

# OVX-6400

## 6400VA DC/AC INVERTER

### GENERAL FEATURES:

- Sine wave output voltage
- Suitable for motors control
- Adjustable output frequency
- Adjustable output voltage
- Input voltage according to:
  - EN50163:2006
  - EN50124-2:2017
- High input-output isolation 5400Vrms
- Remote off opto-coupled
- Alarm by isolated relay contacts
- Configurable input: Reverse or Mid power
- Remote control via RS232
- CAN BUS
- Railway applications according to EN61287-1
- Fire and smoke: EN45545-2 pending



|                      | Input voltage  | Output voltage    | Output power              |
|----------------------|----------------|-------------------|---------------------------|
| <b>OVX-6400-7701</b> | 400 ...900 Vdc | 400 V three phase | 6 kW<br>6.4 kVA<br>8 kWpk |

**INPUT**

|                          |  |
|--------------------------|--|
| Nominal DC input voltage | 600/750Vdc   |
| Minimum DC input voltage | 400V   |
| Maximum DC input voltage | 900V continuous<br>2800Vdc according to EN50124-2=2017 4.2.2 and Annex A |
| Input voltage standard   | EN50163 (Supply voltage of traction systems)                             |
| Inrush current           | 15A  |

**OUTPUT**

|  |   |
|--|---|
| Output type                                    | AC 3ph  |
| Output Voltage                                 | 400V  |
| Voltage tolerance                              | 5±%   |
| Output voltage range                           | 20...100% of Vout (adjust via remote control) |
| Output frequency                               | 50 / 60Hz via DIP-switch, 5...75Hz via RS-232 |
| Maximum continuous current (I <sub>rms</sub> ) | 9.24A   |
| Maximum peak current 5s (I <sub>rms</sub> )    | 11.5A   |
| Continuous active / apparent power             | 6000W / 6400VA                                |
| Peak active / apparent power 5s                | 8000W / 8000VA                                |
| Load regulation                                | < 4.5%  |
| Line regulation                                | < 2%  |
| Output wave distortion THD                     | < 2% (average of 16 samples)                  |
| Output HF ripple                               | < 2.5%  |

**ENVIRONMENTAL**

|  |   |
|--|---|
| Storage temperature                    | -25 ... 80°C  |
| Operating ambient temperature:         |   |
| Full load                              | -25 ... 55°C, 70°C 10 min (SU3 class, according to EN61287-1) |
| 62.5% load                             | -25 ... 70°C  |
| Relative humidity without condensation | 5 ... 95% with no condensation                                |
| Maximum Altitude                       | 2000m at full load, 2500m at 95% of load                      |
| Cooling                                | Internal forced air controlled                                |
| Environmental regulations              | RoHS & Reach according to directive 2011/65/EU                |
| Shock and vibration                    | EN61373 pending   |

**EMC**

|                     |                          |
|---------------------|--------------------------|
| Immunity according  | EN61000-6-2, EN50121-3-2 |
| Emissions according | EN61000-6-4, EN50121-3-2 |

**SAFETY**

|                                     |  |
|-------------------------------------|--|
| Safety according to                 | EN50124-1 Railway app. (Insulation coordination) |
| Dielectric strength: Input /output  | 5400Vac / 50Hz / 10s                             |
| Dielectric strength: Output / Earth | 1500Vac / 50Hz / 1min                            |
| Dielectric strength: Input / Earth  | 5400Vac / 50Hz / 10s                             |
| Pollution degree                    | PD2  |
| Overvoltage category                | OV3  |
| Fire and smoke                      | EN45545-2 pending                                |

**RELIABILITY**

|              |                                      |
|--------------|--------------------------------------|
| MTBF         | >150.000h @40°C according to SN29500 |
| Service life | 20 years                             |
| Life cycle   | 20 years                             |

**MECHANICAL**

|                                   |   |
|-----------------------------------|---|
| Dimensions (H x W x D mm)         | 85,8 x 372 x 450,3                      |
| Weight                            | < 12000 g                               |
| Shock and Vibrations according to | EN61373 Category 1 class B body mounted |



