

# ODX-1300

## 1300VA DC/AC INVERTER

### GENERAL FEATURES:

Sine wave output voltage  
 Suitable for motors control  
 Adjustable output voltage  
 High input-output isolation 3000Vrms  
 Remote control via RS232  
 Alarm by isolated relay contacts  
 Remote ON/OFF opto-coupled  
 According to the standard EN50155  
 Fire and smoke: EN45545-2 approved



|        | 24Vdc<br>16.8 ... 30V           | 72Vdc<br>50.4 ... 90V            | 110Vdc<br>77 ... 138V           |
|--------|---------------------------------|----------------------------------|---------------------------------|
| 250Vac | <b>ODX-1300-7442</b><br>1300 VA | <b>ODX-1300-7445</b><br>1300 VA  | <b>ODX-1300-7447</b><br>1300 VA |
| 400Vac | <b>ODX-1300-7452</b><br>1300 VA | <b>ODX-1300-7455*</b><br>1300 VA | <b>ODX-1300-7457</b><br>1300 VA |

\*References subject to special MOQs and lead times

**INPUT**

|                      |                          |
|----------------------|--------------------------|
| Input voltage range  | -30, +25% Vin nom        |
| Maximum input ripple | 5% Vin nom (Vrms, 100Hz) |
| Inrush current       | <25A                     |
| Polarity protection  | By diode                 |

**OUTPUT**

|                              |  |
|------------------------------|--|
| Nominal output voltage (Von) | See table (ordering codes)   |
| Output voltage range         | 150 ... 250V (models of 250V output) via RS-232<br>200 ... 400V (models of 400V output) via RS-232 |
| Output frequency range       | 5...60Hz via RS-232  |
| Load regulation              | < 4%   |
| Line regulation              | < 2% Vin -25% ... +25%, < 10% Vin -30% ... +30%  |
| Output wave distortion THD   | < 3% (average of 16 samples)   |
| Output HF ripple             | < 2.5%   |

**ENVIRONMENTAL**

|  |                            |
|--|----------------------------|
| Storage temperature                          | -25 ... 85°C               |
| Operating temperature:                       |                            |
| Full load                                    | -25 ... 55°C (EN50155 OT1) |
| 62.5% load                                   | -25 ... 70°C (EN50155 OT3) |
| 25% load                                     | -25 ... 85°C (EN50155 OT5) |
| Relative humidity without condensation       | 5 ... 95%                  |
| Cooling                                      | Controlled internal fan    |
| MTBF (MIL-HDBK-217-E; G <sub>b</sub> , 25°C) | 100.000 h                  |

**EMC**

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

**SAFETY**

|  |                         |
|--|-------------------------|
| Dielectric strength: Input /output         | 3000 Vrms / 50Hz / 1min |
| Dielectric strength: Output / Earth        | 1500 Vrms / 50Hz / 1min |
| Dielectric strength: Input / Earth         | 1500 Vrms / 50Hz / 1min |
| Dielectric strength: Remote ON/OFF / Input | 500 Vrms / 50Hz / 1min  |
| Safety according to                        | EN60950-1, EN62368-1    |
| Fire and smoke                             | EN45545-2               |

**MECHANICAL**

|        |         |
|--------|---------|
| Weight | <3200 g |
|--------|---------|

**PROTECTIONS**

|                                      |  |
|--------------------------------------|--|
| Against overloads and short-circuits | Shutdown with auto-recovery (see working parameters) |
| Against over-temperature             | Shutdown with auto-recovery                          |

**CONTROL**

|                     |  |
|---------------------|--|
| Output alarm        | Open when alarm. Maximum rating: 0.16A at 160Vdc                                 |
| Remote ON/OFF input | ON applying a voltage within the input voltage range<br>OFF open circuit or < 5V |

