TITLE: Voltage stabilizer for mains electric refrigerators and freezers

Specification reference:	E007/VS01.2
Product verification protocol:	E007/VS01-VP.2
Issue date:	14 April 2016
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Contents:

1. Scope:

This specification defines the requirements for voltage stabilizers suitable for mains electric refrigerators and freezers.

2. Normative references (use the most recent version of these standards):

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.
EMAS: *European Union Eco-Management and Audit Scheme.*
IEC 60038: *IEC standard voltages.*
IEC 60068-2-6: *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*
IEC 60335-1: *Household and similar electrical appliances - Safety - Part 1: General requirements.*
IEC 61000-6-3 Edition 2.1 (2011): *Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments.*
IEC 61000-6-1 Edition 2 (2005): *Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments.*
IEC 61000-3-2 Edition 4.0 (2014): *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)*
IEC 61643-11: *Low-voltage surge protective devices – Part 11: Surge protective devices.*
ISO 9001: *Quality Management Systems – Requirements.*
ISO 14001: *Environmental management systems - Requirements with guidance for use.*
ISO/IEC 17025: *General requirements for the competence of testing and calibration laboratories.*
ISO 20282-1: *Ease of operation of everyday products - Part 1: Context of use and user characteristics.*
Directive 2004/108/EC of the European Parliament and of the Council.

3. Terms and definitions:

In writing: means communication by letter, fax or email.
Legal Manufacturer: The natural or legal person with responsibility for the design, manufacture, packaging and labelling of a product or device before it is placed on the market under his own name, regardless of whether these operations are carried out by that person himself or on his behalf by a third party.
Reseller: A commercial entity, licensed to act on behalf of a Legal Manufacturer, and which carries product liability and warranty responsibilities no less onerous than those carried by the Legal Manufacturer.

4. Requirements:

4.1 *General:*

Voltage stabilizer designed to reduce fluctuations in input voltage and frequency, and to thereby ensure a stable electricity supply for refrigerators and freezers in situations where the mains voltage is subject to wide fluctuations. The device must be compatible with both compression and absorption cycle equipment. Alternative mains voltage and frequency combinations are also covered.

4.2 *Performance:*

4.2.1 Mode of operation

Both electronic and tap-changing technologies may be offered, but the device must be substantially maintenance-free. Products that incorporate cooling fans are not acceptable because of the maintenance issues involved in keeping the airways clear.

4.2.2 Nominal input and output voltage and frequency:

The device must provide one or more of the following three output voltage and frequency combinations when connected to a mains supply with one or more of the following nominal mains frequencies and voltage ranges. Note that the "230/50-60: Extended" type is required to tolerate a wider range of input voltages (see Section 4.2.3). This type is recommended for countries with wider input voltage fluctuations.

Type	Nominal mains (input) voltage and frequency	Nominal output voltage and frequency
120/50-60	110, 115, 120, 127 volt; 50-60 Hz	120 volt; 50-60 Hz
230/50-60	220, 230, 240 volt; 50-60 Hz	230 volt; 50-60 Hz
230/50-60:Extended	220, 230, 240 volt; 50-60 Hz	230 volt; 50-60 Hz

Preferably the purchaser should be able to specify the nominal mains voltage within one of these four voltage/frequency bands so that the manufacturer can optimize the product before delivery.

4.2.3 Input voltage fluctuations:

The device must tolerate (i.e., continue supplying nominal output voltage and frequency, as specified in Section 4.2.2) the following minimum ranges of input voltage fluctuation:

Type	Minimum mains (input) voltage	Maximum mains (input) voltage
120/50-60	82 volts	159 volts
230/50-60	165 volts	275 volts
230/50-60: Extended	110 volts	285 volts

4.2.4 Protection voltage range:

Input:

The device must be able to tolerate spikes up to 230 volts (Type 120/50-60), or 450 volts (Type 230/50-60 and 230/50-60: Extended), tested in accordance to Class II of the IEC 61643-1 standards (8x20 microseconds waveform), without damaging the device and without triggering a cut-off.

Output:

The device must switch to 0 volts at the limits of the input voltage fluctuation range. When the input voltage is restored to a value within the applicable range shown in the table in specification clause 4.2.3, the output supply of 120 or 230 volts must be restored automatically after a delay of three to six minutes.