Protection degree IP20

### PROTECTIONS

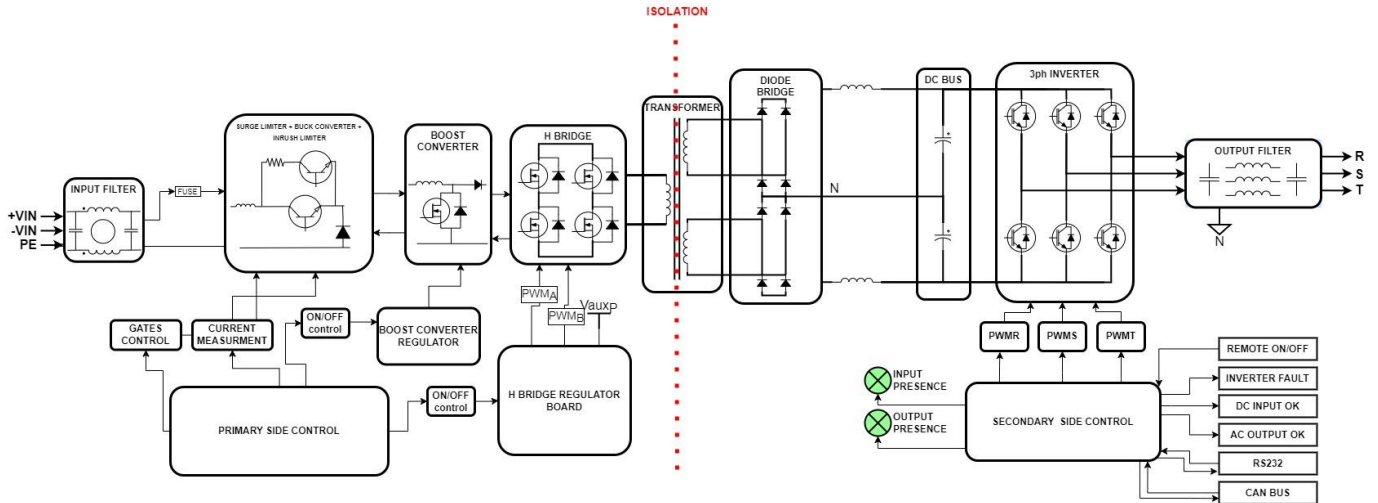
|                          |  |
|--------------------------|--|
| Against overloads        | Current and I <sup>2</sup> T limited (see overload protection curve) |
| Against over-temperature | Shutdown with auto-recovery  |

### CONTROL

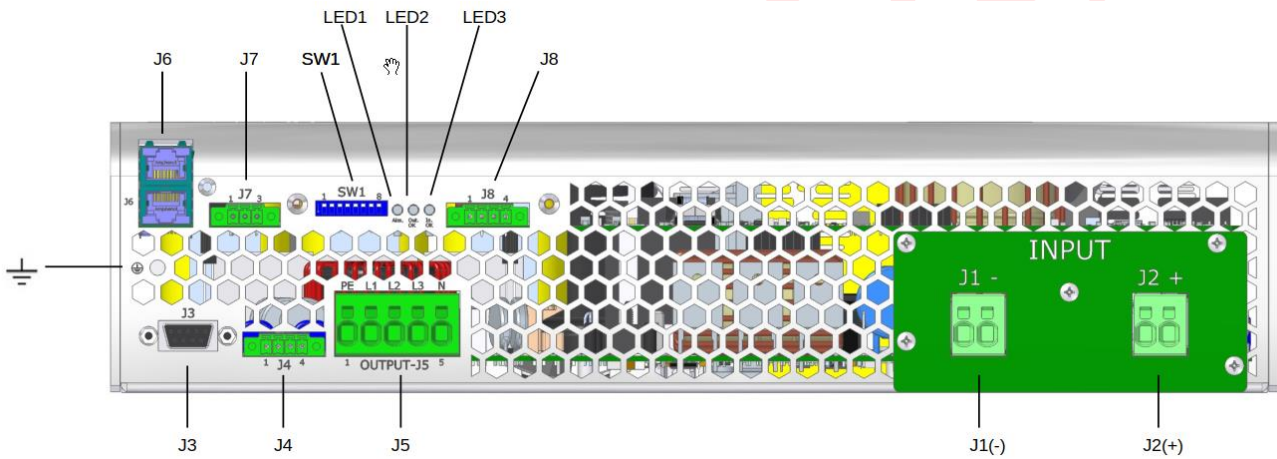
|   |  |
|---|--|
| Output OK LED                             | Green  |
| Input OK LED                              | Green  |
| Alarm LED                                 | Red  |
| Input alarm                               | Open when alarm. Maximum rating: 0.16A at 160Vdc   |
| Output alarm                              | Open when alarm. Maximum rating: 0.16A at 160Vdc   |
| Remote OFF input                          | Off applying 15...143 Vdc, Impedance >35k $\Omega$ |
| Configurable input (reverse or mid-power) | ON: applying 15...143 Vdc, Impedance >35k $\Omega$ |