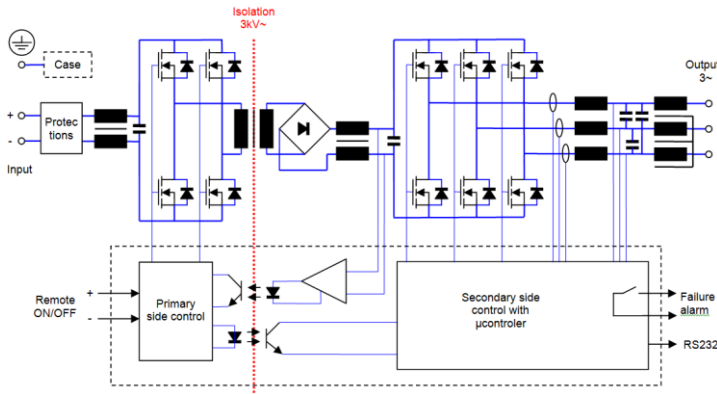


## ORDERING CODES

| Model                 | Input voltage DC [V] | Input voltage range [V] | Output voltage AC [V] | Output current [A] | Active output power [W] | Appar. output power [VA] | Output peakcurrent 10ms (Iopk) [A] | Efficien. [%] | No load input current [A] | Size |
|-----------------------|----------------------|-------------------------|-----------------------|--------------------|-------------------------|--------------------------|------------------------------------|---------------|---------------------------|------|
| <b>ODX-1300-7442</b>  | 24                   | 16.8 - 30               | 250                   | 3.10               | 1100                    | 1300                     | 6.6                                | 89            | <1.58                     | 2    |
| <b>ODX-1300-7445</b>  | 72                   | 50.4 - 90               | 250                   | 3.10               | 1100                    | 1300                     | 6.6                                | 90            | < 0.52                    | 1    |
| <b>ODX-1300-7447</b>  | 110                  | 77 - 138                | 250                   | 3.10               | 1100                    | 1300                     | 6.6                                | 90            | < 0.34                    | 1    |
| <b>ODX-1300-7452</b>  | 24                   | 16.8 - 30               | 400                   | 1.88               | 1100                    | 1300                     | 3.4                                | 89            | <1.58                     | 2    |
| <b>ODX-1300-7455*</b> | 72                   | 50.4 - 90               | 400                   | 1.88               | 1100                    | 1300                     | 3.4                                | 90            | < 0.52                    | 1    |
| <b>ODX-1300-7457</b>  | 110                  | 77 - 138                | 400                   | 1.88               | 1100                    | 1300                     | 3.4                                | 91            | < 0.34                    | 1    |

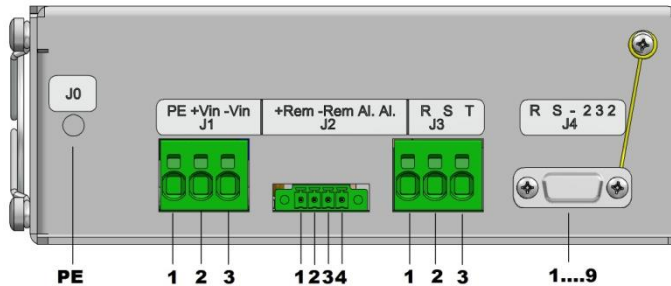
\*References subject to special MOQs and lead times

## BLOCKS DIAGRAM



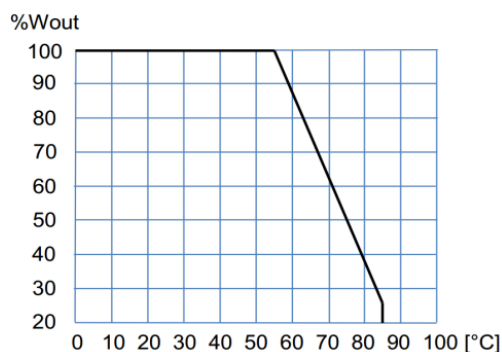
| RS232 Monitoring     | RS232 Settings   |
|----------------------|------------------|
| Output voltage       | On / Off         |
| Internal temperature | Output voltage   |
| Output frequency     | Output frequency |
| Inverter state       | Reset            |
| Model number         |                  |
| Firmware version     |                  |