4.2.5 Capacity rating:

Stand-alone devices must be rated at a minimum of 1.0 kVA peak load. Integrated devices (i.e., with the voltage stabilizer fully integrated into the design and manufacture of the refrigerator) no minimum rating is specified and this is left to the manufacturer to decide what rating best suits the

equipment. Under fully rated load conditions there must be 10 successful starts out of 10.

4.2.6 *Input frequency fluctuations:*

The device must tolerate mains input frequency fluctuations up to ± 3.0 Hz continuously, ± 4.0 Hz up to an hour, ± 5.0 Hz for 10 minutes. This is an adapted version of similar guidance from EN 60950 standards.

4.2.7 *Output voltage accuracy:*

Maximum ±7.0% of the nominal output voltages set out in the table in clause 4.2.2, zero to full load, over the full input voltage range specified in the table in clause 4.2.3. This is to be tested in accordance to the EN 60950 standards.

4.2.8 *Corrosion resistance of enclosure:*

Legal Manufacturer to certify compliance that internal and external cabinet, lid and frame are protected against corrosion as appropriate to EN ISO 6270-1 / ASTM D2247 / EN 13523-26 Determination of resistance to humidity – Part 1: Continuous condensation, EN ISO 6270-2 / EN 13523-25 Determination of resistance to humidity - Part 2: Procedure for exposing test specimens in condensation-water atmospheres, ISO 6272 / EN 13523-5 Impact resistance – external cabinet, and ISO 2409: 2013: Paints and varnishes – cross cut test (external cabinet).

4.2.9 *Electrical safety:*

Manufacturer to certify compliance with IEC 60335-1.

4.2.10 *Electromagnetic compatibility:*

To ensure product meets EMC emissions requirements, Legal Manufacturer must certify compliance to the latest version of IEC 61000-6-3.

To ensure product meets EMC immunity requirements, Legal Manufacturer must certify compliance with the requirements of the latest version of IEC 61000-6-1.

To ensure product meets EMC harmonic distortion requirements where appropriate, Legal Manufacturer must certify compliance with the requirements of the latest version of IEC 61000-3-2.

4.2.11 *Robustness:*

The device must withstand the vibration tests specified in IEC 60068-2-6 as well as the mechanical strength tests specified in IEC 60950-1 (Clause 4.2) and thermal requirements specified in IEC 60950-1 (Clause 4.5) without suffering mechanical damage or functional failure.

4.2.12 *Protection against dust and water ingress:*

A stand-alone device that is not part of the refrigerator design may be installed in dusty environments. The design of the enclosure should ensure that the device is not damaged by dust penetration. A minimum of IP21 rating is required. This IP rating requirement does not apply for devices that are integrated into the refrigerator design (i.e., within the body of the refrigerator).

4.2.13 *Markings:*

For all stand-alone devices that are not part of the refrigerator design, the device enclosure must be clearly marked to show the following:

- Nominal input voltage and frequency.
- Nominal output voltage and frequency.
- kVA rating.

The top of the device enclosure must also carry a waterproof label carrying the following user information in minimum 18 point lettering and in the language requested in the order:

- ‘Voltage stabilizer for compression cycle and absorption cycle refrigerators and freezers’.
- ‘DO NOT connect more than one appliance’.

Note: These markings are not necessary for integrated devices (i.e., incorporated into the body of the refrigerator).

4.3 *Environmental requirements:*

4.3.1 Ambient temperature range during transport, storage and use:

-30°C to +70°C when the product is inactive.
-5°C to +45°C during use.

4.3.2 Ambient humidity range during transport, storage and use:

5% to 95% RH, non-condensing.

4.4 *Physical characteristics*

4.4.1 Overall dimensions:

No restrictions

4.4.2 Weight:

No restrictions.

4.5 *Interface requirements:*

4.5.1 Compatibility with electronic circuits:

Vaccine refrigerators and freezers may contain non-adjustable electronic thermostats and electronic thermometers. The voltage stabilizer must not produce supply disruptions and/or voltage jumps which could damage such components.

4.5.2 Power lead:

The product is to be supplied with a power lead with a sealed-on plug. The power lead must be at least 1.5 meters and not more than 2.0 meters in length. Both the plug and the output socket mounted on the device must be compatible with the electricity socket standard in the country where the equipment is to be installed.