PRELIMINARY

## BLOCKS DIAGRAM



## CONNECTIONS



|          |                             |  |
|----------|-----------------------------|--|
| J1       | -Vin                        | Spring clamp terminals<br>cables 2.5 ... 4mm <sup>2</sup>                                  |
| J2       | +Vin                        |  |
| J5 - 1   | Protective Earth            |  |
| J5 - 2   | Output R                    |  |
| J5 - 3   | Output S                    |  |
| J5 - 4   | Output T                    | Phoenix Contact MC1.5/4-GF-3.81<br>Recommended female:<br>Phoenix Contact MC1.5/4-STF-3.81 |
| J5 - 5   | Output Neutral              |  |
| J4 - 1   | + Configurable input        |  |
| J4 - 2   | - Configurable input        |  |
| J4 - 3   | + Remote                    | Phoenix Contact MC1.5/4-GF-3.81<br>Recommended female:<br>Phoenix Contact MC1.5/4-STF-3.81 |
| J4 - 4   | - Remote                    |  |
| J8 - 1   | Status output               |  |
| J8 - 2   | Status output               |  |
| J8 - 3   | Status input                | Phoenix Contact MC1.5/3-GF-3.81<br>Recommended female:<br>Phoenix Contact MC1.5/3-STF-3.81 |
| J8 - 4   | Status input                |  |
| J7 - 1   | CAN L (optional Can bus)    |  |
| J7 - 2   | CAN H (optional Can bus)    | Female D-Sub DB9   |
| J7 - 3   | GND CAN                     |  |
| J3       | RS-232                      | RJ45   |
| J6A -J6B | Optional Parallel operation |  |



## DESCRIPTION

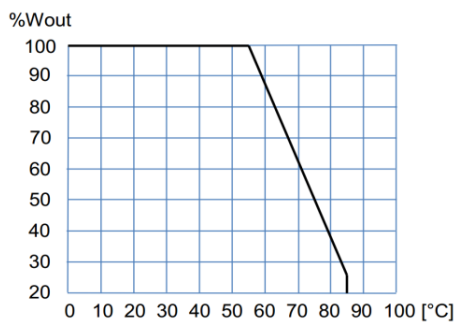
The OVX-6400 is a three-phase sine-wave DC-AC inverter designed not only to work within 400 to 900V input voltage range but also to withstand surges and over-voltages as described in EN50124-2.

The unit allows:

- Changing the output frequency by means of DIP-switch-7 of SW1. OFF: 50Hz or default programmed, ON: 60Hz
- Change local/remote (waiting RS-232 commands) by means of DIP-switch-6 of SW1. OFF: local, ON: remote
- Shutdown applying voltage output 15 to 143V on pins 3 and 4 of J4
- Start-up motors by means of a soft start. In the start-up, the output voltage rises linearly from 0V to set voltage and the frequency from the initial to the set one. The start-up ramp slope may be changed via RS-232
- Set the rotation speed of a motor according to the appropriate Voltage/Frequency ratio.
- Configurable input (pin 1 and 2 of J4):
  - Reverse mode: Changing the rotation direction for the next start-up of a motor by applying voltage between 15 and 143V.
  - Mid power mode: Changing the output frequency in V/F mode from nominal to a mid-power frequency by applying voltage between 15 and 143V.
- Monitoring the status of the input and output voltage through the contacts of two separate solid state relays.
- Set and monitor parameters via RS-232, CAN BUS.

The OVX-6400 is equipped with a maximum average power protection as well as maximum output peak current protection. This protects the semiconductors even when an output short-circuit occurs. It also features a disable function for input under-voltage, which allows protecting the batteries from harmful discharges.

## POWER DERATING vs AMBIENT TEMP.



## START-UP

- The unit has 6 threaded holes for the fixation on a mounting surface.
- The unit has internal fans. For an appropriate cooling, the air input and output should be free of elements that cause and an air flow reduction (minimum recommended distance to other objects 90mm).
- Make connections as shown in the figure.
- The default output frequency is 50Hz. For 60Hz simply actuate the dip-switch as indicated in the figure.

### **For safety reasons, the following requirements must be met:**

- Provide the equipment with some kind of protective enclosure that complies with the electrical safety directives in effect within the country where the equipment is installed.
- Include an input fuse with a rating immediately higher than the maximum input current.



## RS232 communication port

It is possible to control and monitor the unit via RS232 by means of an application tool named PAM. This application is free and can be downloaded from the Premium web site

Also it is possible to control and monitor the unit directly using the protocol showed in table:

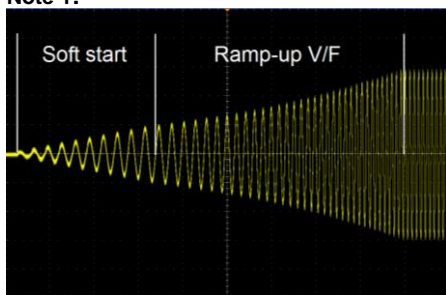
**Protocol configuration:** ASCII code, 57600 bauds, parity none, 8 bits, 1bit stop