## CONNECTIONS



| J0   | Case PE          | Threaded shank M6                              |
|------|------------------|--|
| J1-1 | Protective Earth | Cable<br>1.5...16mm <sup>2</sup>               |
| J1-2 | +Input           |  |
| J1-3 | -Input           |  |
| J2-1 | +Remote off      | Phoenix Contact<br>MC1.5/4-ST-3.81<br>Note (1) |
| J2-2 | -Remote off      |  |
| J2-3 | Alarm            |  |
| J2-4 | Alarm            |  |
| J3-1 | R Output         | Cable<br>0.75...4mm <sup>2</sup>               |
| J3-2 | S Output         |  |
| J3-3 | T Output         |  |
| J4-2 | RS232 Rx         | SUB DB9  |
| J4-3 | RS232 Tx         |  |
| J4-5 | RS232 GND        |  |

## POWER DERATING vs AMBIENT TEMP.



## DESCRIPTION

The ODX-1300 consists of three phase sine-wave DC-AC inverters with galvanic isolation between input and output.

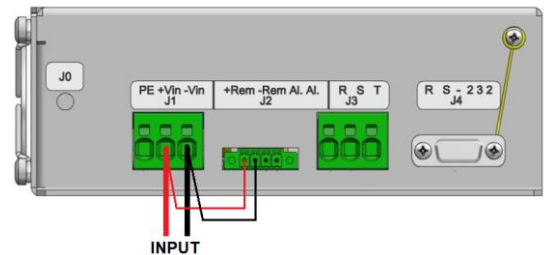
The unit allows:

- Start-up motors by means of a soft start. In the start-up, the output voltage and frequency rise linearly from 0V to set voltage and from 5Hz to set frequency. The start-up ramp slope may be changed via RS-232 port
- Set the rotation speed of a motor according to the appropriate Voltage/Frequency ratio.
- Monitoring the status of the input and output.
- Set and monitor parameters via RS-232.

The ODX-1300 has a maximum output current protection. This protects the semiconductors even when an output short-circuit occurs. It also features a disable function for input under-voltage.

## INSTALLATION

- The unit has 4 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 an air flow reduction (minimum recommended distance to other objects 50mm).
- Make connections as shown in the figure
- To start up the unit without a remote ON/OFF signal, it is possible by configuring the unit via RS232 port or by making the following connection



**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.
- Use cables of adequate cross-section to connect inputs and outputs. The following table lists the maximum currents and the minimum cross-sections for the cables used for each power connection.

|                     | Input<br>24V      | Input<br>72V        | Input<br>110V       | Output<br>250V       | Output<br>400V       |
|---------------------|-------------------|---------------------|---------------------|----------------------|----------------------|
| Current             | 70A               | 24.4A               | 16 A                | 3.1A                 | 1.88A                |
| Cable cross section | 16 m <sup>2</sup> | 2.5 mm <sup>2</sup> | 1.5 mm <sup>2</sup> | 0.75 mm <sup>2</sup> | 0.75 mm <sup>2</sup> |



## 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:

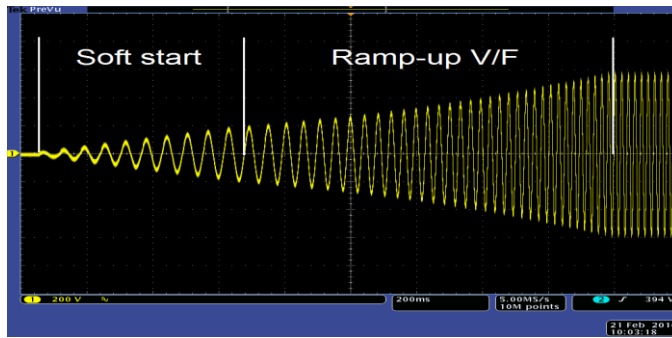
**Protocol configuration:** ASCII code, 9600 bauds, parity none, 8 bits, 1bit stop