4.6 *Human factors*

4.6.1 Generally:

The device must incorporate an LED that conveys when the input voltage is within the ranges specified in Clause 4.2.2. The product must be designed for use by untrained personnel, in accordance with the general principles laid out in ISO 20282-1. In particular, indicator lights and indicator light labelling must be designed so that interpretation is not confusing for colour blind users.

4.6.2 Control panel:

Voltmeters or indicator lamps should be positioned on the front or top of the unit.

4.7 *Materials*

4.7.1 Restricted materials:
The product and its constituent components must not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated biphenyl ethers (PBDE).

4.8 *Warranty*
The product is to be covered by a two year replacement warranty in the event of any component failure arising from defective design, materials or workmanship.

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4.9 *Servicing provision*
The product is to be designed to achieve a maintenance-free life of not less than 10 years, apart from occasional cleaning and the replacement of user-accessible fuses, if any.

4.10 *Disposal and recycling:*
The manufacturer is to provide information to the buyer on the hazardous materials contained within the system and suggestions for resource recovery/recycling and/or environmentally safe disposal. For the European Union WEEE compliance in accordance with European Union Directive 2002/96/EC is mandatory.

4.11 *Instructions:*
User and maintenance instructions are required to be available in Arabic, Mandarin Chinese, English, French, Russian and Spanish. The instructions are to be written for users and repair technicians and are to cover the following topics:

- installation procedures;
- routine maintenance tasks;
- diagnostic and repair procedures, including replacement of accessible fuses, if any;
- itemized list of spare parts including part numbers;
- end-of-life resource recovery and recycling procedures.

4.12 *Training:*
Not required.

4.13 *Verification:*
In accordance with PQS Verification Protocol **E07/VS01-VP.1.2.**

5. Packaging:
Materials used for packaging the finished product are to be free of ozone-depleting compounds as defined in the Montreal Protocol. The general specification of shipping containers will be subject to agreement with the individual procurement agencies.

6. On-site installation:
Not required.

7. Product dossier:

The legal manufacturer or reseller is to provide WHO with a pre-qualification dossier containing the following:

- Dossier examination fee in US dollars.
- General information about the legal manufacturer, including name and address.
- Unique identification reference for the product type.
- Full specifications of the product being offered, covering all the requirements set out in this document, including details of product marking and traceability.
- Photographs of the product clearly showing all sides of the device, including indicator lights and product identification labelling.
- Certified photocopies of all type-approvals obtained for the product, including CE marking and the like.
- Certified photocopies of the legal manufacturer's ISO 9001 quality system certification.
- Where relevant, certified photocopies of the legal manufacturer's ISO 14001 certification, EMAS registration or registration with an equivalent environmental audit scheme. Conformity with an environmental audit scheme is not mandatory; however preference will be given to manufacturers who are able to demonstrate compliance with good environmental practice.
- Where available, laboratory test report(s) proving conformity with the product specifications.
- Indicative cost of the product per unit, EXW (Incoterms 2010).

8. On-site maintenance:

Maintenance will be carried out by the end-user and/or his agents.

9. Change notification:

The legal manufacturer or reseller is to advise WHO in writing of any changes which adversely affect the performance of the product after PQS pre-qualification has taken place.

10. Defect reporting:

The legal manufacturer or reseller is to advise WHO and the UN purchasing agencies in writing in the event of safety-related product recalls, component defects and other similar events.

Revision history:

Date	Change summary	Reason for change	Approved
December 2015	4.1 language changed to reflect both the purpose and the functioning of voltage stabilisers		IG
	4.2.2 Number of output voltage and frequency combinations reduced from 4 to 3. Addition of the extended type	Feedback from the field and input from manufacturers	IG
	4.2.3 change in the output voltage/frequency combinations from 4 to 3	Feedback from the field and input from manufacturers	IG
	4.2.4 change in the wording to reflect compliance with IEC 61643-1 Standards	Feedback from manufactures	IG
	4.2.5 change of wording to cover separate requirements for both standalone and integrated devices	To better reflect practical situation	IG
	4.2.6 Additional clause to reflect the duration sensitivity to frequency changes	Feedback from manufacturers	IG
	4.2.12 Additional clause to include minimum accepted IP rating for standalone voltage stabilisers	Feedback from manufacturers	IG