| Header | Function | Parameter | Returns                                 | Explanation   |   |   |
|--------|----------|-----------|---|---|---|---|
| P      | L        | V         | PTV####                                 | Input voltage in Volts  |   |   |
|        |          | v         | PTv####                                 | Input voltage ripple in Volts   |   |   |
|        |          | Y         | PTYRN=#### [13]YSN=####<br>[13]YTN=#### | Output voltage in Volts RMS Phase-Neutral<br>([13] = char 13 of ASCII code)   |   |   |
|        |          | I         | PTIR=####[13]IS=####<br>[13]IT=####     | Output current in Amps RMS<br>([13] = char 13 of ASCII code)  |   |   |
|        |          | T         | PTT####                                 | Internal temperature1 in K  |   |   |
|        |          | t         | PTt####                                 | Internal temperature 2 in K   |   |   |
|        |          | F         | PTF####                                 | Nominal output frequency in Hz  |   |   |
|        |          | f         | PTf####                                 | Actual output frequency in Hz   |   |   |
|        |          | y         | PTy####                                 | Actual output voltage set-point in V  |   |   |
|        |          | S         | PTS####                                 | Inverter state<br>999.9 → Enabled<br>000.0 → Disabled<br>222.2 → Blocked by overload<br>111.1 → Blocked by overload or shortcircuit |   |   |
|        |          | M         | PTM####                                 | Model number  |   |   |
|        |          | R         | PTR####                                 | Firmware version  |   |   |
|        |          | Other     | PTE                                     | Command not supported   |   |   |
|        |          | R         | G                                       | 1 ###.  | OK / ERR  | Set the low input voltage timed shutdown in V   |
|        | 2 ###.   |           |   | OK / ERR  | Set the minimum alarm input voltage in V  |   |
|        | 3 ###.   |           |   | OK / ERR  | Change the status bit (after start up enabled with SW3 =LOCAL and disabled with SW3 =REMOTE)<br>999.9 → Inverter enabled<br>000.0 → Inverter disabled |   |
|        | 4 ###.   |           |   | OK / ERR  | Set the output voltage Phase-neutral in Vrms (Vo)(output must be stopped)<br>040.0 ≤ ###. ≤ 230.0   |   |
|        | 5 ###.   |           |   | OK / ERR  | Set the maximum output current in Arms<br>20% I <sub>nom</sub> ≤ ###. ≤ 100% I <sub>nom</sub>   |   |
|        | 6 ###.   |           |   | OK / ERR  | Set the nominal output frequency in Hz (Fo) (output must be stopped)<br>005.0 ≤ ###. ≤ 075.0  |   |
|        | 7 ###.   |           |   | OK / ERR  | Set the alarm maximum output current<br>0 < ###. ≤ 100% I <sub>max_warning</sub>  |   |
|        | 8 ###.   |           |   | OK / ERR  | 111.1 → Reset the inverter  |   |
|        | L ###.   |           |   | OK / ERR  | Set the minimum input starting voltage in Volts   |   |
|        | O ###.   |           |   | OK / ERR  | Set the initial frequency in the startup (Fi)<br>005.0 ≤ ###. ≤ 075.0   |   |
|        | P ###.   |           |   | OK / ERR  | Set the ramp-up in increment of "N" cycles per Hz in mode V/F, frequency changes or start-up (Note-1)<br>001.0 ≤ ###. ≤ 100.0                         |   |
|        | Q ###.   |           |   | OK / ERR  | Set the ramp-down in decrement of "N" cycles per Hz in mode V/F (Note-1)<br>002.0 ≤ ###. ≤ 100.0  |   |
|        | Y ###.   |           |   | OK / ERR  | Change the working mode of the input J4-1,J4-2<br>111.1 → Input as reverse phase control (default)<br>222.2 → Input as mid-power control (Note-2)     |   |
|        | X ###.   |           |   | OK / ERR  | Set the mid-power frequency for V/F mode by the use of input J4-1,J4-2<br>005.0 ≤ ###. ≤ 75.0   |   |
|        | M        |           |   | 1 ###.  | OK / ERR  | Set a new output frequency in Hz (output must be run and not stored in memory)<br>005.0 ≤ ###. ≤ 075.0  |
|        |          |           |   | 2 ###.  | OK / ERR  | Set a new output voltage in Volts (output must be run and not stored in memory)<br>040.0 ≤ ###. ≤ 230.0   |
|        |          |           |   | 3 ###.  | OK / ERR  | Set a new output frequency in Hz in mode V/F (output must be run and not stored in memory)<br>005.0 ≤ ###. ≤ 075.0                                    |
|        |          |           |   | 4 ###.  | OK / ERR  | Changes the output phase order (output must be run and not stored in memory)<br>111.1 → Phase RST (direct phase)<br>222.2 → Phase SRT (reverse phase) |