| Header | Function | Parameter       | Returns | Description   |  |
|--------|----------|-----------------|---------|---|--|
| P      | L        | U               | PTU#### | Output voltage in Volts RMS   |  |
|        |          | T               | PTT#### | Internal temperature in °C  |  |
|        |          | F               | PTF#### | Output frequency in Hz  |  |
|        |          | S               | PTS#### | Inverter status<br>999.9 → Enabled<br>000.0 → Disabled<br>111.1 → Inverter blocked by overload or short-circuit |  |
|        |          | M               | PTM#### | Model number  |  |
|        |          | R               | PTR#### | Firmware version  |  |
|        |          | Other character | PTE     | Command not supported   |  |
|        | G        | 3               | ####    | OK / ERR  | Changes the inverter status<br>999.9 → Enabled<br>000.0 → Disabled   |
|        |          | 4               | ####    | OK / ERR  | Set the output voltage in Volts RMS<br>150.0 ≤ #### ≤ 250.0 (models of 250V output)<br>200.0 ≤ #### ≤ 400.0 (models of 400V output)  |
|        |          | 6               | ####    | OK / ERR  | Changes the output frequency in Hz (output must be stopped)<br>005.0 ≤ #### ≤ 075.0<br>Factory preconfigured → 50 Hz   |
|        |          | 8               | ####    | OK / ERR  | 111.1 → Reset the inverter   |
|        |          | B               | ####    | OK / ERR  | Changes the logic of the 'Remote OFF input'<br>222.2 → Inverter On applying 15...143Vdc on 'Remote OFF input'<br>111.1 → Inverter Off applying 15...143Vdc on 'Remote OFF input' |
|        |          | O               | ####    | OK / ERR  | Set the initial frequency in the start-up (Fi) (output must be stopped)<br>005.0 ≤ #### ≤ 075.0<br>Factory preconfigured → 16Hz  |
|        |          | 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  |

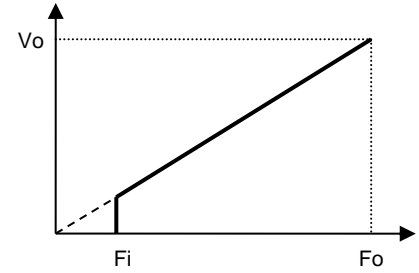
Note: **OK** (Data accepted) / **ERR** (Data not valid for the current parameter)



Note 1:



