proper safety equipment safe practices are used.