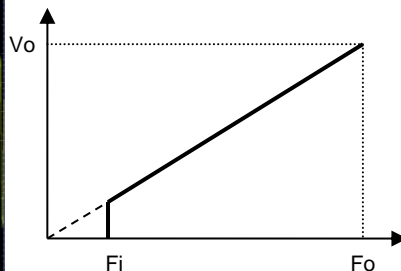
OTHER PORTS PENDING



**Note 1:**

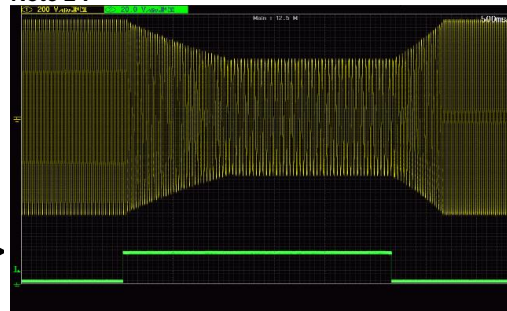


Example for N=1: start-up time = N x 1.7s for changes from 16Hz to 50Hz



Mode V/F curve

**Note 2 :**



Example for change from 50Hz / 400V to 30Hz and 240V with ramp-down of 2 cycles /Hz and ramp-up de 1 Cycle/Hz. Yellow: output voltage and Green: Mid-Power input signal

**WORKING PARAMETERS**

| <b>Thermal protection</b>                        |  |     |
|--|--|-----|
| Internal warning temperature (output alarm)      | 88                                     | °C  |
| Internal shutdown temperature                    | 92                                     | °C  |
| Internal restart temperature                     | 75                                     | °C  |
| Internal temperature of fan start-up             | 45                                     | °C  |
| <b>Input voltage parameters</b>                  |  |     |
|  | <b>750Vdc</b>                          |     |
| High input voltage instantaneous shutdown        | 1300>                                  | Vdc |
| High input voltage timed shutdown (t)            | 1270 - 1080                            | Vdc |
| Time to shutdown (t)                             | Controlled via temperature measurement |     |
| Start-up voltage                                 | 390                                    | Vdc |
| Low input voltage instantaneous shutdown         | 370                                    | Vdc |
| Time to shutdown (t)                             | 500m                                   | s   |
| <b>Output voltage parameters</b>                 |  |     |
| <u>Output voltage phase-neutral</u>              | 230                                    | Vac |
| Output under-voltage shutdown                    | < 85% of setting 1000ms                |     |
| Warning voltage (output alarm)                   | < 90% of setting 200ms                 |     |
| <u>Initial start-up frequency</u>                | 5                                      | Hz  |
| Soft start duration                              | 1 cycles                               |     |
| <u>Ramp-up V/F</u>                               | 1 Hz/cycle                             |     |
| <b>Output current parameters</b>                 |  |     |
| <u>Maximum continuous output current</u>         | 9.24                                   | A   |
| <u>Warning current (output alarm)</u>            | 8.8                                    | A   |
| Maximum overload I <sup>2</sup> t                | See figure below                       |     |
| Time between restart attempts                    | 4000                                   | ms  |
| Number of attempts of consecutive overload       | 5                                      |     |
| <b>Working failures and reset</b>                |  |     |
| Lock for continuous overload or internal failure | Unlimited time                         |     |
| Reset time by input disconnection                | > 2                                    | min |