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



Mode V/F curve

## DEFAULT WORKING PARAMETERS

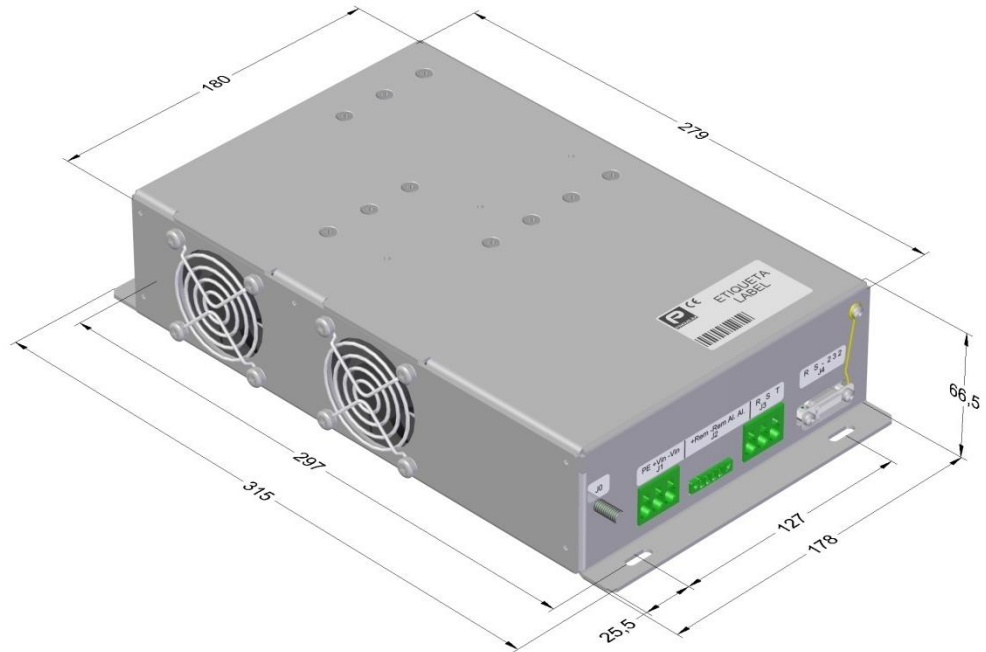
| <b>Thermal protection</b>                                 |  | <b>7442 ... 7457</b>    |             |             |     |
|---|--|-------------------------|-------------|-------------|-----|
| Internal shutdown temperature                             |  | 87                      |             |             | °C  |
| Internal restart temperature                              |  | 82                      |             |             | °C  |
| Internal temperature of fan start-up                      |  | 45                      |             |             | °C  |
| <b>Input voltage parameters</b>                           |  | <b>74X2</b>             | <b>74X5</b> | <b>74X7</b> |     |
| <u>Low input voltage timed shutdown (t)</u> (Input alarm) |  | 16.8                    | 50.4        | 77.0        | Vdc |
| Low input voltage instantaneous shutdown                  |  | 14.4                    | 43.2        | 66.0        | Vdc |
| Time to shutdown (t)                                      |  | 500                     |             |             | ms  |
| <b>Output voltage parameters</b>                          |  | <b>744X</b>             |             | <b>745X</b> |     |
| <u>Output voltage</u>                                     |  | 250                     |             | 400         | 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                                       |  | 10 cycles               |             |             |     |
| <u>Ramp-up V/F</u>  |  | 1 Hz/cycle              |             |             |     |
| <b>Output current parameters</b>                          |  | <b>744X</b>             |             | <b>745X</b> |     |
| <u>Maximum continuous output current</u>                  |  | 3.10                    |             | 1.88        | A   |
| Time between restart attempts                             |  | 4000                    |             |             | ms  |
| Number of attempts of consecutive overload                |  | 3                       |             |             |     |
| <b>Working failures and reset</b>                         |  | <b>7442 ... 7457</b>    |             |             |     |
| Lock for continuous overload or internal failure          |  | Unlimited time          |             |             |     |
| Reset time by input disconnection                         |  | >2                      |             |             | min |

Configurable parameters underlined

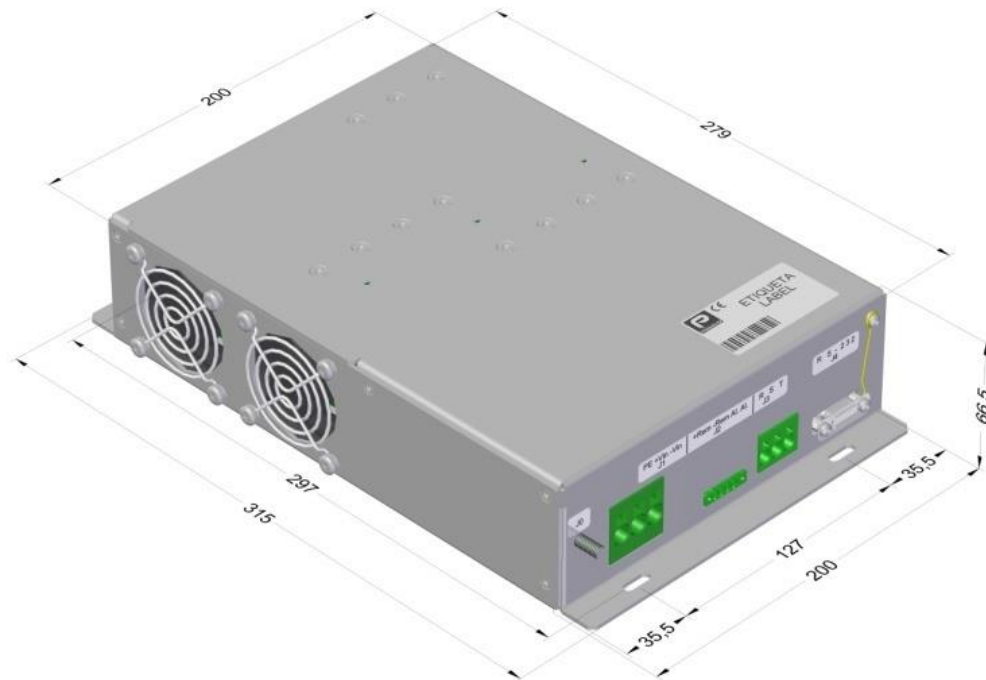


## DIMENSIONS

**SIZE-1**



**SIZE-2**





## CE EU DECLARATION OF CONFORMITY

The undersigned, representing the following:

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

herewith declares that the product:

Type: DC/AC INVERTER  
Models: **ODX-1300-7442 ... 7457**

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

|            |  |
|------------|--|
| 2014/35/EU | Low voltage  |
| 2014/30/EU | Electromagnetic compatibility  |
| 2011/65/EU | Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) |

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

|                     |   |
|---------------------|---|
| EN 60950-1: 2005    | Safety. Information technology equipment                                  |
| 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   |
| EN 50155: 2017*     | Railway applications. Electronic equipment used on rolling stock material |
| EN 50121-3-2: 2016* | Railway applications. EMC Rolling stock equipment                         |