Configurable parameters underlined

**OVERLOAD PROTECTION**

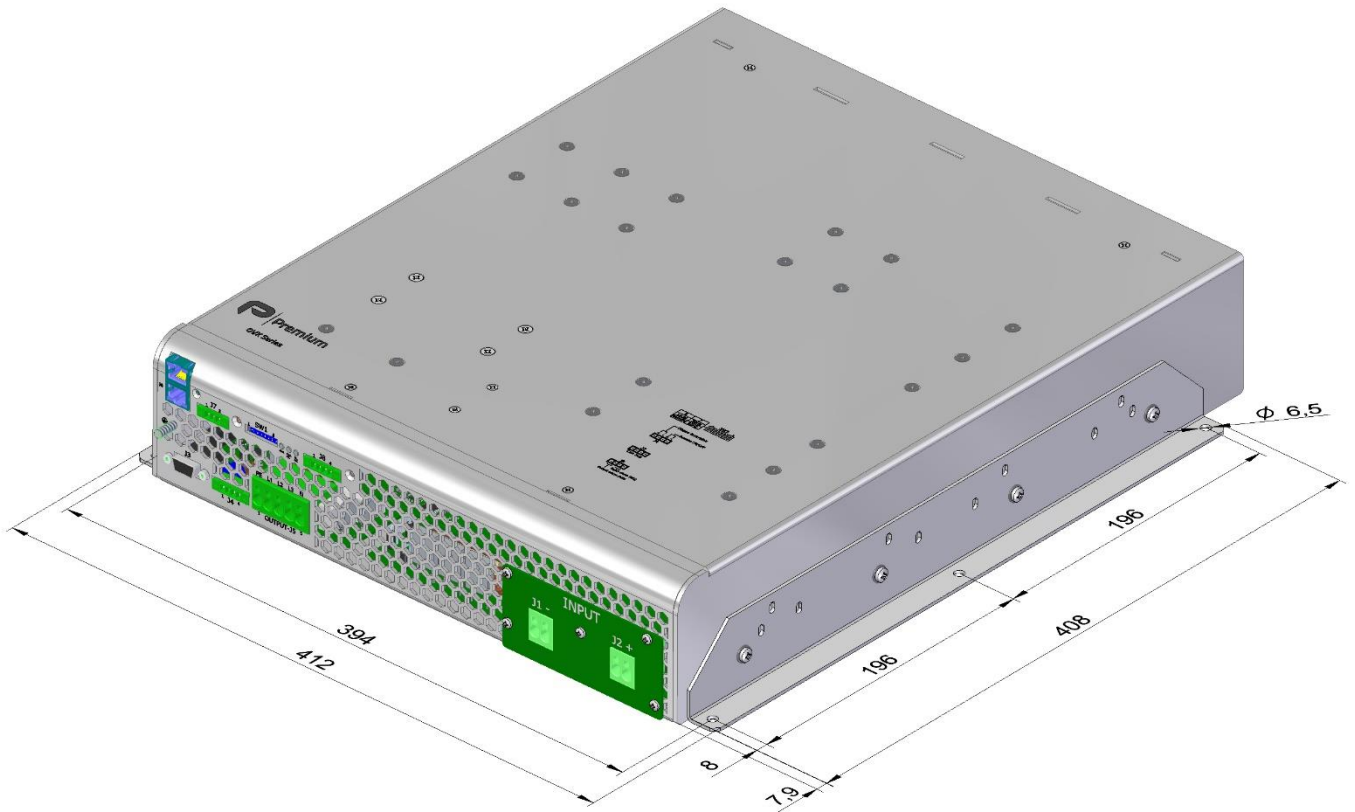
|   |   |  |
|---|---|--|
| Protection against overloads and short-circuits | By <b>current</b> limiting at Iopk<br>By <b>I<sup>2</sup>t</b> . The unit shutdowns when the current-time is over the continuous operation curve                  |  |
| Overload protection recovery                    | Every 4 seconds after shutdown, the unit tries to restart up to 5 times. If the overload persists, the unit reminds shutdown until an <b>input reconnection</b> . |  |





## ACCESSORIES

| Description           | Notes                            | CODE |
|-----------------------|----------------------------------|------|
| Mounting brackets kit | Contains two brackets and screws | 9282 |



NP-9282

PRELIMINARY



## EU, UKCA DECLARATION OF CONFORMITY

The undersigned, representing the following:

Manufacturer: PREMIUM, S. A.,  
Address: C/ Dolors Aleu 19-21, 08908 L'Hospitalet de Llobregat, SPAIN

herewith declares that the product:

Type: DC/AC converter  
Model: **OVX-6400**

is in conformity with the provisions of the following EU directive(s):

|                                 |  |
|---------------------------------|--|
| 2014/35/EU<br>SI 2016 No 1101   | Low voltage / The electrical equipment (safety) regulations  |
| 2014/30/EU<br>SI 2016 No 1091   | EMC / Electromagnetic compatibility regulations  |
| 2015/863/EU<br>SI 2012 No. 3032 | RoHS / Restriction of the use of certain hazardous substances in electrical and electronic equipment |

and that standards and/or technical specifications referenced below have been applied:

|                    |   |
|--------------------|---|
| EN50124-1:2017     | Railway app. (Insulation coordination)                                  |
| EN 62368-1: 2014   | Safety. Audio/video, information and communication technology equipment |
| EN 61000-6-3: 2007 | Generic emission standard   |
| EN 61000-6-2: 2005 | Generic immunity standard   |
| IEC 61287-1: 2015  | Railway applications. Power converters installed on board rolling stock |
| EN 50121-3-2: 2016 | Railway applications. EMC Rolling stock equipment                       |

\* Optional, See annexe

CE marking year: **2022**; UKCA marking year: **2022**

### Notes:

For the fulfilment of this declaration the product must be used only for the aim that has been conceived, considering the limitations established in the instructions manual or datasheet.

L'Hospitalet de Llobregat, 10-02-2022

Albert Sole  
Technical Director

**PREMIUM S.A.** is an ISO9001 and ISO14001  
certified company by **Bureau Veritas**

**ANNEXE**

| Applicable values for the different sections of the norm 61287-1: 2015 |  |   |              |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|--|--|---|--------------|--------------------------|-----------------|----------------------------|------------|--------------------|-------------------------|--------------|----------------|-----------------------|----------------------|-----------------------|----------|----------------------------|-------------------------|-------------------------|---------------------|----------|---------------------------|-----------------|--------------|--------------------------|--------------|--------------------------|------|------------------------|-----------------|--------------|-------|------|----------------|---|--------|------|--------|------|-------|--------------|----|------|-----------------|---|--------------|------|---------------|------|--------------|--------------|-------|-----|--------------------------|---|--------|-----|--------|-----|----|-----|----------------|--------------|------------|--------|----------------------|---|
| 4.2.2  | Working altitude   | Up to 2000m   |              |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 4.2.3  | Ambient temperature  | Class T3 inside vehicle compartment (-25 to 55°C full load)   |              |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 4.2.5  | Shocks and vibrations  | According EN61373:2010 Category 1 class B   |              |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 4.5.3.19   | EMC Electromagnetic Compatibility<br>EN50121-3-2:2016<br>IEC62236-3-2:2018 | <table border="1"> <thead> <tr> <th>Test</th> <th>Norm</th> <th>Port</th> <th>Frequency</th> <th>Limits</th> </tr> </thead> <tbody> <tr> <td rowspan="4">Radiated emissions</td> <td rowspan="4">IEC55016</td> <td rowspan="4">Case</td> <td>30MHz...230MHz</td> <td>40dB(µV/m) Qpk at 10m</td> </tr> <tr> <td>230MHz...1GHz</td> <td>47dB(µV/m) Qpk at 10m</td> </tr> <tr> <td>1...3GHz</td> <td>Do not apply</td> </tr> <tr> <td>3...6GHz</td> <td>Internal freq. &lt; 108MHz</td> </tr> <tr> <td rowspan="2">Conducted emissions</td> <td rowspan="2">IEC55016</td> <td rowspan="2">Input</td> <td>150kHz...500kHz</td> <td>99dB(µV) Qpk</td> </tr> <tr> <td>500kHz...30MHz</td> <td>93dB(µV) Qpk</td> </tr> </tbody> </table>   | Test         | Norm                     | Port            | Frequency                  | Limits     | Radiated emissions | IEC55016                | Case         | 30MHz...230MHz | 40dB(µV/m) Qpk at 10m | 230MHz...1GHz        | 47dB(µV/m) Qpk at 10m | 1...3GHz | Do not apply               | 3...6GHz                | Internal freq. < 108MHz | Conducted emissions | IEC55016 | Input                     | 150kHz...500kHz | 99dB(µV) Qpk | 500kHz...30MHz           | 93dB(µV) Qpk |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | Test  | Norm         | Port                     | Frequency       | Limits                     |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | Radiated emissions  | IEC55016     | Case                     | 30MHz...230MHz  | 40dB(µV/m) Qpk at 10m      |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  |   |              |                          | 230MHz...1GHz   | 47dB(µV/m) Qpk at 10m      |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  |   |              |                          | 1...3GHz        | Do not apply               |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  |   |              |                          | 3...6GHz        | Internal freq. < 108MHz    |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | Conducted emissions   | IEC55016     | Input                    | 150kHz...500kHz | 99dB(µV) Qpk               |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  |   |              |                          | 500kHz...30MHz  | 93dB(µV) Qpk               |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | <table border="1"> <thead> <tr> <th>Test</th> <th>Norm</th> <th>Port</th> <th>Severity</th> <th>Conditions</th> <th>P</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Electrostatic discharge</td> <td rowspan="2">IEC61000-4-2</td> <td rowspan="2">Case</td> <td>±8kV</td> <td>Air (isolated parts)</td> <td rowspan="2">B</td> </tr> <tr> <td>±8kV</td> <td>Contact (conductive parts)</td> </tr> <tr> <td rowspan="4">Radiated high frequency</td> <td rowspan="4">IEC61000-4-3</td> <td rowspan="4">X/Y/Z Axis</td> <td>20V/m</td> <td>0.08...1.0GHz M. 80% 1kHz</td> <td rowspan="4">A</td> </tr> <tr> <td>10V/m</td> <td>1.4...2.1GHz M. 80% 1kHz</td> </tr> <tr> <td>5V/m</td> <td>2.1...2.5GHz M. 80% 1kHz</td> </tr> <tr> <td>3V/m</td> <td>5.1...6GHz M. 80% 1kHz</td> </tr> <tr> <td rowspan="3">Fast transients</td> <td rowspan="3">IEC61000-4-4</td> <td>Input</td> <td>±2kV</td> <td rowspan="3">Tr/Th: 5/50 ns</td> <td rowspan="3">A</td> </tr> <tr> <td>Output</td> <td>±2kV</td> </tr> <tr> <td>Signal</td> <td>±2kV</td> </tr> <tr> <td rowspan="3">Surge</td> <td rowspan="3">IEC61000-4-5</td> <td>PE</td> <td>±1kV</td> <td rowspan="3">Tr/Th: 1.2/50µs</td> <td rowspan="3">B</td> </tr> <tr> <td>Input L to L</td> <td>±1kV</td> </tr> <tr> <td>Input L to PE</td> <td>±2kV</td> </tr> <tr> <td rowspan="4">Conducted RF</td> <td rowspan="4">IEC61000-4-6</td> <td>Input</td> <td>10V</td> <td rowspan="4">0.15...80MHz M. 80% 1kHz</td> <td rowspan="4">A</td> </tr> <tr> <td>Output</td> <td>10V</td> </tr> <tr> <td>Signal</td> <td>10V</td> </tr> <tr> <td>PE</td> <td>10V</td> </tr> <tr> <td>Magnetic field</td> <td>IEC61000-4-8</td> <td>X/Y/Z Axis</td> <td>300A/m</td> <td>0Hz, 16.7Hz, 50/60Hz</td> <td>A</td> </tr> </tbody> </table> | Test         | Norm                     | Port            | Severity                   | Conditions | P                  | Electrostatic discharge | IEC61000-4-2 | Case           | ±8kV                  | Air (isolated parts) | B                     | ±8kV     | Contact (conductive parts) | Radiated high frequency | IEC61000-4-3            | X/Y/Z Axis          | 20V/m    | 0.08...1.0GHz M. 80% 1kHz | A               | 10V/m        | 1.4...2.1GHz M. 80% 1kHz | 5V/m         | 2.1...2.5GHz M. 80% 1kHz | 3V/m | 5.1...6GHz M. 80% 1kHz | Fast transients | IEC61000-4-4 | Input | ±2kV | Tr/Th: 5/50 ns | A | Output | ±2kV | Signal | ±2kV | Surge | IEC61000-4-5 | PE | ±1kV | Tr/Th: 1.2/50µs | B | Input L to L | ±1kV | Input L to PE | ±2kV | Conducted RF | IEC61000-4-6 | Input | 10V | 0.15...80MHz M. 80% 1kHz | A | Output | 10V | Signal | 10V | PE | 10V | Magnetic field | IEC61000-4-8 | X/Y/Z Axis | 300A/m | 0Hz, 16.7Hz, 50/60Hz | A |