\* Optional, See annexe

CE marking year: **2017**

### 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, 04-11-2019

Jordi Gazo  
Chief Executive Officer

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



## ANNEXE

| Applicable values for the different sections of the norm EN50155: 2017 |   |   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|--|---|---|---------------------|--------------------------|--------------------|----------------------------|---------------------|--------------------|-------------------------|--------------|--------------------------------|-----------------------|---------------------------------|-----------------------|-----------------|----------------------------|-------------------------|-------------------------|---------------------|----------|--|-----------------|--------------|--------------------------|-------------------------------|--------------------------|------------------------------------|------------------------------------|-------------------------------------|--------------|-------|------|----------------|---|--------|------|--------|------|----|------|-------|--------------|--------------|------|-----------------|---|---------------|------|--------------|--------------|-------|-----|--------------------------|---|--------|-----|--------|-----|----|-----|----------------|--------------|------------|--------|----------------------|---|
| 4.3.1  | Working altitude                                      | Up to 2000m   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 4.3.2  | Ambient temperature                                   | Class OT1 (-25 to 55°C): load < 100%<br>Class OT3 (-25 to 70°C): load <62.5%<br>Class OT5 (-25 to 85°C): load <25%  |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 4.3.3  | Switch-on extended operating temp.                    | ST1   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 4.3.4  | Rapid temperature variations                          | H1  |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 4.3.5  | Shocks and vibrations                                 | According to EN61373:2010 Category 1 class B  |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 4.3.6  | EMC Electromagnetic Compatibility<br>EN50121-3-2:2016 | <table border="1" style="width: 100%; border-collapse: collapse;"> <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" style="width: 100%; border-collapse: collapse;"> <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="4">Fast transients</td> <td rowspan="4">IEC61000-4-4</td> <td>Input</td> <td>±2kV</td> <td rowspan="4">Tr/Th: 5/50 ns</td> <td rowspan="4">A</td> </tr> <tr> <td>Output</td> <td>±2kV</td> </tr> <tr> <td>Signal</td> <td>±2kV</td> </tr> <tr> <td>PE</td> <td>±1kV</td> </tr> <tr> <td rowspan="2">Surge</td> <td rowspan="2">IEC61000-4-5</td> <td>Input L to L</td> <td>±1kV</td> <td rowspan="2">Tr/Th: 1.2/50µs</td> <td rowspan="2">B</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 | PE | ±1kV | Surge | IEC61000-4-5 | Input L to L | ±1kV | Tr/Th: 1.2/50µs | B | 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                |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |   | PE  | ±1kV                |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| Surge  | IEC61000-4-5  | Input L to L  | ±1kV                | Tr/Th: 1.2/50µs          | B                  |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
|  |   | 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                  |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| <b>P</b> = Performance criteria, L= Line, PE= Protective Earth         |   |   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 4.3.7  | Relative humidity                                     | Up to 95%   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 5.1.1.2  | DC power supply range                                 | From 0.70 to 1.25 Un continuous   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 5.1.1.3  | Temporary DC power supply fluctuation                 | From 0.60 to 1.40 Un 0.1s<br>From 1.25 to 1.40 Un 1s without damage   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 5.1.1.4  | Interruptions of voltage supply                       | Class S1 (without interruptions)  |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 5.1.1.6  | Input ripple factor                                   | 10% peak to peak with a DC Ripple Factor of 5 %   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 5.1.3  | Supply change-over                                    | 0.6 Un duration 100 ms (without interruptions). Performance criterion A   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 7.2.7  | Input reverse polarity protection                     | By external fuse  |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 10.7   | Protective coating for PCB assemblies                 | Class PC2   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 13.3   | Tests list  | <table style="width: 100%; border-collapse: collapse;"> <tbody> <tr><td>1 Visual Inspection</td><td>Routine</td></tr> <tr><td>2 Performance test</td><td>Routine</td></tr> <tr><td>3 Power supply test</td><td>Routine</td></tr> <tr><td>4 Insulation test</td><td>Routine</td></tr> <tr><td>5 Low temperature storage test</td><td>-</td></tr> <tr><td>6 Low temperature start-up test</td><td>Type</td></tr> <tr><td>7 Dry heat test</td><td>Type</td></tr> <tr><td>8 Cyclic damp heat test</td><td>Type</td></tr> <tr><td>9 Salt mist test</td><td>-</td></tr> <tr><td>10 Enclosure protection test (IP code)</td><td>-</td></tr> <tr><td>11 EMC test</td><td>Type</td></tr> <tr><td>12 Shocks and vibrations test</td><td>Type</td></tr> <tr><td>13 Equipment stress screening test</td><td>Routine: 24h at 40°C and load 100%</td></tr> <tr><td>14 Rapid Temperature variation test</td><td>-</td></tr> </tbody> </table>  | 1 Visual Inspection | Routine                  | 2 Performance test | Routine                    | 3 Power supply test | Routine            | 4 Insulation test       | Routine      | 5 Low temperature storage test | -                     | 6 Low temperature start-up test | Type                  | 7 Dry heat test | Type                       | 8 Cyclic damp heat test | Type                    | 9 Salt mist test    | -        | 10 Enclosure protection test (IP code) | -               | 11 EMC test  | Type                     | 12 Shocks and vibrations test | Type                     | 13 Equipment stress screening test | Routine: 24h at 40°C and load 100% | 14 Rapid Temperature variation test | -            |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 1 Visual Inspection  | Routine   |   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 2 Performance test   | Routine   |   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 3 Power supply test  | Routine   |   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 4 Insulation test  | Routine   |   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 5 Low temperature storage test   | -   |   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 6 Low temperature start-up test  | Type  |   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 7 Dry heat test  | Type  |   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 8 Cyclic damp heat test  | Type  |   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 9 Salt mist test   | -   |   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 10 Enclosure protection test (IP code)                                 | -   |   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 11 EMC test  | Type  |   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 12 Shocks and vibrations test  | Type  |   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 13 Equipment stress screening test                                     | Routine: 24h at 40°C and load 100%                    |   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |
| 14 Rapid Temperature variation test                                    | -   |   |                     |                          |                    |                            |                     |                    |                         |              |                                |                       |                                 |                       |                 |                            |                         |                         |                     |          |  |                 |              |                          |                               |                          |                                    |                                    |                                     |              |       |      |                |   |        |      |        |      |    |      |       |              |              |      |                 |   |               |      |              |              |       |     |                          |   |        |     |        |     |    |     |                |              |            |        |                      |   |