|  |  | Test  | Norm         | Port                     | Severity        | Conditions                 | P          |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | Electrostatic discharge   | IEC61000-4-2 | Case                     | ±8kV            | Air (isolated parts)       | B          |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  |   |              |                          | ±8kV            | Contact (conductive parts) |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | Radiated high frequency   | IEC61000-4-3 | X/Y/Z Axis               | 20V/m           | 0.08...1.0GHz M. 80% 1kHz  | A          |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  |   |              |                          | 10V/m           | 1.4...2.1GHz M. 80% 1kHz   |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 5V/m   | 2.1...2.5GHz M. 80% 1kHz   |   |              |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 3V/m   | 5.1...6GHz M. 80% 1kHz   |   |              |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| Fast transients  | IEC61000-4-4   | Input   | ±2kV         | Tr/Th: 5/50 ns           | A               |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | Output  | ±2kV         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | Signal  | ±2kV         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| Surge  | IEC61000-4-5   | PE  | ±1kV         | Tr/Th: 1.2/50µs          | B               |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | Input L to L  | ±1kV         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | Input L to PE   | ±2kV         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| Conducted RF   | IEC61000-4-6   | Input   | 10V          | 0.15...80MHz M. 80% 1kHz | A               |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | Output  | 10V          |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | Signal  | 10V          |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | PE  | 10V          |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| Magnetic field   | IEC61000-4-8   | X/Y/Z Axis  | 300A/m       | 0Hz, 16.7Hz, 50/60Hz     | A               |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| P= Performance criteria, L= Line, PE= Protective Earth                 |  |   |              |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 4.5.2.3  | Tests list   | 1 Visual Inspection   | Routine      |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 2 Verification of size and tolerance  | Type         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 3 Weight  | Type         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 4 Marking inspection  | Routine      |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 5 Functional test on refrigeration system   | Type         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 6 Sealing test  | N/A          |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 7 Grade protection test   | N/A          |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 8 Dielectric strength test  | Routine      |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 9 Resistance to isolation test  | Type         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 10 Test for mechanical and electrical protection and for the measurement equipment  | N/A          |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 11 Low load test  | Type         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 12 Switching test   | Routine      |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 13 Measurement of acoustic noise  | Routine      |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 14 Heating test   | Type         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 15 Power loss test  | Type         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 16 Power overvoltage test and energy transients   | Type         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 17 Fast changes in load test  | Type         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 18 Inspection of safety requirements  | Type         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 19 Shock and vibration test   | Type         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 20 EMC test   | Type         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 21 Step in power line test  | Type         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 22 Interruption of voltage supply test  | Type         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |  | 23 Current Sharing  | Type         |                          |                 |                            |            |                    |                         |              |                |                       |                      |                       |          |                            |                         |                         |                     |          |                           |                 |              |                          |              |                          |      |                        |                 |              |       |      |                |   |        |      |        |      |       |              |    |      |                 |   |              |      |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |